# FORT PULASKI NATIONAL MONUMENT INVENTORY
# FINAL REPORT

## Part A: Plants

December 1998

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1924 Building
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Atlanta, GA 30303

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Prepared by:

Thomas E. Govus, Botanist

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## SUMMARY

As a result of this inventory, one hundred thirty-four new species of vascular plants are reported for Fort Pulaski National Monument. One hundred ten of these were located during five rounds of fieldwork extending from November 1997 through October 1998. The remaining new species are reported (but not confirmed) from a 1938 survey of the area by Donald E. Eyles. Data from the current study and two previous studies has been included in a database of plant species reported for this site.

*Forestiera segregata* (Florida privet) and *Rumex verticillatus* (swamp dock), species listed by the state of Georgia as special concern, were located during this study on McQueens Island. Two additional species, *Tribulus terestris* (puncture-weed) and *Hypochoeris microcephala* (cat's ear), apparently represent state records for this site and are typical of the many introduced plants found here. The new international classification of ecological communities was used to delineate and map plant communities for this site and descriptions of these plant associations are provided.

A final outcome of this work was the development of a simple monitoring program to track non-native woody plants within portions of the forested communities that would appear to be relatively pristine at this time. Photopoints for use in a photomonitoring program were also established to track gross changes in vegetation form and composition through time.

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# INTRODUCTION

## Description of Site

Fort Pulaski National Monument is located in Chatham County, Georgia along the Savannah River only a few miles from its junction with the Atlantic Ocean. The site consists of two islands that were, before human intervention, primarily salt marsh. Judging from the composition of existing vegetation, Cockspur Island probably supported some coastal hammock forest or woodland. It was selected for fortification as early as the seventeen hundreds. In the eighteen hundreds, as part of the development of the site for defense, the island was modified by the installation of drainage canals and a dike system. In latter years, the site was also impacted by the deposition of spoil material. The addition of dredge material from the Savannah River to Cockspur Island has continued until recently. During the civil war period, the vegetation was removed to enhance visibility and kept in early successional stages. Since the abandonment of the fort in the late eighteen hundreds, a large portion of central Cockspur Island has reverted to maritime forest. Currently the upland portions of Cockspur (approximately 260 acres) support a mosaic of maritime forest, maritime shrub communities, maintained grasslands and successional spoil deposit areas. It also includes over 340 acres of tidal shrubland and tidal herbaceous marsh.

McQueens Island makes up the largest portion of land holdings for the National Monument (about 4,900 acres) and the majority of this consists of salt marsh. A railroad was constructed along the northern edge of the island in 1887 to connect the city of Savannah with Tybee Island and operated until 1933. In 1923 US Highway 80 was constructed. It occupies a location across the central portion of the island and adjacent the old railroad grade along the eastern section. In 1994 Chatham County converted the abandoned railroad right-of-way to a multipurpose hiking trail. Both the highway and the converted rails-to-trails areas support ruderal habitat for a number of coastal plain herbaceous species. Other upland habitat on McQueens Island occurs in association with a public fishing and boat ramp on the eastern end of the island and an old section of US 80 leading to an abandoned steel bridge on the Bull River.

## History and Purpose of Study

The goal of this study was to update the work that was undertaken in 1979 by Southeastern Wildlife Services Incorporated. This previous effort concentrated on quantitative measurement of vegetation while the current study has emphasized a qualitative approach aimed at identifying all plant species found on site. During the twenty years since the last study, a great deal of information has been gathered at the state and federal level regarding protected species. As a result, another important goal of the current study is to identify the potential and actual presence of either state or federally listed plants. In addition, many changes have taken place in plant taxonomy and another objective of the current study has been to update nomenclature. Since 1996 the Nature Conservancy has been working to develop a standardized classification of vegetation (Weakley et al. 1998). The current study has undertaken the classification and mapping

of plant communities present here based on this new system. As an additional outcome of this project, the National Park Service has requested that a database be created listing all species discovered during the survey (including previous studies) along with information regarding family, common name, global and state rarity ranks, and abundance. Finally, the Park Service has also requested help in discussing the need and development of a monitoring program to track the condition of plants, plant communities and animals through time.

## Taxonomic Treatment

A large number of changes have taken place in the taxonomic treatment of vascular plants since the last study of vegetation was conducted for this site. At the present time no comprehensive, updated flora exists for the southeastern United States (or Georgia). For this inventory, the nomenclature used generally follows a working draft of a revision of the Flora of the Carolinas by Weakley (1995). Other sources for updated taxonomy include Cronquist (1980), Isley (1990), Kartesz (1994) and the Flora of North America Editorial Committee (1993). Synonyms and varietal (subspecies) status for species are included in the database.

## METHODS

### Protected Plant Survey

Prior to fieldwork, a search of the Georgia Natural Heritage Program database for special concern plants potentially occurring in the vicinity of Fort Pulaski was undertaken. This search included not only officially state and federally listed plant species, but also special concern and watch list species whose status is poorly known. An evaluation of the habitats required by these species was made to consider only those with potential for occurring at Fort Pulaski. The results of this effort are shown in Table 1 (p 4). A thorough review of the characteristics of these potential special concern plants regarding habitat, optimum time for recognition and unique identifying characters was undertaken to ensure their detection if present. As a part of the inventory process, these plants were searched for in addition to the process of verifying previous plant lists for the site and identifying new species. Populations of special concern plants located were mapped on a 7.5' topographic map and data was collected for element occurrence forms for the Georgia Natural Heritage Program.

### Botanical Inventory

The site was surveyed four times throughout the growing season. Initially during the late fall of 1997 and three times during 1998. The later visits (1998) were coordinated with the National Park Service to coincide with peak blooming periods (early spring, late spring-early summer, and late summer) to aid in plant identification. During each of these visits a complete systematic search of all upland habitats was made. On a daily basis, a well-defined portion of the Monument was identified and transects were made using a compass to thoroughly examine each survey unit. Site survey forms were completed to document the search effort. Field notes were taken to record all species encountered and to begin the process of community identification and aid in the mapping of plant communities. All unknown plant species were collected and examined for identification. Species determined to be county records (based on Jones and Coile (1988) and current data provided by the UGA Herbarium) were collected along with species that appear to be new records for this site. These species will be deposited at the UGA Herbarium and data from these collections are included in Appendix D of this report. Collected species that were unidentifiable by the end of the study were turned over to the University of Georgia for identification.

During the initial preparation for this study, an examination of a recently completed bibliography for the National Park Service revealed the existence of a flora of Fort Pulaski National Monument by Eyles (1938). This study (three volumes) includes Cockspur, McQueens, Long Island, Oysterbed Island, Tybee Island, Wilmington Island and Whitmarsh Island. Collections were made (with collection numbers provided) and deposited at Emory University. Determination of grasses and sedges were made by Dr. H.L. Bloomquist, a very respected botanist (deceased), at Duke University. A copy of this report was procured from Park Service Archives and provided for the current study so that the species reported from this study could be included in the database.

## TABLE 1
## SPECIAL CONCERN SPECIES POTENTIALLY* OCCURRING AT FORT PULASKI

| Species<br>Common name | Global Rank | State Rank | Habitat |
|---|---|---|---|
| *Cenchrus myosuroides*<br>SANDBUR | G4 | SR | Sandy clearings |
| *Eleocharis montevidensis*<br>SPIKERUSH | G5 | S1 | Wet sands on barrier islands |
| *Hibiscus grandiflorus*<br>SWAMP HIBISCUS | G4? | SH | Tidal marshes, coastal flatwoods |
| *Ipomea pes-caprae*<br>RAILROAD MORNING GLORY | G5? | SU | Open beaches, dunes |
| *Polygonum glaucum*<br>WHITE SMARTWEED | G3 | S1? | Coastal sandridges and beaches |
| *Rhynchospora pleiantha*<br>COASTAL BEAKRUSH | G3 | S1 | Pond margins; wet savannas |
| *Vigna luteola*<br>WILD YELLOW COWPEA | G5 | S2? | Maritime beaches and tidal flats |

* Based on Georgia Natural Heritage Database records as of 23 September 1997

The database was produced using Microsoft Access and includes results from the current inventory and two previous studies. The fields identified include scientific name, authority, family name, common name, varietal status, synonyms, global and state rarity ranks, habitat, abundance, source of identification (which study reported the plant), identification of exotic status, and general notes regarding the species. This database is compatible with NPS software and can be used for a variety of reporting purposes.

## Plant Community Classification and Mapping

During the inventory process qualitative data was gathered regarding the composition, structure, condition and distribution of natural communities and habitats at Fort Pulaski National Monument. As mentioned earlier, the new standardized classification system developed for southeastern vegetation was used for naming and mapping communities. Because of the land use history of Cockspur Island, there are only small examples of undisturbed upland natural communities; most of the island was originally salt marsh that has been subjected to either drainage, deposition of spoil or to clearing in the last hundred years. In addition, management practices at the Monument include the maintenance of large areas as grassland or open forest with a mown grass groundcover layer. A large portion of McQueens Island is best treated as ruderal communities. These areas will be regarded as habitats rather than natural communities and described as such. All of these communities and habitats will be delineated and discussed in the results section of this report. A vegetative map has been produced using computer graphics and a hard copy of the map and a copy on disk has been provided to the National Park Service.

## RESULTS

### Protected Plants

As seen from examining Table 1, no federally listed or state officially listed species are reported for the vicinity of the study area. The results of five site visits produced no evidence of the occurrence of any of these species at Fort Pulaski National Monument. However, two species regarded as special concern by the Georgia Natural Heritage Program (GANHP) were located. *Forestiera segregata* (Florida privet) was found in association with shell deposits on the northeast end of McQueens Island and *Rumex verticillatus* (swamp dock) was found in low depressions on a spoil deposit hammock adjacent the Elba Island Cut at the west end of McQueens Island. Both populations were mapped and data was collected and provided to the Natural Heritage Program. *Forestiera segregata* (G4?, S2) appears to be rare in Georgia. The population here represents only the seventh station in Georgia and a new record for the GANHP in Chatham County. A Plant Characterization Abstract is provided for this species (p. 31). Conversations with the GANHP (Tom Patrick, pers. comm.) indicate that *Rumex verticillatus* (G5, S1?) is probably not rare in Georgia but overlooked. The Natural Heritage Program is considering removing this species from the Special Concern list. Radford, Ahles and Bell (1968) and Duncan and Duncan (1987) describe this species as common and ranging along the gulf and Atlantic coasts from Texas to Ontario. For these reasons a Plant Characterization Abstract has not been produced for this species.

### Botanical Inventory

At the beginning of this inventory, based on the checklist provided by Southeastern Wildlife Services (1981), 158 species were reported for this site. The flora of the area produced by Eyles (1938) indicates collections of 121 taxa on Cockspur and McQueens Island. The current survey has documented the occurrence of 256 species (134 new plants reported – 81 species a result of this study). Table 2 (p. 8) lists new species reported for the study area. The total number of species reported for the site, including all three studies, is 292 taxa. Thirty-six species reported from the previous studies were not verified during this effort. Collection data for the new species discovered during this inventory is presented in Appendix D.

In addition to the special concern species already mentioned, five other species are notable:

*Atriplex prostrata* Boucher ex A. DC. – sea-beach atriplex – Regarded by Weakley (1997) as uncommon, this species occurs on overwash areas in association with *Juniperus virginiana* var. *silicicola* along the edge of high marsh and salt marsh communities at several locations along the northern edge of Cockspur Island (adjacent the north channel of the Savannah River). It is only reported for three coastal counties in Georgia (1997 UGA Herbarium data). [= *A. patula* L. – in part]

*Hypochoeris microcephala* (Schultz-Bip.) Cabrera – cat's ear – Native to warm-temperate South America and apparently only reported as an introduction, occurring from south Texas to Louisiana (Cronquist 1980). This collection apparently represents a state record and was verified at the UGA Herbarium with material collected from Texas. This plant was collected twice along the dike system on Cockspur Island.

*Polypogon maritimus* Willdenow – Mediterranean beardgrass – An introduction from Europe, reported by (Hitchcock 1950, Small 1933) from Tybee Island but poorly documented in Georgia (apparently not represented in UGA Herbarium data). Widely scattered along marsh edges and fields on northern Cockspur Island. *P. monspeliensis,* rabbitfoot grass, is also present and perhaps more widespread.

*Pteris vittata* L. – Chinese brake fern – Escape from cultivation and native of Asia. Also poorly documented in Georgia (UGA Herbarium data reports only one county). The Flora Of North America (1993) reports this species as widespread in south Florida on various calcareous substrates including old masonry, sidewalks and exposed limestone. It has become a nuisance at Fort Pulaski where it has become associated with the old masonry and removal is necessary to protect the physical integrity of the structure.

*Tribulus terrestris* – puncture-weed – A rare Mediterranean introduction only reported for a few coastal counties in North and South Carolina. The collection here at Fort Pulaski represents the first record of this species in Georgia. It was discovered growing in grassy areas on the roof of the fort itself.

Appendix B lists plants that were reported from the previous two studies but not verified during this effort. This is presented to facilitate the identification of these species, if they are present, in the future. Many of these species may have been ephemeral species and are no longer present. Other species may have been misidentified. The two species of cat's ear reported (*Hypochoeris glabra* and *Hypochoeris brasiliensis)* may represent an attempt by the two previous studies to fit *Hypochoeris microcephala,* new to the state, into keys that did not include this species. The fact that the current study has included all the new and old species into a database makes it easier for additions, deletions and corrections to be made to the checklist of plants reported for Fort Pulaski. Future studies can use the current database as a starting point for tracking changes in the composition of the flora through time.

## Table 2
## New Species Reported for Fort Pulaski National Monument

| Species Name | Authority | Common Name | Family |
|---|---|---|---|
| Acalypha gracilens | Gray | acalypha | Euphorbiaceae |
| Agalinis fasiculata | (Ell.) Raf. | gerardia | Scrophulariaceae |
| Agrostis hiemalis | (Walt.) BSP | bentgrass | Poaceae |
| Alternanthera philoxeroides | (Mart.) Griseb. | alligator-weed | Amaranthaceae |
| Arenaria serpyllifolia | L. | thyme-leaved sandwort | Caryopyhllaceae |
| Arundinaria gigantea | (Walt.) Muhl. | switch cane | Poaceae |
| Aster tenuifolius | L. | salt marsh aster | Asteraceae |
| Atriplex prostrata | Boucher ex DC | sea beach atriplex | Chenopodiaceae |
| Bidens bipinnata | L. | spanish-needles | Asteraceae |
| Bidens pilosa | L. | sheperd's-needle | Asteraceae |
| Briza minor | L. | quaking grass | Poaceae |
| Campsis radicans | (L.) Seem. ex Bureau | trumpet creeper | Bignoniaceae |
| Carex albolutescens | Schweinitz | sedge | Cyperaceae |
| Centella asiatica | (L.) Urban | centella | Apiaceae |
| Chaerophyllum tainturieri | Hooker | wild chervil | Apiaceae |
| Chamaecrista nictitans | (L.) Moench | southern sensitive-plant | Fabaceae |
| Chamaesyce cordifolia | (Ell.) Small | spurge | Euphorbiaceae |
| Chasmanthium laxum | (L.) Yates | slender spikegrass | Poaceae |
| Cladium jamaicense | Crantz | saw-grass | Cyperaceae |
| Coreopsis grandifolia | Hogg. | tickseed | Asteraceae |
| Cyperus filicinnus | Vahl. | cyperus | Cyperaceae |
| Cyperus ovularis | (Michaux) Torrey | cyperus | Cyperaceae |
| Diospyros virginiana | L. | persimmon | Ebenaceae |
| Eupatorium compositifolium | Walt. | dog fennel | Asteraceae |
| Eupatorium fistulosum | Barratt. | joe-pye weed | Asteraceae |
| Forestiera segregata | (Jacquin) Krug & Urban | Florida privet | Oleaceae |
| Gaillardia pulchella | Foug. | Indian blanket | Asteraceae |
| Galium hispidulum | Michaux | bedstraw | Rubiaceae |
| Galium parisiense | L. | bedstraw | Rubiaceae |

## Table 2
## New Species Reported for Fort Pulaski National Monument (cont.)

| Species Name | Authority | Common Name | Family |
|---|---|---|---|
| Gnaphalium obtusifolium | L. | rabbit tobacco | Asteraceae |
| Helenium amarum | (Raf.) H. Rock | bitterweed | Asteraceace |
| Hypericum hypericoides | (L). Crantz | St. Andrew's Cross | Clusiaceae |
| Hypochoeris microcephala | (Schultz-Bip.) Cabrera | cat's ear | Asteraceae |
| Juncus diffusissimus | Buckley | diffuse rush | Juncaceae |
| Juncus effusus | L. | common rush | Juncaceae |
| Juncus tenuis | Willd. | path rush | Juncaceae |
| Krigia oppositifolia | Raf. | dandelion | Asteraceae |
| Krigia virginica | (L.) | dandelion | Asteraceae |
| Lactuca floridana? | (L.) Gaertner | wild lettuce | Asteraceae |
| Ligustrum sinense | Lour | chinese privet | Oleaceae |
| Linaria canadensis | (L.) Dum.-Cours. | toadflax | Scrophulariaceae |
| Oplismenus hirtellus | (L.) Beauv. | woods-grass | Poaceae |
| Phalaris caroliniana | Walter | canary grass | Poaceae |
| Phytolacca rigida | Small | maritime pokeweed | Phytolaccaceae |
| Polycarpon tetraphyllum | L. | four-leaved allseed | Caryophyllaceae |
| Polygonatum punctatum | Ell. | smartweed | Polygonaceae |
| Polygonum setaceum | Baldwin ex Ell. | smartweed | Polygonaceae |
| Polypogon maritimus | Willdenow | Meditteranean beardgrass | Poaceae |
| Pteris vittata | L. | Chinese brake fern | Pteridaceae |
| Pyracantha coccinea | MJ Roemer | pyracantha | Rosaceae |
| Quercus hemispaerica | Bartram | laurel oak | Fagaceae |
| Quercus virginiana | Miller | live oak | Fagaceae |
| Ranunculus pusillus | Poiret | buttercup | Ranunculaceae |
| Rubus argutus | L. | blackberry | Rosaceae |
| Rubus trivialis | Michaux | dewberry | Rosaceae |
| Salvia lyrata | L. | lyre-leaved sage | Lamiaceae |
| Sanicula canadensis | L. | snakeroot | Apiaceae |
| Sassafras albidum | (Nutt.) Nees | sassafras | Lauraceae |
| Scleria triglomerata | Michaux | nut-sedge | Cyperaceae |
| Senna obtusifolia | (L.) Irwin & Barneby | coffeeweed | Caesalpinaceae |

## Table 2
## New Species Reported for Fort Pulaski National Monument (cont.)

| Species Name | Authority | Common Name | Family |
|---|---|---|---|
| Sida spinosa | L. | prickly mallow | Malvaceae |
| Sisyrinchium exile | Bickn. | annual blue-eyed-grass | Iridaceae |
| Solanum pseudogracile | Heisse | black nightshade | Solanaceae |
| Solidago canadensis | L. | goldenrod | Asteraceae |
| Spermolepis echinata | (Nuttall ex DC) | hooked spermolepis | Apiaceae |
| Spiranthes praecox | (Walt.) Watson | grass leaved ladies' tresses | Orchidaceae |
| Stachys floridana | Shuttlew. | Florida hedge nettle | Lamiaceae |
| Stenotaphrum secundatum | (Walt.) Kuntze | Saint Augustine grass | Poaceae |
| Trifolium arvense | L. | rabbit foot clover | Fabaceae |
| Ulmus americana | L. | American elm | Ulmaceae |
| Verbena bonariensis | L. | verbena | Verbenaceae |
| Vicia angustifolia | L. | vetch | Fabaceae |
| Vicia dasycarpa | Tenore | smooth vetch | Fabaceae |
| Vicia tetrasperma | (L.) Moench | vetch | Fabaceae |
| Vinca minor | L. | periwinkle | Apocynaceae |
| Vitis aestivalis | Michaux | summer grape | Vitaceae |
| Vitis rotundifolia | Michx. | muscadine | Vitaceae |
| Vulpia sciurea | (Nutt.) Henr. | squirreltail fescue | Poaceae |
| Youngia japonica | (L.) DC. | hawk's beard | Asteraceaee |

## Plant Communities

Since 1996 the Nature Conservancy has been working along with many other partners to develop a uniform classification system for vegetation in the southeast and this year released a working draft of this effort (Weakley *et al.* 1998). This new standardized approach is hierarchical in nature and involves very fine divisions in plant communities. The current inventory of the vegetation of Fort Pulaski has employed this new system to name, classify and map the plant communities present. For the purposes of this report, the levels of the hierarchy used here includes: 1) The Formation - A grouping of community types that share physiognomy or structural and environmental factors, such as elevation or hydrologic regime; 2) The Alliance - A somewhat uniform group of associations sharing one or more diagnostic species; and 3) The Association - This is the finest level of the classification system and represents what might be called "community elements". Appendix C presents a classification of these communities including the alliance numbers and plant association numbers from the current system. A discussion of the composition, location and abundance of these communities follows. These communities are listed first by the formation name, alliance name (scientific and common) followed by the association scientific and common name. Global ranks for the associations are also provided. A map of the distribution of these communities is presented for Cockspur and McQueens Islands (p. 20-21).

### Lowland temperate seasonal evergreen forest

*Quercus virginiana* - (*Sabal palmetto*) Forest Alliance [Live Oak – (Cabbage Palmetto) Forest Alliance]

*Quercus virginiana* - (*Pinus elliotii* var. *elliottii, Sabal palmetto*) / *Persea borbonia* - *Callicarpa americana* Forest [Live Oak - (Slash Pine - Cabbage Palmetto) / Redbay - Beautyberry Forest] –G2

This maritime forest community is located on central Cockspur Island within the dike system, to the northwest of the fort. It represents the most well developed and diverse forest community for this site. It is located on the highest elevation and most protected portion of the island. It differs significantly from other examples of this association along the south Atlantic Coast in that live oak (*Quercus virginiana*) is absent from both the canopy and understory layers of the community. The fact that Cockspur Island has been largely a product of man made spoil deposit, in an area primarily of salt marsh, no doubt is responsible for this anomaly. This forest, although now reaching maturity, has only developed since the fort was abandoned in the early 1920's (Talley Kirkland, pers. com.). The canopy is diverse and well developed including nearly an even mixture of cabbage palmetto (*Sabal palmetto*), coastal red-cedar (*Juniperus virginiana* var. *silicicola* and sugarberry (*Celtis laevigata*). Scattered large American elms (*Ulmus americana*) are also present. The understory includes the same species already mentioned and, in addition, redbay (*Persea borbonia)* and laurel cherry (*Prunus caroliniana*). The shrub layer varies from dense thickets of yaupon (*Ilex vomitoria*) to more open situations with sparse laurel

cherry, wax myrtle (*Myrica cerifera*) and beauty- berry (*Callicarpa americana*). This is a densely shaded habitat and few herbaceous species are present. Basket-grass (*Oplismenus hirtellus*), snakeroot (*Sanicula canadensis*) and panic grass (*Dicanthelium* sp.) were the only members of the groundcover stratum noted. Vines are an important component of this forest and Virginia-creeper (*Parthenocissus quinquefolius*), pepper-vine (*Ampelopsis arborea*), smilax (*Smilax auriculata*) and muscadine (*Vitis rotundifolia*) represent the most common species found.

*Juniperus virginiana* var. *silicicola* - (*Quercus virginiana, Sabal palmetto*) Forest [Coastal Red-cedar - (Live Oak, Cabbage Palmetto) Forest]

This is the most widespread forest type on Cockspur Island and occurs largely on the older spoil deposits to the west of the dike system and along the southwestern edge of the island within the dike system. The canopy typically is an even mixture of coastal red-cedar, cabbage palmetto and sugarberry, but variation does occur and the exotic species Chinese tallow (*Sapium sebiferum*) and Chinaberry (*Melia azederach*) are occasionally also present. In some cases the shrub layer is absent or sparsely developed. Hercules' club (*Zanthoxylum clava-herculis*), winged sumac (*Rhus coppalina*) and wax-myrtle are common members of a sparse shrub layer. In other instances there is a dense yaupon shrub layer. Herbaceous species are generally absent but vines such as pepper-vine, muscadine and smilax are usually present. The groundcover layer is typically comprised of a dense cover of old cabbage palmetto leaves. Portions of this association occur in low-lying areas within the dike system on the southern part of Cockspur Island. The canopy here includes a significant amount of Chinese tallow, which is a good indicator of saturated soils. In some small areas (in the vicinity of the mosquito control pond) tallow may actually dominate, but occurs over too small an area to be mapable. Sugarberry is also a significant part of the canopy. In these wetter situations, the shrub layer is dominated by dense, tree like stands of yaupon. Wax-myrtle is also present to a much lesser extent. Few to no herbaceous species are present. Smilax (*Smilax auriculata*) and pepper-vine are the most common vines present. This community grades to the east into a saturated shrub wetland (dominated by yaupon).

**Planted/Cultivated temperate or subpolar needle-leaved evergreen forest**

*Pinus elliotii* Planted Forest Alliance [Slash Pine Planted Forest Alliance]

*Pinus elliotii* var. *elliotii* Planted Forest [Slash Pine Planted Forest]

This forest located on south central Cockspur was planted by the National Park Service early on in the history of the management of this site. Used for a picnic area, the canopy and subcanopy is comprised completely of slash pine. There are a few widely scattered shrubs or understory species including *Sabal palmetto* and *Prunus caroliniana.* The groundcover consists of maintained grass and is regularly mowed. A few herbaceous species are mixed in with the grasses including seaside pennywort (*Hydrocotyle*

*bonariensis*) and frog-fruits (*Phyla nodiflora*). Although of little botanical importance this pine dominated community has apparent significance for nesting birds on Cockspur Island (Southeastern Wildlife Services 1981).

**Temperate broad-leaved evergreen woodland**

*Sabal palmetto* Woodland Alliance (Cabbage Palmetto Woodland Alliance)

*Sabal palmetto* - (*Juniperus virginiana* var. *silicicola*) Woodland [Cabbage Palmetto - (Coastal Red-cedar) Woodland] – G2?

This association consists of nearly pure stands of cabbage palmetto located along the north edge of Cockspur Island, adjacent the high marsh communities. The vegetation described here technically would be considered a forest. The canopy is approximately eight meters in height and crowns are in contact with one another. The best fit, at present, for this association is in this woodland alliance that describes pure stands of cabbage palmetto that occur on areas of high exposure to storm tides and salt spray. Coastal red-cedar (*Juniperus virginiana* var. *silicicola*) is occasionally a very minor component of the subcanopy layer. The shrub layer is usually very open but includes yaupon, wax myrtle, winged sumac (*Rhus coppalina*) and Spanish-bayonet (*Yucca aloifolia*). The groundcover layer is devoid of herbaceous species and largely consists of a dense carpet of old palmetto leaves. Vine species are present including pepper-vine and smilax (*Smilax auriculata*) along with dewberry (*Rubus trivialis)* a low shrub.

*Quercus virginiana - Juniperus virginiana* - (*Sabal palmetto*) Woodland Alliance [Live Oak - Red-cedar - (Cabbage Palmetto) Woodland Alliance]

*Juniperus virginiana* var. *silicicola - Zanthoxylum clava-herculis - Quercus virginiana-* (*Sabal palmetto*) / *Sageretia minutiflora* - (*Sideroxylon tenax*) Woodland [Coastal Red-cedar - Toothache-tree - Live Oak - (Cabbage Palmetto) / Smallflower Sageretia - (Tough Bumelia) Woodland] – G2?

This community is located on shell deposits near the mouth of the south channel of the Savannah River on northeast McQueens Island. The four large elliptical mounds suggest, from aerial view, to be of aboriginal origin. Early results from a brief investigation by the NPS Southeast Archaeological Center have not produced any evidence of aboriginal creation (Dr. Guy Prentise – pers. com.). Regardless of origin, these oyster shell heaps support vegetation typical of shell midden sites along the Sea Islands section of the south Atlantic Coast. The canopy is nearly pure coastal red-cedar with occasional cabbage palms and sugarberry. Hercules' club (*Zanthoxylum clava-herculis)*, tough bumelia (*Sideroxylon tenax*), wild-olive (*Osmanthus americanus)* and Florida privet (*Forestiera segregata*) are key calciphilic indicators in the shrub layer of this restricted coastal habitat. Occasional openings in the canopy over extremely dense and deep areas of shell deposits create areas with very dense stands of Florida privet and showy patches of

prickly-pear (*Opuntia humifusa*) and Spanish bayonet. Other species also found here include laurel cherry, redbay, groundsel-tree (*Bacharris halimifolia*) and yaupon. As stated earlier in this report, this community would appear to be stable and self-sustaining. The identification, recognition and mapping of this community is important, however, in order to prevent impacts such as spoil deposition in this area in the future.

### Saturated temperate broad-leaved evergreen shrubland

*Myrica cerifera* Saturated Shrubland Alliance [Wax-myrtle Saturated Shrubland Alliance]

*Myrica cerifera / Spartina patens* – (*Juncus roemerianus*) Shrubland [Wax-myrtle / Saltmeadow Cordgrass - (Black Needlerush) Shrubland] – G3

These tree-like stands of nearly pure wax myrtle or yaupon (or a mixture of both) occur along the southern edge of Cockspur Island. They are located just above the tidal shrublands and salt panne communities of central Cockspur or occur within the dike system near the southeastern part of the island in very low lying areas. Occasionally these associations include widely scattered coastal red-cedar and cabbage palmetto. In the eastern portion (within the dike system) a substantial amount of Chinese tallow (*Sapium sebiferum*) also occurs as widely scattered individuals. This is suggestive of the saturated soil conditions found here. Few other species are associated with this habitat. The shrubs are so densely arranged that no herbaceous species are afforded light or space to grow. The previous report (Southeastern Wildlife Services 1981) referred to this association as a mixed shrub community. Along the central portion of Cockspur Island this shrubland grades into the tidal shrublands described below.

### Tidal cold-deciduous shrublands

*Baccharis halimifolia - Iva frutescens* Tidal Shrubland Alliance [Groundsel-tree - Maritime Marsh-elder Tidal Shrubland Alliance]

*Baccharis halimifolia - Iva frutescens - Myrica cerifera - (Ilex vomitoria)* Shrubland [Groundsel-tree - Maritime Marsh-elder - Wax myrtle (Yaupon) Shrubland] – G4?

This community is widespread on Cockspur Island and occurs as a fringe shrubland between either salt panne communities and upland forests or high marsh communities and upland communities. It is especially well developed along the southern edge of Cockspur where extensive salt flats grade gently into the adjacent upland communities. In addition to the dominant species described in the name of this association, other species present include false-willow (*Baccharis angustifolia*), sea lavender (*Limnobium carolinianum*) and fimbristylis (*Fimbristylis castanea*).

*Borrichia frutescens* Tidal Shrubland Alliance [Seaside Oxeye Tidal Shrubland Alliance]

*Borrichia frutescens / Spartina patens - Juncus roemerianus* Shrubland [Seaside Oxeye /Saltmeadow Cordgrass - Black Needlerush Shrubland] – G4

Not as widespread as the community described previously, usually occurring as a very narrow band adjacent and below these tidal shrublands (so narrow as to be unmapable at a reasonable scale). Two large examples of this association are extensive enough to map and occur on tidal flats adjacent the extensive salt marsh communities of eastern Cockspur Island (see vegetation map). Typically this community is monospecific, being made up almost exclusively of seaside oxeye.

**Tidal needle-leaved or microphyllous evergreen dwarf-shrubland**

*Batis maritima* Tidal Dwarf-shrubland Alliance [Saltwort Tidal Dwarf-shrubland Tidal Alliance]

*Batis maritima - Sarcocornia perennis* Dwarf-shrubland (Saltwort - Woody-glasswort Dwarf-shrubland) – G5

This community is described as sub-tropical and not yet reported for Georgia (in the new classification system) but at least two large mapable examples of this association occur on hypersaline flats that grade into other salt panne communities along eastern and southeastern Cockspur Island. *Batis* is by far the most dominant species but other halophytes found here do include woody-glasswort (*Sarcocornia perennis*), sea-blite (*Sueda linearis*), sea-purslane (*Sesuvium portulacastrum*) and sea lavender.

*Sarcocornia perennis* - (*Distichlis spicata, Spartina alterniflora*) Tidal Dwarf-shrubland Alliance [Woody-glasswort - (Salt Grass, Saltmarsh Cordgrass) Tidal Dwarf-shrubland Alliance]

*Sarcocornia perennis - Batis maritima - Distichlis spicata* Dwarf-shrubland [Woody-glasswort - Saltwort - Salt Grass Dwarf-shrubland] - G4

This association represents the salt panne community that is widely represented on Cockspur Island (and also on McQueens Island to a lesser extent). It is particularly well developed on the broad gentle flats that lie along the south side of Cockspur. This is a hypersaline environment caused by the repeated evaporation of tidal water from these expansive shallow areas. Vegetative cover varies from a total absence of vascular plants to a dense concentration of halophytic herbs particularly woody-glasswort (*Sarcocornia perennis*) which is clearly dominant. Saltwort (*Batis maritima*) and salt grass (*Distichlis spicata*) are also abundant and usually interspersed with dwarfed saltmarsh cordgrass (*Spartina alterniflora*). Additional species found in this association include sea lavender, sea-blite, and sea purslane (*Sesuvium portulacastrum*).

## Tidal temperate or subpolar grassland

*Juncus roemerianus* Tidal Herbaceous Alliance [Needle Rush Tidal Herbaceous Alliance]

*Juncus roemerianus* Herbaceous Vegetation [Needle Rush Herbaceous Vegetation]-G5

This community is not widely developed on either Cockspur or McQueens Island and does not occur in large enough patches to be mapable at a reasonable scale. Discrete examples are visible on both Cockspur and McQueens Islands and are usually located near the low salt marsh fringe. This is another example of an association that is primarily comprised of one species however sea lavender, saltgrass (*Distichlis spicata*) and saltmarsh aster (*Aster tenuifolius)* are also sometimes present.

*Spartina alterniflora* Tidal Herbaceous Alliance [Saltmarsh Cordgrass Tidal Herbaceous Alliance]

*Spartina alterniflora* Carolinian Zone Vegetation (Saltmarsh Cordgrass Carolinian Zone Herbaceous Vegetation) – G5

This community by far occupies the greatest amount of the property present at Fort Pulaski National Monument. Over 340 acres of Cockspur Island and over 4,400 acres of McQueens Island are dominated by salt marsh (NPS 1968). It is best developed in areas between mean high and low tides that are regularly flooded. It is largely monospecific but occasionally is interspersed with patches of the needlerush community described above. It also slowly grades into salt panne communities that include *Spartina alterniflora* along the extensive gentle flats along the southern edge of Cockspur Island.

*Spartina cynosuroides* Tidal Herbaceous Alliance [Giant Cordgrass Tidal Herbaceous Alliance]

*Spartina cynosuroides* Herbaceous Vegetation [Giant Cordgrass Herbaceous Vegetation] – G4

This is another example of a community that was evident during fieldwork but that does not occur over a large enough area to be mapped in a meaningful way. It typically is located in narrow bands associated with tidal ditches and also along fringe areas between tidal herbaceous vegetation and tidal shrublands. In addition to giant cordgrass, saltmarsh bulrush (*Scirpus robustus*) is also sometimes present.

*Spartina patens - (Distichlis spicata)* Tidal Herbaceous Alliance [Saltmeadow Cordgrass – (Salt Grass) Tidal Herbaceous Alliance]

*Spartina patens - Distichlis spicata - Borrichia frutescens* Herbaceous Vegetation [Saltmeadow Cordgrass - Salt Grass - Seaside Oxeye Herbaceous Vegetation] - G4G5

Although of restricted extent this "high marsh" community is conspicuous and occurs in large enough areas to be mapped, primarily along the steep infrequently tidally flooded terraces of north central Cockspur Island. It is one of the most diverse and scenically attractive natural communities present on site. In addition to saltmeadow cordgrass, saltgrass and seaside oxeye, other species found here include seaside goldenrod (*Solidago sempervirens*), sea lavender, sand-vine (*Cynanchium angustifolium*), knotgrass (*Paspalum distichum*), fimbristylis and, along the upper edges in overwash areas, includes sea-beach atriplex (*Atriplex prostrata).*

## Miscellaneous Habitats

A large portion of Cockspur Island and the upland portion of McQueens Island do not support natural communities. Significantly large areas have been modified for various purposes. The fort itself takes up a large part of Cockspur Island. The Coast Guard Station and Port of Savannah Pilot House occupy smaller areas. A very significant portion of Cockspur Island has been either planted or maintained as grass. The following is a discussion of the man-influenced habitats of both Cockspur and McQueens Islands.

### Maintained Grass

Much of the area surrounding the fort, large areas to the east and south of the fort, and the central portion of Cockspur Island is managed as maintained grass. This habitat occupies over 140 acres on Cockspur (Southeastern Wildlife Services 1981) and, next to salt marsh communities, it is the second most abundant habitat present. Cultivated grass species such as bermuda (*Cynodon dactylon*), Dallis grass (*Paspalum dilataum*), vasey grass (*Paspalum urvillei*), and Bahai grass (*Paspalum notatum*) dominate but a number of native species and a few exotic grass species are also present. Broomsedge (*Andropogon virginicus*), bushy beardgrass (*Andropogon glomeratus*), rescue grass (*Bromus catharticus*), rabittfoot grass (*Polypogon monspielensis*) and Mediterranean beardgrass (*Polypogon maritimus*) are examples of other grass species that can be found in these areas. A number of herbaceous species, mostly introduced, are also associated with these lawn type habitats. Commonly found species include false dandelion (*Pyrrhopappus carolinianus*), richardia (*Richardia brasiliensis*), evening primrose (*Oenothera laciniata*), wood sorrel (*Oxalis stricta*), centella (*Centella asiactica*), pennywort (*Hydrocotyle bonariensis*) and verbena (*Verbena brasiliensis*). The proximity of Savannah, with a history of maritime trade and potential for new species from old ballast piles, makes this habitat a good site for newly introduced exotics. The puncture weed and cat's ear, that apparently are new state records found here at Fort Pulaski, are good examples of this potential.

## Ruderal Areas

This habitat is also widespread but largely confined to McQueens Island in association with the right-of-way for US Highway 80 and the old Savannah-Tybee railroad grade (converted more recently into a multipurpose trail). The Old Savannah-Tybee Railroad Multipurpose Trail extends for about six miles along the northern edge of McQueens Island. It was originally the only land route to Tybee Island and was constructed in 1887 and operated until 1939. Many of the plants reported by Eyles (1938) from this site refer to this old railroad grade. US Highway 80 extends for about five miles, crossing onto central McQueens and then running parallel with the old railroad. It was not constructed until 1923. Although similar in many respects to the maintained grass areas described above, this is an ecotonal habitat adjacent the extensive marshes of McQueens Island and is much more diverse in structure and composition. In many respects it provides the best habitat for wildflowers present at the Monument. The canopy tends to be heterogeneous with widely scattered individuals. Cabbage palmetto, coastal red-cedar, slash pine and live oak are the principal species encountered. Shrub and understory species are also distributed in scattered patches and most are representative of the tidal shrubland communities. Sea myrtle (*Baccharis halimifolia*), marsh-elder (*Iva frutescens*), wax- myrtle, yaupon, seaside oxeye, tough bumelia (*Sideroxylon tenax*), Hercules'-club (*Zanthoxylum clava-herculis*) and winged sumac (*Rhus coppalina*) are some of the shrubs found here. A wide variety of herbaceous species are associated with the open edges of the railroad grade and the edges of the marshes. Indian blanket (*Gaillardia pulchella*), gaura (*Gaura angustifolia*), gerardia (*Agalinis fasiculata*), butterfly-pea (*Clitoria mariana*), wild bean (*Strophosyles helvola*), blue-curls (*Trichostema dichotomum*), camphorweed (*Heterotheca subaxilaris*) and flat-topped goldenrod (*Euthamia tenuifolia*) are some of the more showy species found here. These ecotonal areas probably have some of the highest diversity of plant species for this site.

During the initiation of this project the National Park Service requested that special attention be given the US Highway 80 corridor because of impending highway construction proposals. A substantial effort was made to examine this right-of-way during the course of the growing season for the presence of any state or federally listed plant species. No evidence of any special concern plants was found and the potential for listed species was judged to be extremely poor.

## Recent Sandy Spoil Deposits

A final significant man-influenced habitat at Fort Pulaski is the more recent spoil deposits comprised nearly of pure sand that have been placed along north central and the southwestern portion of Cockspur Island. Although these deposits are approximately 15-17 years old (Cliff Kevill pers. com.) the sterile conditions associated with the sand have resulted in young successional communities that will be interesting to track through time. Photopoints (see monitoring section) were established here to help detect trends in the change of these communities in the years ahead. Currently, the existing vegetation consists of widely scattered trees with large areas of exposed open sand, sparsely inhabited by a number of herbaceous species and vines. Coastal red-cedar, sugarberry, cabbage palmetto, China-berry, white mulberry (*Morus alba*) are the principal trees found in these habitats. Along the north central area (east from the Pilot House) the canopy is pure coastal red-cedar. Shrubs scattered in these areas include wax-myrtle, groundsel-tree (*Baccharis halimifolia*), yaupon, winged sumac and lantana

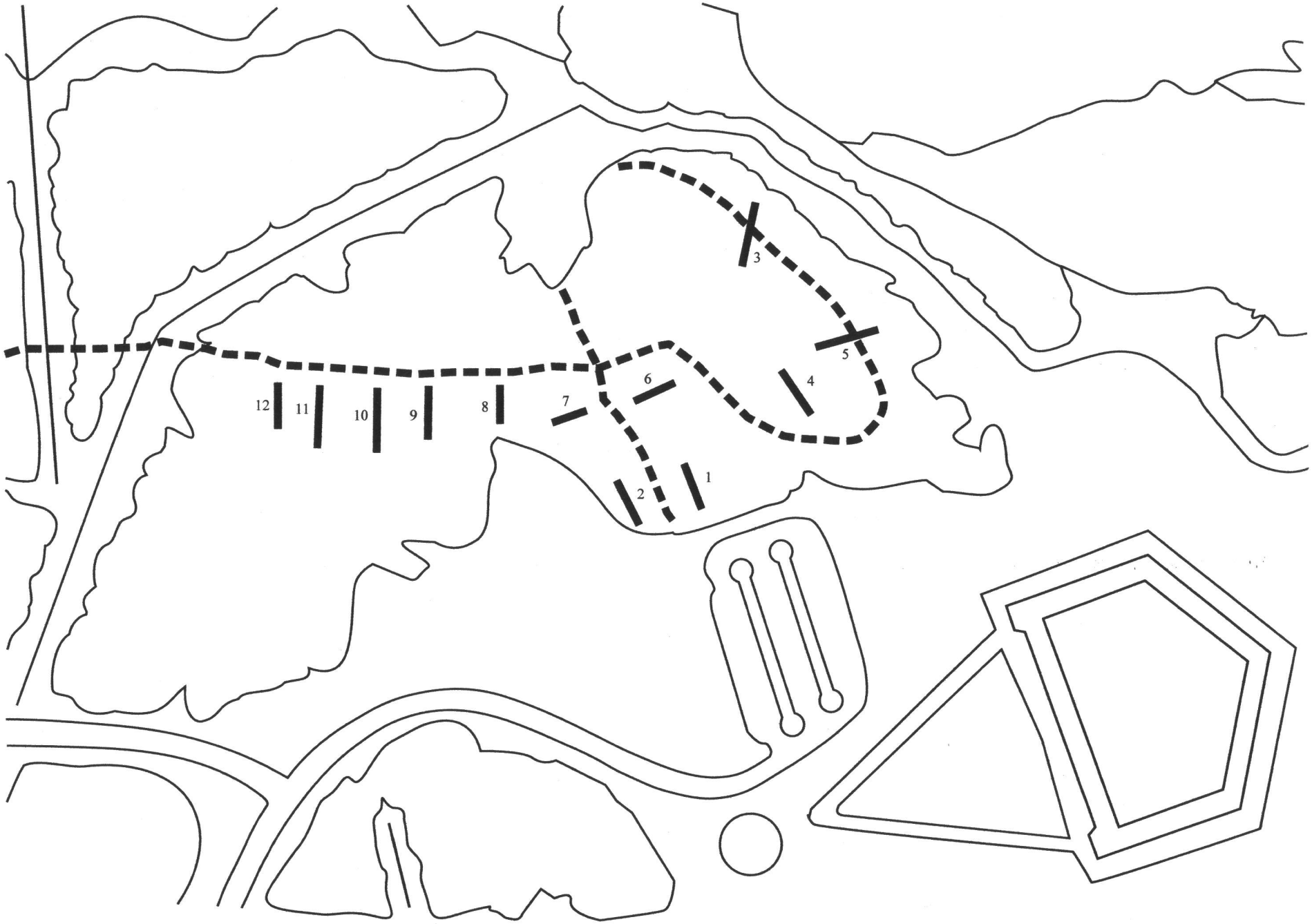
(*Lantana camara*). The herbaceous layer, although sparsely developed is diverse with camphorweed, blue-curls, Mexican-tea (*Chenopodium ambroisiodes*), verbena (*Verbena bonariensis*), horseweed (*Conyza canadensis*), peppervine, smilax, sandspur (*Cenchrus echinatus*), prickly pear, and ragweed (*Ambrosia artemesiifolia*). These communities may remain open for many more years to come but eventually should develop into one of the forest types described in the earlier portions of this section.

## Monitoring Program

An important goal identified for this project by the National Park Service was the consideration and development of a monitoring program for this site. An important criterion specified for this effort was that it be simple enough and limited in scope so that Park Service personnel could continue the program into the future. The Southeast Regional Office of the Nature Conservancy assisted in discussions and development of techniques to use for this effort. Two approaches were decided upon to answer two basic questions regarding vegetation at Fort Pulaski. The first was to determine whether or not exotic tree and shrub species, already established on site, were increasing in abundance and possibly threatening the more pristine communities. The second approach was a simple technique to monitor general changes in vegetation through time. The first approach involved the establishment of permanent presence/absence transects in the more pristine portions of the older maritime forest near central Cockspur Island. The second involved the installation of twelve permanent photopoints scattered throughout the Monument to track gross changes in particular communities and plant species. Although two special concern plants were located during the inventory, only *Forestiera segregata* would seem to be rare. This population appears to be stable and self-sustaining and therefore not worthy of monitoring efforts. A more detailed discussion of the rationale and methods of the two monitoring techniques follow.

### Transects for Invasive Non-native Plant Species

The 1981 inventory of vegetation (Southeastern Wildlife Services) identifies two exotic tree species as being a component of portions of the plant communities of Fort Pulaski National Monument. These species are *Sapium sebiferum* (Chinese tallow) and *Melia azederach* (China-berry). At the time of this study these species were regarded as a minor component of the vegetation and not of concern to management. During the current inventory, qualitative analysis would suggest that in some small areas, particularly the southeast portion of Cockspur Island, Chinese tallow might be a dominant canopy species. China-berry also would appear to have significant presence in these low, wetter and primarily shrub dominated areas. Another plant noted during this study was *Ligustrum sinense* (Chinese privet), another invasive species of concern to land managers. The central portion of Cockspur Island, in the vicinity of the nature trail, supports a mature, diverse maritime forest that is largely free from these non-native species. As one goal of this initial monitoring program, it was decided to establish simple presence or absence transects to determine if these species were becoming established and/or increasing over time. To this end twelve permanent transects were established in the vicinity of the nature trail within the dike system on central Cockspur Island. One inch aluminum conduit was used to mark the beginning and endpoints of each transect and marked with permanent tags. Two witness trees were also tagged and data on distance and bearing to each permanent stakes was recorded. Data sheets were prepared for the initial round of work and data on the location, length of transects and exotic species present in the transects were noted. Figure 3 (p. 23) shows a schematic location of these transects. Transect length varied from 15-30 meters (depending on site conditions) and exotic species were recorded within 5 meters on each side of the tape for each 5 meter segment of the transect (each presence/absence cell is 5x10 meters). Data was collected separately for juvenile or adult (fruit producing) individuals. Six transects were selected to include a starting point near the edge of the forest where at least one exotic species would be

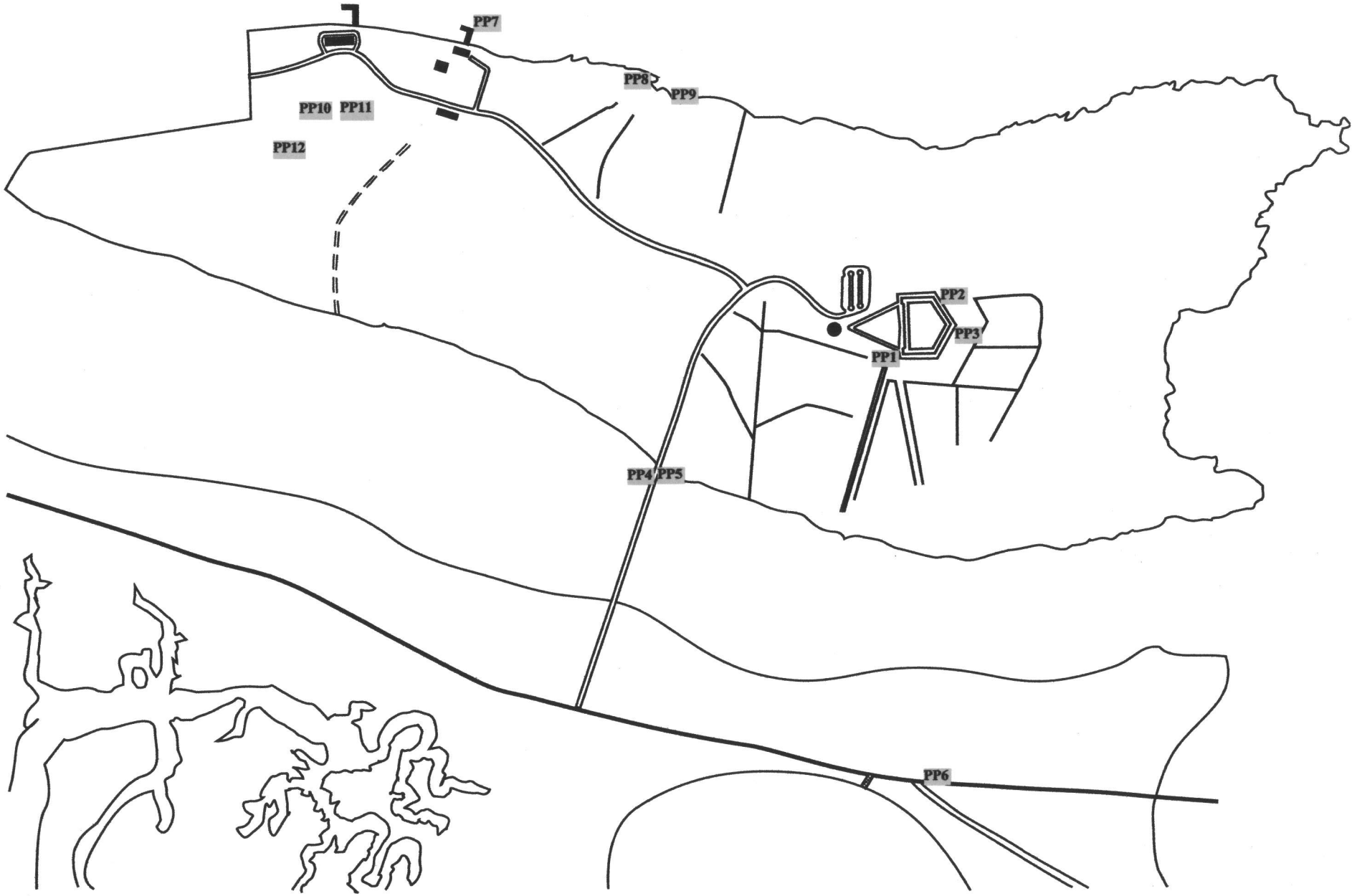



**Schematic Map of Monitoring Transects — Fort Pulaski National Monument**

included in the transects. The remaining six transects were randomly located in the open forest interior and did not include exotic species. The data sheets and location data have been provided to the Park Service in both a hard copy and electronic copy for archival purposes. Although it is not anticipated that it is necessary to collect monitoring data more frequently than every two to three years, for the purpose of making sure that the program is followed through with, it is recommended that this data be collected on an annual basis. The estimated amount of time necessary to sample these monitoring transects is approximately four hours.

**Photopoint Establishment and Photomonitoring Techniques**

The use of photomonitoring techniques, particularly photopoints, is often suggested as a simple, inexpensive and useful method of detecting gross changes in vegetation over time. For the limited needs of Fort Pulaski National Monument it is felt that the twelve photopoints established during this study should allow the tracking of large changes in the appearance and composition of forested communities and ecotone areas surrounding Cockspur Island. For the convenience of the National Park Service, the techniques were simplified somewhat to make the process quicker and easier to repeat. For example, rather than employ tripods and record camera heights, all views were taken handheld and repeatability and accuracy are probably not affected enough to influence the usefulness of the process. Three photopoints were established at known positions on the fort wall that offer superior vantages of the nearby-forested areas of Cockspur Island. Additional points were established along the perimeter of Cockspur Island to track changes in the ecotonal areas between upland and tidal commentates. Four photopoints were established in relatively new spoil deposit areas to study the changes in successional vegetation for this portion of north central and western Cockspur Island. Many points were located at known positions that are easy to relocate (such as particular positions on the fort wall). For other photopoints, a permanent stake was positioned and marked with numbered tags. Where possible or appropriate witness trees were also tagged and distance and bearing to the photopoints were recorded. Figure 4 (p. 25) shows the approximate location of these points. All data regarding the twelve photopoints including bearing for view, f-stop, shutter speed, lens, film type and ASA were recorded on data sheets provided by the Nature Conservancy and are on file at Fort Pulaski National Monument.




**Schematic Map of Photo Points (Labeled PP's) — Fort Pulaski National Monument**

## Discussion and Management Considerations

The fact that this study has reported an additional seventy-nine species for this site is best explained by the difference in approach taken for this work compared to the previous two studies. The 1938 study (Eyles) was focused on a large area including (in addition to Cockspur and McQueens Islands) Long Island, Oysterbed Island, Wilmington Island, Tybee Island and Whitmarsh Island. Eyles indicates that the entire period of fieldwork for this effort took place in just three months (June through August of 1938). It would be difficult for any botanist to cover such a large area in so short a period of time with any degree of thoroughness. It is not surprising that Eyles was only able to document 121 taxa for McQueens and Cockspur Island. The Southeastern Wildlife study (1981) was quantitative in nature and concentrated on measuring vegetation in seventy 10 x 10 meter plots scattered throughout the site but primarily on Cockspur Island. These plots were not permanently marked so were not useful in tracking changes in vegetation and the result of focusing on quantitative plots probably led to the failure to observe and record a number of species. The current study has emphasized a qualitative approach with a systematic search of the entire property four times during the growing season extending from November 1997 through October 1998. It is believed that the current study represents nearly a complete inventory of the species present for this site. The total of 246 species would seem reasonable for a site with less than three hundred acres of upland. Krakow and Ruckdeschel (1991) report only 615 taxa for Cumberland Island, an area of over 19,000 acres. The extreme exposure of this site would also limit species and, typically, maritime habitats have fewer species than nearby inland situations. As an example, Mellinger and Mellinger (1960) report 943 species for the Savannah National Wildlife Refuge, some twenty miles inland.

### Non-native Species

The past history of Cockspur Island in regard to its alteration by man for fortification and spoil deposits is reflected in the number of non-native species found here. The proximity of this area to the port of Savannah and the long history of maritime trade along the Savannah River provides further opportunities for species not native to the southeast coastal plain to become established here. Several areas in the vicinity of Cockspur Island include old ballast heaps that have likely been moved from port to port around the world (Talley Kirkland, pers. comm.). These ballast heaps are well-recognized sources of introduction for many non-native species throughout coastal areas. Of the 292 species reported for this site, 68 would be considered non-native (twenty-three percent). By contrast, Krakow and Ruckdeschel (1991) reported 74 "exotics" out of 615 total species for Cumberland Island (twelve percent). For the purposes of this report, a non-native species is defined strictly as any species that is known not to have occurred naturally on this site. The database prepared for this inventory includes a field for these species and although the whole list is not presented here, a report is included within the database detailing them.

A number of non-native species have been introduced in the landscape for such a long time that they appear to be natural. These naturalized species include many of the grasses, clovers, legumes, and weeds associated with the extensive maintained grass present on Cockspur Island. Included here would be Dallis grass, Bahia grass, Bermuda grass, bur clover (*Medicago polymorpha*), vetch (*Vicia sativa* ssp. *nigra*), dandelion (*Taraxacum officianale*) and many

others. Another category of non-natives would be those species that are rare introductions or escapes from cultivation that are poorly established. Examples of this type here at Fort Pulaski would be species such as zephyranthes (*Zephyranthes candida*), fig (*Ficus carica*), pyracantha (*Pyracantha coccinea*) and huisache (*Acacia farnesiana*). Puncture-weed (*Tribulus terestris*), cat's ear (*Hypochoeris microcephala)* and camphor-tree (*Cinnamomum camphora*) are similarly poorly established non-native species for this site that have probably spread by birds, wind or tide from ballast or nearby populations.

A final category of non-native species are those that are of concern to land managers because they tend to be invasive or disruptive to natural communities. These are sometimes referred to as exotics and are identified as such in this report and a separate field in the database was included for them. Table 3 (p. 28) lists eighteen species judged at the time of this inventory to be of concern to the Park Service. The previous list for this site (Southeastern Wildlife Services 1981) included species such as dandelion, large-flowered vetch (*Vicia grandiflora*) and zephyranthes that, for reasons explained above, should not be of concern to land managers. The current list does include two species, *Hypochoeris microcephala* and *Tribulus terrestris,* which also are not necessarily invasive or of concern to managers. These species are listed here to draw attention to them because they represent new state records and their status in Georgia is unknown. To varying degrees the remaining species should be regarded by the Park Service as of potential concern. A brief discussion of the status of each of these other species at Fort Pulaski follows.

*Acacia farnesiana* (huisache) – According to Eyles (1938) these trees were planted during the thirties at the CCC camp. Only a handful of trees remain, widely scattered in the group camping area.

*Alternanthera philoxeroides* (alligator-weed) – Only discovered during this survey in two locations (the mosquito control pond and in depressions near the maintenance building) this invasive weed of riverine habitats would not appear to be a threat here.

*Cinnamomum camphora* (camphor-tree) – Another plant that has either escaped or spread from nearby populations, this tree only occurs in as few locations along the edges of patches of forests and would not seem to be a problem.

*Fumaria officinalis* (fumatory) – This plant is widely established and perhaps dominant over large portions of the maintained grass portions of Cockspur Island. It would not seem to pose a threat to other habitats due to shade intolerance.

*Lagerstromia indica* (crepe myrtle) – Largely restricted to the US Highway 80 right-of-way this plant would not seem to be of concern for the Park Service.

*Lantana camara* (lantana) – This shrub is well established in the western portion of Cockspur Island, largely in spoil deposit areas. It occasionally also has become established in thin stands of cabbage palmetto. Spread by birds and a prolific fruit producer, this plant would be hard to eliminate.

*Ligustrum japonicum* (Japanese privet) – Not as widespread as Chinese privet (see below) this shrub is occasionally a part of the maritime forests including the midden type on McQueens Island. Would not appear to be out-competing native shrubs.

**Table 3**
**Exotic Species at Fort Pulaski National Monument**

| Species Name | Authority | Common Name | Family |
|---|---|---|---|
| *Acacia farnesiana* | (L.) Willd. | huisache | Mimosaceae |
| *Alternanthera philoxeroides* | (Mart.) Griseb. | alligator-weed | Amaranthaceae |
| *Cinnamomum camphora* | (L.) Presl. | camphor-tree | Lauraceae |
| *Fumaria officinalis* | L. | fumatory | Fumariaceae |
| *Hypochoeris microcephala* | (Schultz-Bip.) Cabrera | cat's ear | Asteraceae |
| *Lagerstromia indica* | L. | crape myrtle | Lythraceaea |
| *Lantana camara* | L. | lantana | Verbenaceae |
| *Ligustrum japonicum* | Thunberg | Japanese privet | Oleaceae |
| *Ligustrum sinense* | Lour | Chinese privet | Oleaceae |
| *Lonicera japonica* | Thunberg | Japanese honeysuckle | Caprifoliaceae |
| *Melia azedarach* | L. | China-berry | Meliaceae |
| *Nerium oleander* | L. | oleander | Apocynaceae |
| *Pteris vittata* | L. | Chinese brake fern | Pteridaceae |
| *Sapium sebiferum* | (L.) Roxb. | Chinese tallow-tree | Euphorbiaceae |
| *Sorghum halepense* | (L.) Persoon | Johnson grass | Poaceae |
| *Tamarix gallica* | L. | tamarisk | Tamaricaceae |
| *Tribulus terrestris* | L. | puncture-weed | Zygophyllaceae |
| *Vinca minor* | L. | periwinkle | Apocynaceae |

*Ligustrum sinense* (Chinese privet) – Occasionally quite dense in openings in the older maritime forests this species is one that has been selected for monitoring. A producer of abundant fruit that is spread by birds, this species would also be difficult to eliminate.

*Lonicera japonica* (Japanese honeysuckle) – Also restricted to edges and newly formed openings in the forested portions of Cockspur Island. Not extremely widespread or a particularly acute problem.

*Melia azedarach* (China-berry) – Widely scattered in small blocks of forest on spoil deposits of western Cockspur, it is also well established as a part of the saturated forest with Chinese tallow and coastal red-cedar within the dike system of south Cockspur. It is not well established yet in the mature, more protected maritime forest west of the Visitor Center. This species is another target of the monitoring program.

*Nerium oleander* (oleander) – To the credit of the National Park Service, this species was removed from Cockspur Island in 1990. It is still growing along the US Highway 80 right-of-way on McQueens Island but should not be considered of concern for the Park Service.

*Pteris vittata* (Chinese brake fern) – Not widely reported for Georgia, this species is a nuisance, growing in the cracks of the masonry and weakening the structural integrity of the fort. Since it is restricted to high calcium sites such as the mortar of the brickwork it would not appear to be a threat to plant communities. In order to protect the fort, the National Park Service is currently using herbicide to control this species.

*Sapium sebiferum* (Chinese tallow-tree) – Perhaps the non-native species of greatest concern for this site. It was originally first introduced into the United States in 1772 in Georgia from seed sent to a farmer by Ben Franklin (Bruce *et al.* 1997). It could be argued that this species has probably been naturalized along the Georgia coast since before the civil war. The waxy fruit is consumed by birds and a twenty-five year old tree can produce over 100,000 seeds. It is a wonder that this species does not dominate more of the site than it currently does. It is particularly well established within the dike system as a part of the canopy along the low lying portion of southern Cockspur Island. This would agree with this species preference for saturated soils. According to Bruce *et al.* (1997), this tree seems to compete well on a wide variety of soils except for well-drained sites. It currently is not well established within the older and more protected portion of the maritime forest of central Cockspur. The monitoring program developed for this site has primarily focused on the question of whether or not this species will eventually replace native species in the canopy through time.

*Sorghum halepense* (Johnson grass) – This is a widespread and noxious weed of pastures and croplands throughout the south. It is not widespread on Cockspur or McQueens Island and would appear to pose no threat to the site.

*Tamarix gallica* (tamarisk) – This species was reported for the site by Southeast Wildlife Services but was not observed during this inventory. This plant also tends to be highly invasive in the coastal plain, but would be assumed not to be abundant (if it occurs at all) on this site. It is included on the list of plants to verify.

*Vinca minor* (periwinkle) – This low growing groundcover occurs as a large patch in the vicinity of the old cistern near Battery Hambright. It may be a relict of cultivation during the period of the construction village. It is mentioned here because it is beginning to extend into the maritime forest. It should be monitored visually and either reduced in size or removed if it appears to threaten this community.

**Management Considerations**

Because Fort Pulaski National Monument is a cultural resource based park and a historic park and, to a large extent, because much of the upland portion of the site was created by man, management concerns for the Park Service are minimal. The vegetation that has developed on the spoil deposits and altered marshlands is similar to many other sites along the Intracoastal Waterway and other areas adjacent coastal navigation routes in the southeast. The high proportion of non-native species associated with these disturbed habitats is typical and to be expected. As discussed above, it is remarkable that the maritime forest that has developed on the central portion of Cockspur Island displays the degree of integrity seen today. The simple monitoring program that has been initiated will be able to determine whether or not this forest may be threatened by tallow. Since there is a large amount of open area available for this species to become established, it is recommended that wherever an opportunity occurs to remove this

species, the National Park Service should attempt to prevent further encroachment. As an example, it was noted during the course of fieldwork, that the area surrounding the mosquito control pond was a site for heavy seedling / sapling recruitment for this species. This area was later mowed but constant vigilance of such sites needs to be maintained. It was also noted that tallow occasionally has become established along some of the open drainage ditches in the maintained grass portions of Cockspur Island. These discrete occurrences would also present good opportunities for the removal of this species. This will undoubtedly be an ongoing process and tallow will most likely always be a part of the vegetation here. The current policy of maintaining the large amount of grassy areas on Cockspur Island is probably the best management for this site. If these areas were to be left to the process of plant succession, Chinese tallow would increase dramatically and perhaps dominate this site.

Although no official federal or state threatened or endangered plant species were located during this inventory, the population of *Forestiera segregata* associated with the shell deposits on McQueens Island represents both a significantly rare plant occurrence for the state and a rare community. Weakley *et al.* (1998) assigns a G2? ranking to this plant association indicating that, at this time, so few examples of this community type exist that it should be considered globally imperiled. It has to be pointed out that the origins of this particular example are unknown and may only be recent and made-made. The National Park Service Southeastern Archaeological Center has indicated that they will continue to investigate the history of these deposits. For the present time the National Park Service should recognize and protect this area as a significant natural resource.

also distinct in being pubescent rather than glabrous.

**HABITAT:** In Georgia, primarily found on shell middens in salt marshes, it is also reported to occur on coastal hammocks, scrub, scrub barrens, and maritime woods [especially along the backside (sound side) margin of islands].

**DISTRIBUTION:** This shrub is found along the south Atlantic Coast from Florida to southern South Carolina and along the eastern Gulf Coast of Florida. It is also known to occur in Bermuda in the West Indies.

**STATUS COMMENTS:** Currently this species has a G4 global ranking and, at the time of this abstract, an S2 state ranking for Georgia. According to the Georgia Natural Heritage Program Element Occurrence database, only seven known stations for this species are currently recorded. Probably most abundant in Florida, it is regarded as rare in South Carolina.

**ECOLOGY:** Almost nothing has been published regarding the biology or ecology of this species. The rarity of this shrub can be attributed to its preference for the calcium rich habitat associated with shell deposits. The fact that these sites are generally small and widely scattered accounts for the low number of sites reported, particularly in the northern portion of its range. It is presumed that birds are an important agent in distributing seed from one remote site to the next.

**PHENOLOGY:** In some deciduous plants, flowering in the spring before new shoot emergence. In plants with overwintering leaves, flowers are produced on branchlets of the previous season. Occasionally flowering later in the season on the current years growth. Duncan and Duncan (1987) indicate blooming from September through April.

**BEST TREATMENT REFERENCE:**

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# APPENDIX A:

## Plant Checklist Fort Pulaski National Monument

# Plant Checklist Fort Pulaski National Monument

| Scientific Name | Common Name | Family |
|---|---|---|
| *Acacia farnesiana* (L.) Willd. | huisache | Mimosaceae |
| *Acalypha gracilens* Gray | acalypha | Euphorbiaceae |
| *Acer rubrum* L. | red maple | Aceraceae |
| *Agalinis fasiculata* (Ell.) Raf. | gerardia | Scrophulariaceae |
| *Agrostis hiemalis* (Walt.) BSP | bentgrass | Poaceae |
| *Alternanthera philoxeroides* (Mart.) Griseb. | alligator-weed | Amaranthaceae |
| *Amaranthus hybridus* L. | pigweed | Amaranthaceae |
| *Ambrosia artemisifolia* L. | ragweed | Asteraceae |
| *Ampelopsis arborea* (L.) Koehne | pepper-vine | Vitaceae |
| *Anagallis arvensis* L. | scarlet pimpernel | Primulaceae |
| *Andropogon glomeratus* (Walter)BSP | broom sedge | Poaceae |
| *Andropogon virginicus* L. | broom sedge | Poaceae |
| *Apium leptophyllum* (Persoon) | marsh parsley | Apiaceae |
| *Arenaria serpyllifolia* L. | thyme-leaved sandwort | Caryopyhllaceae |
| *Arundinaria gigantea* (Walt.) Muhl. | switch cane | Poaceae |
| *Asplenium platyneuron* (L.) Oakes | ebony spleenwort | Aspleniaceae |
| *Aster subulatus* Michx. var. *ligulatus* Shinners | aster | Asteraceae |
| *Aster tenuifolius* L. | salt marsh aster | Asteraceae |
| *Atriplex arenaria* Nuttall | seabeach orach | Chenopodiaceae |
| *Atriplex prostrata* Boucher ex DC | sea beach atriplex | Chenopodiaceae |
| *Baccharis angustifolia* Michaux | false willow | Asteraceae |
| *Baccharis halimifolia* L. | groundsel tree | Asteraceae |
| *Batis maritima* L. | saltwort | Bataceae |
| *Bidens bipinnata* L. | spanish-needles | Asteraceae |
| *Bidens pilosa* L. | sheperd's-needle | Asteraceae |
| *Boerhavia coccinea* P. Miller | wineflower | Nyctaginaceae |
| *Borrichia frutescens* (L.) DC | sea ox-eye | Asteraceae |
| *Briza minor* L. | quaking grass | Poaceae |

# Plant Checklist Fort Pulaski National Monument

| Scientific Name | Common Name | Family |
|---|---|---|
| *Bromus catharticus* Vahl. | rescue grass | Poaceae |
| *Bulbostylis capillaris* (L.) Clarke | bulbostylis | Cyperaceae |
| *Callicarpa americana* L. | French mulberry | Verbenaceae |
| *Calystegia sepium* (L.) R.Brown | hedge bindweed | Convolvulaceae |
| *Campsis radicans* (L.) Seem. ex Bureau | trumpet creeper | Bignoniaceae |
| *Carex albolutescens* Schweinitz | greenish-white sedge | Cyperaceae |
| *Carya illenoensis* (Wang.) K. Koch | pecan | Juglandaceae |
| *Celtis laevigata* Willd. | sugarberry | Ulmaceae |
| *Cenchrus echinatus* L. | southern sandspur | Poaceae |
| *Cenchrus longispinus* (Hackel) Fernald | northern sandspur | Poaceae |
| *Cenchrus tribuloides* L. | dune sandspur | Poaceae |
| *Centella asiatica* (L.) Urban | centella | Apiaceae |
| *Centrosema virginianum* (L.) Benth. | climbing butterfly pea | Fabaceae |
| *Cephalanthus occidentalis* L. | buttonbush | Rubiaceae |
| *Chaerophyllum tainturieri* Hooker | wild chervil | Apiaceae |
| *Chamaecrista nictitans* (L.) Moench var. *aspera* (Muhl. ex Ell.) Irwin & Barneby | southern sensitive-plant | Fabaceae |
| *Chamaesyce bombensis* (Jacquin) Dugand | chamaesyce | Euphorbiaceae |
| *Chamaesyce cordifolia* (Ell.) Small | spurge | Euphorbiaceae |
| *Chamaesyce maculata* (L.) Small | chamaesyce | Euphorbiaceae |
| *Chamaesyce polygonifolia* (L.) Small | seaside spurge | Euphorbiaceae |
| *Chasmanthium laxum* (L.) Yates | slender spikegrass | Poaceae |
| *Chenopodium album* L. | lamb's-quarters | Chenopodiaceae |
| *Chenopodium ambrosiodes* L. | mexican tea | Chenopodiaceae |
| *Cinnamomum camphora* (L.) Presl. | camphor-tree | Lauraceae |
| *Cirsium arvense* (L.) Scop. | Canada thistle | Asteraceae |
| *Cladium jamaicense* Crantz | saw-grass | Cyperaceae |
| *Clitoria mariana* L. | butterfly pea | Fabaceae |
| *Cnidoscolus stimulosus* (Michaux) Engelm.&Gray | spurge nettle | Euphorbiaceae |

# Plant Checklist Fort Pulaski National Monument

| Scientific Name | Common Name | Family |
|---|---|---|
| *Commelina communis* L. | dayflower | Commelinaceae |
| *Conyza bonariensis* (L.) Cronq. | horseweed | Asteraceae |
| *Conyza canadensis* (L.) Cronq. | horseweed | Asteraceae |
| *Coreopsis grandifolia* Hogg. | tickseed | Asteraceae |
| *Croton glandulosus* L. var. *septentrionalis* Mueller | sand croton | Euphorbiaceae |
| *Croton punctatus* Jaquin | silverleaf croton | Euphorbiaceae |
| *Cynanchum angustifolium* Persoon | sand-vine | Apocynaceae |
| *Cynodon dactylon* (L.) Persoon | bermuda grass | Poaceae |
| *Cyperus breifoloides* Thieret & Delahoussaye | cyperus | Cyperaceae |
| *Cyperus filicinnus* Vahl. | cyperus | Cyperaceae |
| *Cyperus lancastriensis* Porter | cyperus | Cyperaceae |
| *Cyperus ovularis* (Michaux) Torrey | cyperus | Cyperaceae |
| *Cyperus polystachys* Rottb. var. *texensis* (Torrey) Fernald | cyperus | Cyperaceae |
| *Cyperus retrorsus* Chapman | cyperus | Cyperaceae |
| *Cyperus rotundus* L. | cyperus | Cyperaceae |
| *Cyperus virens* Michx. | cyperus | Cyperaceae |
| *Digitaria sanguinalis* (L.) Scopoli | crab grass | Poaceae |
| *Diodia teres* Walter | rough buttonweed | Rubiaceae |
| *Diodia virginiana* L. | button-weed | Rubiaceae |
| *Diospyros virginiana* L. | persimmon | Ebenaceae |
| *Distichlis spicata* (L.) Greene | salt grass | Poaceae |
| *Echinocloa crusgali* (L.) Beauvois | barnyard grass | Poaceae |
| *Eclipta alba* (L.) Hasskarl | eclipta | Asteraceae |
| *Eleusine indica* (L.) Gaertner | goose grass | Poaceae |
| *Eragrostis elliottii* Watson | love grass | Poaceae |
| *Erechtites hieracifolia* (L.) Raf. | fireweed | Asteraceae |
| *Erigeron quercifolius* Lam. | flea-bane | Asteraceae |

# Plant Checklist Fort Pulaski National Monument

| Scientific Name | Common Name | Family |
|---|---|---|
| *Erigeron strigosus* Muhl. Ex Willd. | daisy fleabane | Asteraceae |
| *Eupatorium capillifolium* (Lam.) Small | dog-fennel | Asteraceae |
| *Eupatorium compositifolium* Walt. | dog-fennel | Asteraceae |
| *Eupatorium fistulosum* Barratt. | joe-pye weed | Asteraceae |
| *Eupatorium serotinum* Michaux | thoroughwort | Asteraceae |
| *Euphorbia curtisii?* Engelm. | euphorbia | Euphorbiaceae |
| *Eustachys petraea* (Sw.) Desv. | finger grass | Poaceae |
| *Euthamia tenuifolia* (Pursh) Greene | goldenrod | Asteraceae |
| *Ficus carica* L. | fig | Moraceae |
| *Fimbristylis castanea* (Michaux.) Vahl. | fimbristylis | Cyperaceae |
| *Fimbristylis puberula* (Michx.) Vahl. | fimbristylis | Cyperaceae |
| *Forestiera segregata* | Florida privet | Oleaceae |
| *Fumaria officinalis* L. | fumatory | Fumariaceae |
| *Gaillardia pulchella* Foug. | Indian blanket | Asteraceae |
| *Galactia elliotii* Nuttall | galactia | Fabaceae |
| *Galactia regularis* (L.) BSP. | milk-pea | Fabaceae |
| *Galactia volubilis* (L.) Britton | milk pea | Fabaceae |
| *Galium hispidulum* Michaux | bedstraw | Rubiaceae |
| *Galium parisiense* L. | wall bedstraw | Rubiaceae |
| *Gaura angustifolia* Michaux | gaura | Onagraceae |
| *Gleditsia triacanthos* L. | honey locust | Caesalpiniaceae |
| *Glottidium vesicarium* (Jacquin) Mohr. | bladder-pod | Fabaceae |
| *Gnaphalium obtusifolium* L. | rabbit tobacco | Asteraceae |
| *Gnaphalium purpureum* L. | purple cudweed | Asteraceae |
| *Helenium amarum* (Raf.) H. Rock | bitterweed | Asteraceace |
| *Heliotropium curassavicum* L. | seaside heliotrope | Boraginaceae |
| *Heterotheca subaxillaris* (Lam.) Britton & Rusby | camphorweed | Asteraceae |
| *Hordeum pusillum* Nuttall | barley | Poaceae |
| *Hydrocotyle bonariensis* Lam. | pennywort | Apiaceae |

# Plant Checklist Fort Pulaski National Monument

| Scientific Name | Common Name | Family |
|---|---|---|
| *Hydrocotyle umbellata* L. | water pennywort | Apiaceae |
| *Hypericum gentianoides* (L.) BSP. | pineweed | Hypericaceae |
| *Hypericum hypericoides* (L). Crantz | St. Andrew's Cross | Clusiaceae |
| *Hypochoeris brasiliensis* (Less.) Hook. & Arn. | cat's ear | Asteraceae |
| *Hypochoeris glabra* L. | cat's ear | Asteraceae |
| *Hypochoeris microcephala* (Schultz-Bip.) Cabrera var. *albiflora* (Kuntze) Cabrera | cat's ear | Asteraceae |
| *Ilex vomitoria* Aiton | yaupon | Aquifoliaceae |
| *Ipomea hederacea* (L.) Jacquin | morning glory | Convolvulaceae |
| *Ipomea pandurata* (L.) Mey. | manroot | Convolvulaceae |
| *Ipomea sagittata* Cav. | morning glory | Convolvulaceae |
| *Iva frutescens* L. | marsh elder | Asteraceae |
| *Juncus coriaceus* Mackenzie | rush | Juncaceae |
| *Juncus dichotomus* Ell. | rush | Juncaceae |
| *Juncus diffusissimus* Buckley | diffuse rush | Juncaceae |
| *Juncus effusus* L. | common rush | Juncaceae |
| *Juncus marginatus* Rostk. | rush | Juncaeae |
| *Juncus roemarianus* Scheele | black needle-rush | Juncaceae |
| *Juncus tenuis* Willd. | path rush | Juncaceae |
| *Juniperus virginiana* L. var. *silicicola* (Small) J. Silba | coastal red-cedar | Cupressaceae |
| *Krigia oppositifolia* Raf. | dandelion | Asteraceae |
| *Krigia virginica* (L.) | dandelion | Asteraceae |
| *Lactuca floridana?* (L.) Gaertner | wild lettuce | Asteraceae |
| *Lactuca graminifolia* Michx. | wild lettuce | Asteraceae |
| *Lagerstromia indica* L. | crape myrtle | Lythraceaeae |
| *Lantana camara* L. | lantana | Verbenaceae |
| *Lepidium virginicum* L. | poor-man's pepper | Brassicaceae |
| *Lespedeza cuneata* (Dumont) G. Don | sericea | Fabaceae |

# Plant Checklist Fort Pulaski National Monument

| Scientific Name | Common Name | Family |
|---|---|---|
| *Ligustrum japonicum* Thunberg | Japanese privet | Oleaceae |
| *Ligustrum sinense* Lour | Chinese privet | Oleaceae |
| *Limonium carolinianum* (Walter) | sea lavender | Plumbaceae |
| *Liquidambar styraciflua* L. | sweet-gum | Hamamelidaceae |
| *Lonicera japonica* Thunberg | Japanese honeysuckle | Caprifoliaceae |
| *Medicago polymorpha* L. | bur clover | Fabaceae |
| *Melia azedarach* L. | China-berry | Meliaceae |
| *Melilotus alba* Desr. | white sweet clover | Fabaceae |
| *Melilotus indica* (L.) All. | sour clover | Fabaceae |
| *Melilotus officinalis* (L.) Lam. | yellow sweet clover | Fabaceae |
| *Melothria pendula* L. | creeping cucumber | Cucurbitaceae |
| *Mikania scandens* (L.) Willd. | climbing hempweed | Asteraceae |
| *Mirabilis jalapa* L. | four-o'clock | Nyctaginaceae |
| *Modiola caroliniana* (L.) G. Don | modiola | Malvaceae |
| *Morus alba* L. | white mulberry | Moraceae |
| *Muhlenbergia filipes* M.A. Curtis | muhlenbergia | Poaceae |
| *Myrica cerifera* L. | wax myrtle | Myricacea |
| *Nerium oleander* L. | oleander | Apocynaceae |
| *Nuttallanthus canadensis* (L.) D.A. Sutton | Canada toadflax | Scrophulariaceae |
| *Oenothera humifusa* Nuttall | dunes evening primrose | Onagraceae |
| *Oenothera laciniata* Hill. | evening primrose | Onagraceae |
| *Oenothera speciosa* Nuttall | primrose | Onagraceae |
| *Oplismenus hirtellus* (L.) Beauv. | woods-grass | Poaceae |
| *Opuntia humifusa* (Raf.) Raf. | prickly pear | Cataceae |
| *Opuntia pusila* (Haw.) Haw. | devil's joint | Cactaceae |
| *Oxalis stricta* L. | wood sorrel | Oxalidaceae |
| *Panicum amarum* Ell. | seaside panicum | Poaceae |
| *Parthenocissus quinquefolia* (L.) Planchorn | Virginia creeper | Vitaceae |
| *Paspalum dilatatum* Poiret | Dallis grass | Poaceae |

# Plant Checklist Fort Pulaski National Monument

| Scientific Name | Common Name | Family |
|---|---|---|
| *Paspalum distichum* L. | paspalum | Poaceae |
| *Paspalum notatum* Flugge | Bahia grass | Poaceae |
| *Paspalum urvillei* Steudle | paspalum | Poaceae |
| *Paspalum vaginatum* Swartz. | seashore paspalum | Poaceae |
| *Passiflora incarnata* L. | maypops | Passifloraceae |
| *Persea borbonia* (L.) Sprengle | red bay | Lauraceae |
| *Phalaris caroliniana* Walter | canary grass | Poaceae |
| *Phyla nodiflora* (L.) Greene | frog's- bit | Verbenaceae |
| *Phyllanthus* sp. | phyllanthus | Euphoriaceae |
| *Physalis walteri* Nuttall. | dune ground cherry | Solanaceae |
| *Phytolacca americana* L. | pokeweed | Phytolaccaceae |
| *Phytolacca rigida* Small | maritime pokeweed | Phytolaccaceae |
| *Pinus elliottii* Engelm. | slash pine | Pinaceae |
| *Platanus occidentalis* L. | sycamore | Platanaceae |
| *Pluchea rosea* Godfrey | marsh-fleabane | Asteraceae |
| *Polycarpon tetraphyllum* (L.) L. | four-leaved allseed | Caryophyllaceae |
| *Polygonatum punctatum* Ell. | smartweed | Polygonaceae |
| *Polygonum setaceum* Baldwin ex Ell. | smartweed | Polygonaceae |
| *Polypogon maritimus* Willdenow | Meditteranean beardgrass | Poaceae |
| *Polypogon monspielensis* (L.) Desf. | rabbitfoot grass | Poaceae |
| *Polypremum procumbens* L. | polypremum | Loganiaceae |
| *Portulaca oleracea* L. | purslane | Portulacaceae |
| *Portulaca pilosa* L. | portulaca | Portulacaeae |
| *Prunus angustifolia* Marsh. | chickasaw plum | Rosaceae |
| *Prunus caroliniana* Aiton | Carolina laurel cherry | Rosaceae |
| *Prunus serotina* Ehrhart | black cherry | Rosaceae |
| *Pteridium aquilinum* (L.) Kuhn. | bracken fern | Dennstaediaceae |
| *Pteris vittata* L. | Chinese brake fern | Pteridaceae |
| *Pyracantha coccinea* MJ Roemer | pyracantha | Rosaceae |

# Plant Checklist Fort Pulaski National Monument

| Scientific Name | Common Name | Family |
|---|---|---|
| *Pyrrhopappus carolinianus* (Walter) DC. | false-dandelion | Asteraceae |
| *Quercus hemisphaerica* Bartram | laurel oak | Fagaceae |
| *Quercus virginiana* Miller | live oak | Fagaceae |
| *Ranunculus pusillus* Poiret | buttercup | Ranunculaceae |
| *Ranunculus sardous* Crantz. | buttercup | Ranunculaceae |
| *Raphanus raphanistrum* L. | wild radish | Brassicaceae |
| *Rhus copallina* L. | winged sumac | Anacardaceae |
| *Rhynchosia tomentosa* (L.) H.&A. | rhynchosia | Fabaceae |
| *Richardia brasiliensis* (Moq.) Gomez | richardia | Rubiaceae |
| *Rubus argutus* L. | blackberry | Rosaceae |
| *Rubus hispidus* L. | dewberry | Rosaceae |
| *Rubus trivialis* Michaux | dewberry | Rosaceae |
| *Rumex hastatulus* Baldwin ex. Ell. | wild sorrel | Polygonaceae |
| *Rumex verticillatus* L. | swamp dock | Polygonaceae |
| *Sabal palmetto* Lodd. Ex Schultes | cabbage palm | Arecaceae |
| *Sabatia brachiata* Ell. | sabatia | Gentianaceae |
| *Sabatia stellaris* Pursh | sabatia | Gentianaceae |
| *Salicornia bigelovii* Torrey | glasswort | Chenopodiaceae |
| *Salix caroliniana* Michaux | swamp willow | Salicaceae |
| *Salix nigra* Marshall | black willow | Salicaceae |
| *Salsola kali* L. | Russian-thistle | Chenopodiaceae |
| Salv*ia lyrata* L. | lyre-leaved sage | Lamiaceae |
| *Sambucus canadensis* L. | elderberry | Caprifoliaceae |
| *Sanicula canadensis* L. | snakeroot | Apiaceae |
| *Sapium sebiferum* (L.) Roxb. | Chinese tallow-tree | Euphorbiaceae |
| *Sarcocornia perennis* (Mill.) A.J. Scott | perennial glasswort | Chenopodiaceae |
| *Sassafras albidum* (Nutt.) Nees | sassafras | Lauraceae |
| *Scirpus robustus* Pursh | saltmarsh bulrush | Cyperaceae |
| *Scleranthus annuus* L. | scleranthus | Caryophyllaceae |

# Plant Checklist Fort Pulaski National Monument

| Scientific Name | Common Name | Family |
|---|---|---|
| *Scleria triglomerata* Michaux | nut-sedge | Cyperaceae |
| *Senna obtusifolia* (L.) Irwin & Barneby | coffeeweed | Caesalpinaceae |
| *Sesbania exaltata* (Raf.) Rydberg ex A.W. Hill | sesbania | Fabaceae |
| *Sesuvium maritimum* (Walt.) B.S.P. | sea purslane | Aizoaceae |
| *Sesuvium portulacastrum* L. | sea purslane | Aizoaceae |
| *Setaria geniculata* (Lam.)Beauvois | bent foxtail grass | Poaceae |
| *Setaria magna* Griesbach | giant foxtail grass | Poaceae |
| *Sida acuta* Burman f. | broomweed | Malvaceae |
| *Sida rhombifolia* L. | sida | Malvaceae |
| *Sida spinosa* L. | prickly mallow | Malvaceae |
| *Sideroxylon tenax* L. | tough buckthorn | Sapotaceae |
| *Sisyrinchium exile* Bickn. | annual blue-eyed-grass | Iridaceae |
| *Sisyrinchium rosulatum* Bick. | blue-eyed grass | Iridaceae |
| *Smilax auriculata* Walter | greenbrier | Smilacaceae |
| *Smilax bona-nox* L. | greenbrier | Smilacaceae |
| *Solanum carolinense* L. | horse-nettle | Solanaceae |
| *Solanum pseudogracile* Heisse | black nightshade | Solanaceae |
| *Solanum sisymbriifolium* Lam.? | buffalo bur | Soalanceae |
| *Solidago canadensis* L. | goldenrod | Asteraceae |
| *Solidago sempervirens* L. | seaside goldenrod | Asteraceae |
| *Sorghum halepense* (L.) Persoon | Johnson grass | Poaceae |
| *Spartina alterniflora* Loisel | smooth cordgrass | Poaceae |
| *Spartina cynosuroides* (L.) Roth | big cordgrass | Poaceae |
| *Spartina patens* (Aiton ) Muhl. | salt meadow cordgrass | Poaceae |
| *Spenopholis obtusata* (Michx.) Scribn. | prairie wedge-grass | Poaceae |
| *Spergularia salina* J.&K. Presl | sand spurrey | Caryophyllaceae |
| *Spermolepis echinata* (Nuttall ex DC) | hooked spermolepis | Apiaceae |
| *Spiranthes praecox* (Walt.) Watson | grass leaved ladies' tresses | Orchidaceae |
| *Sporobolus indicus* (L.) R. Br. | smut grass | Poaceae |

# Plant Checklist Fort Pulaski National Monument

| Scientific Name | Common Name | Family |
|---|---|---|
| *Sporobolus virginicus* (L.) Kunth | coastal dropseed | Poaceae |
| *Stachys floridana* Shuttlew. | Florida hedge nettle | Lamiaceae |
| *Stellaria media* (L.) Cyrillo | chickweed | Caryophyllaceae |
| *Stenotaphrum secundatum* (Walt.) Kuntze | Saint Augustine grass | Poaceae |
| *Strophostyles helvola* (L.) Ell. | wild bean | Fabaceae |
| *Suaeda linearis* (Ell.) Moq. | suaeda | Chenopodiaceae |
| *Tamarix gallica* L. | tamarisk | Tamaricaceae |
| *Taraxacum officinale* Wiggers | dandelion | Asteraceae |
| *Teucrium canadense* L. | wood-sage | Lamiaceae |
| *Tillandsia usneoides* L. | Spanish moss | Bromeliaceae |
| *Tribulus terrestris* L. | puncture-weed | Zygophyllaceae |
| *Trichostema dichotomum* L. | blue-curls | Lamiaceae |
| *Trifolium arvense* L. | rabbit foot clover | Fabaceae |
| *Trifolium dubium* Sibthorp | low hop clover | Fabaceae |
| *Triodanis perfoliata*(L.) Nieuw. | Venus' looking glass | Campanulaceae |
| Trip*lasis purpurea* (Walter) Chapman | sand grass | Poaceae |
| *Typha angustifolia* L. | narrow-leaved cattail | Typhaceae |
| *Ulmus americana* L. | American elm | Ulmaceae |
| *Uniola paniculata* L. | sea oats | Poaceae |
| *Verbena bonariensis* L. | verbena | Verbenaceae |
| *Verbena brasiliensis* Vellozo | verbena | Verbenaceae |
| *Verbena hastata* L. | verbena | Verbenaceae |
| *Verbena tenuisecta* Briquet | verbena | Verbenaceae |
| *Veronica arvensis* L. | speedwell | Scrophulariaceae |
| *Vicia grandiflora* Scopoli | large-flowered vetch | Fabaceae |
| *Vicia sativa* L. ssp. nigra (L.) Ehrhart. | narrow-leaved vetch | Fabaceae |
| *Vicia tetrasperma* (L.) Moench | vetch | Fabaceae |
| *Vicia villosa* Roth | winter vetch | Fabaceae |

# Plant Checklist Fort Pulaski National Monument

| Scientific Name | Common Name | Family |
|---|---|---|
| *Vinca minor* L. | periwinkle | Apocynaceae |
| *Vitis aestivalis* Michaux | summer grape | Vitaceae |
| *Vitis rotundifolia* Michx. | muscadine | Vitaceae |
| *Vulpia sciurea* (Nutt.) Henr. | squirreltail fescue | Poaceae |
| *Wahlenbergia marginata* (Thunberg) DC. | wahlenbergia | Campanulaceae |
| *Youngia japonica* (L.) DC. | hawk's beard | Asteraceaee |
| *Yucca aloifolia* L. | Spanish bayonet | Agavaceae |
| *Yucca filamentosa* L. | bear-grass | Agavaceae |
| *Zanthoxylum clava-herculis* L. | toothache tree | Rutaceae |
| *Zephyranthes candida* (Lindley) Herbert | zephranthes | Liliaceae |

# APPENDIX B:

## Plant Species Needing Verification Fort Pulaski National Monument

## Fort Pulaski Plant Species Needing Verification

| Species Name | Common Name | Family | *Source |
|---|---|---|---|
| Boerhavia coccinea | wineflower | Nyctaginaceae | A |
| Bulbostylis capillaris | bulbostylis | Cyperaceae | A |
| Calystegia sepium | hedge bindweed | Concolvulaceae | B |
| Centrosema virginianum | climbing butterfly pea | Fabaceae | A |
| Cephalanthus occidentalis | buttonbush | Rubiaceae | A |
| Chamaesyce bombensis | chamaesyce | Euphorbiaceae | AB |
| Chamaesyce polygonifolia | seaside spurge | Euphorbiaceae | A |
| Cirsium arvense | Canada thistle | Asteraceae | A |
| Cnidoscolus stimulosus | spurge nettle | Euphorbiaceae | A |
| Convolvulus arensis | field bindweed | Convolvulaceae | A |
| Cyperus breifoloides | cyperus | Cyperaceae | B |
| Cyperus lancastriensis | cyperus | Cyperaceae | A |
| Cyperus polystachys | cyperus | Cyperaceae | B |
| Diodia virginiana | button-weed | Rubiaceae | A |
| Eclipta alba | eclipta | Asteraceae | B |
| Erigeron strigosus | daisy fleabane | Asteraceae | A |
| Euphorbia curtisii? | euphorbia | Euphorbiaceae | B |
| Galactia volubilis | milk pea | Fabaceae | A |
| Gleditsia triacanthos | honey locust | Caesalpiniaceae | A |
| Hydrocotyle umbellata | water pennywort | Apiaceae | A |
| Hypochoeris brasiliensis | cat's ear | Asteraceae | A |
| Hypochoeris glabra | cat's ear | Asteraceae | B |
| Ipomea pandurata | manroot | Convolvulaceae | A |
| Juncus coriaceus | rush | Juncaceae | A |
| Juncus marginatus | rush | Juncaeae | A |
| Mirabilis jalapa | four-o'clock | Nyctaginaceae | A |

*Source: A = Eyles 1938; B = Southeastern Wildlife Services, Inc. 1981

## Fort Pulaski Plant Species Needing Verification (cont.)

| Species Name | Common Name | Family | *Source |
|---|---|---|---|
| Phyllanthus sp. | phyllanthus | Euphoriaceae | B |
| Portulaca oleracea | purslane | Portulacaceae | A |
| Ranunculus sardous | buttercup | Ranunculaceae | B |
| Rhynchosia tomentosa | rhynchosia | Fabaceae | A |
| Sabatia brachiata | sabatia | Gentianaceae | A |
| Sabatia stellaris | sabatia | Gentianaceae | B |
| Sida acuta | broomweed | Malvaceae | A |
| Spenopholis obtusata | prairie wedge-grass | Poaceae | A |
| Tamarix gallica | tamarisk | Tamaricaceae | AB |
| Vicia grandiflora | large-flowered vetch | Fabaceae | B |

*Source: A = Eyles 1938; B = Southeastern Wildlife Services, Inc. 1981

# Appendix C:

# Classification of Natural Communities at Fort Pulaski National Monument

# Classification of Natural Communities at Fort Pulaski National Monument

[Formation names in bold type – Alliance numbers and Association numbers from Weakley *et al.* (1998)]

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## Lowland temperate seasonal evergreen forest

*I.A.4.N.a. Quercus virginiana* - (*Sabal palmetto*) Forest Alliance (A.55) [Live Oak - (Cabbage Palmetto) Forest Alliance]

> *Quercus virginiana* - (*Pinus elliottii* var. elliottii, *Sabal palmetto*) / *Persea borbonia* - *Callicarpa americana* Forest [Live Oak - (Slash Pine, Cabbage Palmetto) Redbay - Beautyberry Forest] CEGL007032 – G2
>
> *Juniperus virginiana* var. *silicicola* - (*Quercus virginiana, Sabal palmetto*) Forest [Coastal Red-cedar - (Live Oak, Cabbage Palmetto) Forest] CEGL007813 – G3?

## Planted/Cultivated temperate or subpolar needle-leaved evergreen forest

*I.A.8.C.x - Pinus elliotii* Planted Forest Alliance (A.95) [Slash Pine Planted Forest Alliance]

> *Pinus elliotii* var. *elliotii* Planted Forest (Slash Pine Planted Forest) CEGL007170 - GC

## Temperate broad-leaved evergreen woodland

*II.A.2N.a - Quercus virginana - Juniperus virginiana* - (*Sabal palmetto*) Woodland Alliance (A.479) [Live Oak - Eastern Red-cedar - (Cabbage Palmetto) Woodland Alliance]

> *Juniperus virginiana* var. *silicicola - Zanthoxylum clava-herculis - Quercus virginana* - (*Sabal palmetto*) / *Sageretia minutiflora* - (*Sideroxylon tenax*) Woodland [Coastal red-cedar - Toothache-tree - Live Oak (Cabbage Palmetto) / Smallflower Sageretia - (Tough Bumelia) Woodland] CEGL0035250 – G2?

II.A.2.N.a – *Sabal palmetto* Woodland Alliance (A.481) [Cabbage Palmetto Woodland Alliance]

> *Sabal palmetto* (*Juniperus virginiana* var. *silicicola*) Woodland [Cabbage Palmetto (Coastal Red-cedar) Woodland] CEGL003526 – G2?

# Classification of Natural Communities at Fort Pulaski National Monument

[Formation names in bold type – Alliance numbers and Association numbers from Weakley *et al.* (1998)]

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## Saturated temperate broad-leaved evergreen shrubland

*III.A.2.N.i - Myrica cerifera* Saturated Shrubland Alliance (A.1906) [Wax-myrtle Saturated Shrubland Alliance]

*Myrica cerifera / Spartina patens - (Juncus roemerianus)* Shrubland [Wax-myrtle / Saltmeadow Cordgrass - (Black Needlerush) Shrubland] CEGL003839 – G3

## Tidal cold-deciduous shrublands

*III.B.2.N.h - Baccharis halimifolia - Iva frutescens* Tidal Shrubland Alliance (A.1023) [Groundsel-tree - Maritime Marsh-elder Tidal Shrubland Alliance]

*Baccharis halimifolia - Iva frutescens - Myrica cerifera - (Ilex vomitoria)* Shrubland [Groundsel-tree - Maritime Marsh-elder - Wax myrtle (Yaupon) Shrubland] CEGL003920 – G4?

*III.B.2.N.h - Borrichia frutescens* Tidal Shrubland Alliance (A.1026) [Seaside Oxeye Tidal Shrubland Alliance]

*Borrichia frutescens / Spartina patens - Juncus roemerianus* Shrubland [Seaside Oxeye /Saltmeadow Cordgrass - Black Needlerush Shrubland] CEGL003924 – G4

## Tidal needle-leaved or microphyllous evergreen dwarf-shrubland

*IV.A.2.N.c - Batis maritima* Tidal Dwarf-shrubland Alliance (A.1111) [Saltwort Tidal Dwarf-shrubland Tidal Alliance]

*Batis maritima - Sarcocornia perennis* Dwarf-shrubland [Saltwort - Woody-glasswort Dwarf-shrubland] CEGL003956 – G5

*IV.A.2.N.c - Sarcocornia perennis - (Distichlis spicata, Spartina alterniflora)* Tidal Dwarf-shrubland Alliance (A.1705) [Woody-glasswort - (Salt Grass, Saltmarsh Cordgrass) Tidal Dwarf-shrubland Alliance]

*Sarcocornia perennis - Batis maritima - Distichlis spicata* Dwarf-shrubland [Woody-glasswort - Saltwort - Salt Grass Dwarf-shrubland] CEGL002278 – G4

# Classification of Natural Communities at Fort Pulaski National Monument

[Formation names in bold type – Alliance numbers and Association numbers from Weakley *et al.* (1998)]

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## Tidal temperate or subpolar grassland

*V.A.5.N.n - Juncus roemerianus* Tidal Herbaceous Alliance (A.1475) [Needle Rush Tidal Herbaceous Alliance]

> *Juncus roemerianus* Herbaceous Vegetation [Needle Rush Herbaceous Vegetation] - CEGL004186 – G5

*V.A.5.N.n- Spartina alterniflora* Tidal Herbaceous Alliance (A.1471) [Saltmarsh Cordgrass Tidal Herbaceous Alliance]

> *Spartina alterniflora* Carolinian Zone Vegetation [Saltmarsh Cordgrass Carolinian Zone Herbaceous Vegetation] CEGL004191 – G5

*V.A.5.N.n- Spartina cynosuroides* Tidal Herbaceous Alliance (A.1480) [Giant Cordgrass Tidal Herbaceous Alliance]

> *Spartina cynosuroides* Herbaceous Vegetation [Giant Cordgrass Herbaceous Vegetation] CEGL004195 – G4

*V.A.5.N.n- Spartina patens - (Distichlis spicata)* Tidal Herbaceous Alliance (A.1481) [Saltmeadow Cordgrass - Salt Grass Tidal Herbaceous Alliance]

> *Spartina patens - Distichlis spicata - Borrichia frutescens* Herbaceous Vegetation [Saltmeadow Cordgrass - Salt Grass - Seaside Oxeye Herbaceous Vegetation] CEGL004197 – G4G5

# APPENDIX D:

## Plant Collection Data

# Plant Collection Data - Govus 1998 - Fort Pulaski National Monument Inventory

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Acalypha gracilens* Gray
(EUPHORBIACEAE)

Growing in disturbed sandy soil near dike on north end of Cockspur Island.

Tom Govus 887 — 5 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Agalinus fasiculata* (Ell.) Raf.
(SCROPHULARIACEAE)

Widespread in open areas along US 80 on McQueens Island and the Old Savannah-Tybee Railroad Multipurpose Trail.

Tom Govus 955 — 22 September 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Agrostis hiemalis* (Walt.) BSP
(POACEAE)

Growing near edge of high marsh on north Cockspur Island just east of Pilot's House

Tom Govus 956 — 7 May 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Alternanthera philoxeroides* (Mart.) Griseb.
(AMARANTHACEAE)

Several plants growing in low wet depression just southeast of maintenance building, south central Cockspur Island.

Tom Govus 957 — 7 May 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Amaranthus hybridus* L.
(AMARANTHACEAE)

Growing on grassy areas on top of roof of Fort Pulaski, widely scattered.

Tom Govus 958 — 13 July 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Arenaria serpyllifolia* L.
(CARYOPHYLLACEAE)

Cockspur Island, growing in sandy openings along narrow hammocks north and east of the fort.

Tom Govus 959 — 11 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Arundinaria gigantea* (Walt.) Muhl.
(POACEAE)

Small patch growing south of old section of US 80 near old steel bridge on the Bull River, south central McQueens Island.

Tom Govus 960 — 13 July 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Atriplex prostrata* Boucher ex Augustin de Candolle.
(CYPERACEAE)

Growing in groundcover stratum of juniper scrub forest on edge of marsh just east of clearing for view on north Savannah River. Many plants seen.

Tom Govus 926 — 8 November 1997

University of Georgia — Athens, GA USA

# Plant Collection Data - Govus 1998 - Fort Pulaski National Monument Inventory

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Bidens pilosa* L.
(ASTERACEAE)

Widely scattered along US 80 on McQueens Island in vicinity of bridge to Tybee Island.

Tom Govus 961 — 10 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Briza minor* L.
(POACEAE)

Widespread in grassy areas, especially on recent sandy spoil deposits, west Cockspur Island.

Tom Govus 962 — 7 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Cinnamomum camphora* (L.) Presl.
(LAURACEAE)

Western Cockspur Island, just east of picnic area along edge of wood on south side of trail where it enters forest on route to Visitor Center. Young maritime forest.

Tom Govus 882 — 11 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Campsis radicans* (L.) Seem. Ex Bureau
(BIGNONIACEAE)

Widely scatterd and growing on shrubs and small trees on Old Savannah-Tybee Railroad Multipurpose Trail, McQueens Island.

Tom Govus 964 — 13 July 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Carex albolutescens* Schwein.
(CYPERACEAE)

Growing in scattered patches in grassy areas adjacent the entrance road, Cockspur Island.

Tom Govus 965 — 9 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Chaerophyllum tainturieri* Hook.
(APIACEAE)

Located near parking area for Old Savannah-Tybee Railroad Multipurpose Trail, south central McQueens Island.

Tom Govus 966 — 10 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Chamaecrista nictitans* (L.) Moench var. *aspera* (Muhl. ex Ell.) Irwin & Barneby
(CAESALPINACEAE)

Widely scattered along old section of US 80 near old steel bridge on the Bull River, south central McQueens Island.

Tom Govus 967 — 22 September 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Chasmanthium sessiliflorum* (Poir.) Yates
(POACEAE)

Growing in wet depression on western end of Old Savannah-Tybee Railroad Multipurpose Trail, McQueens Island, spoil deposit island.

Tom Govus 968 — 24 September 1998

University of Georgia — Athens, GA USA

# Plant Collection Data - Govus 1998 - Fort Pulaski National Monument Inventory

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Cladium jamaaicense* Crantz
(CYPERACEAE)

Growing in small slough from south channel of Savannah River in vicinity of picnic area, south central Cockspur Island.

Tom Govus 969 — 7 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Coreopsis grandiflora* Hogg. Ex Sweet
(ASTERACEAE)

Widely scattered along Old Savannah-Tybee Railroad Multipurpose Trail, McQueens Island.

Tom Govus 970 — 13 July 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Cyperus filicinus* Vahl.
(CYPERACEAE)

Peaty openings in lawn area just south of fort. Widespread throughout the lawn area.

Tom Govus 925 — 7 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Cyperus ovularis*
(CYPERACEAE)

Growing in sandy spoil bank southwest edge of Cockspur Island south of Coast Guard station. Associates: *Rhus coppalina, Verbena tenuisecta, Ampelopsis arborea.*

Tom Govus 897 — 4 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Diospyros virginiana* L.
(EBENACEAE)

Growing in thickets adjacent road to public boat ramp on eastern end of McQueens Island.

Tom Govus 918 — 8 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Eragrostis elliotii* Watson
(POACEAE)

Widely scattered in spoil area of southwest Cockspur Island.

Tom Govus 899 — 5 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Forestiera segregata* (Jaquin) Krug & Urban
(OLEACEAE)

More than a dozen shrubs scattered widely on four large shell middens located at the northeast end of McQueens Island along the the southern edge of the beginning of the South Channel of the Savannah River. Associates: *Juniperus virginiana* var. *silicicola, Zanthoxylum clava-hercules, Osmanthus americana* and *Opuntia humifusa.*

Tom Govus 929 — 10 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Gaillardia pulchella* Foug.
(ASTERACEAE)

Widely scattered along Old Savannah-Tybee Railroad Multipurpose Trail, McQueens Island.

Tom Govus 971 — 10 April 1998

University of Georgia — Athens, GA USA

# Plant Collection Data - Govus 1998 - Fort Pulaski National Monument Inventory

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Galium hispidulum* Gray
(RUBIACEAE)

Growing at the base of sumac and hackberry in spoil bank near southwest corner of Cockspur Island.

Tom Govus 894 — 5 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Galium parisiense* L.
(RUBIACEAE)

Growing on edge of dike, south of fort, Cockspur Island.

Tom Govus 972 — 8 May 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Gnaphalium obtusifolium* L.
(ASTERACEAE)

Edge of thickets in sandy spoilbank area near western boundary of monument.

Tom Govus 973 — 11 July 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Helenium amarum* (Raf.) H. Rock
(ASTERACEAE)

Near boat ramp on eastern end of McQueens Island, growing along edge of road. Also widely scattered along US 80.

Tom Govus 922 — 8 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Hypericum hypericoides* (L.) Crantz
(CLUSIACEAE)

Scattered in small openings of narrow *Juniperus silicicola* hammocks to north and east of fort, Cockspur Island.

Tom Govus 975 — 22 Sptember 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Hypochaeris microcephalis* (Schultz-Bip) Cabrer.
(ASTERACEAE)

Growing on edge of dike in vicinity of entrance road, Cockspur Island. Verified at UGA, apparently a state record plant, probably introduced from ballast heaps from Gulf Coast.

Tom Govus 976 — 9 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Juncus diffusissimus* Buckl.
(JUNCACEAE)

Abundant along edge of small pond built for mosquito control, south central Cockspur Island.

Tom Govus 977 — 7 May 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Juncus tenuis* Willd.
(JUNCACEAE)

Growing on edge of dike in small clay depression just west of entrance road, Cockspur Island.

Tom Govus 978 — 9 April 1998

University of Georgia — Athens, GA USA

# Plant Collection Data - Govus 1998 - Fort Pulaski National Monument Inventory

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Krigia virginica* (L.) Willd.
(ASTERACEAE)

Scattered in sandy openings on narrow hammocks to north and east of fort, Cockspur Island.

Tom Govus 979 — 9 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Krigia oppositifolia* Raf.
(ASTERACEAE)

Growing in lawn area, north of paved road by picnic area, Cockspur Island.

Tom Govus 980 — 7 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Ligustrum sinese* Lour.
(OLEACEAE)

Western Cockspur Island, along edge of wood just south of trail to picnic area. Young successional maritime forest. Only a few plants seen. Associates: *Persea borbonia, Celtis laevigata.*

Tom Govus 881 — 11 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Nuttallanthus canadensis* (L) D.A. Sutton
[=*Linaria canadensis*]
(SCROPHULARIACEAE)

Scattered throughout mown grassy areas of western Cockspur Island, south of Coast Guard station.

Tom Govus 981 — 6 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Oplismenus hirtellus* (L.) Beavy
(POACEAE)

Widespread as groundcover in mature martime forest along nature trail on central Cockspur Island. Associates: *Juniperus virginiana* var. *silicicola, Sabal palmetto, Celtis laevigata, Ilex vomitoria.*

Tom Govus 884 — 5 November 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Opuntia pusilla* (Haworth) Nuttall
(CATACEAE)

Widely scattered in sandy openings of juniper scrub forests along northeast end of Cockspur Island, adjacent marsh lining the Savannah River.

Tom Govus 901 — 6 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Osmanthus americana* (L.) Gray
(OLEACEAE)

Occurring in central portion of eastern most hammock (shell midden) on northeast corner of McQueens Island. One large tree seen.

Tom Govus 917 — 8 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Phalaris caroliniana* Walt.
(POACEAE)

Widely scattered throughout grassy areas of central Cockspur Island.

Tom Govus 982 — 9 April 1998

University of Georgia — Athens, GA USA

# Plant Collection Data - Govus 1998 - Fort Pulaski National Monument Inventory

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Phytolacca rigida* Small
(PHYTOLACCACEAE)

In shell deposits on northeast McQueens Island, also along Old Savannah-Tybee Railroad Multipurpose Trail.

Tom Govus 983 — 13 July 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Polycarpon tetraphyllum* (L.) L.
(CARYOPHYLLACEAE)

Growing in sandy spoil deposits in pure stands of *Juniperus silicicola,* north Cockspur Island.

Tom Govus 984 — 7 May 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Polygonum punctatum* Ell.
(POLYGONACEAE)

Growing in water of ditch just northwest of parking area for Visitor Center. Near large open unmowed area.

Tom Govus 905 — 6 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Polygonum setaceum* Baldwin ex Ell.
(POLYGONACEAE)

Growing along edge of trail to picnic area, five meters east of junction with nature trail. Edge of young maritime forest.

Tom Govus 906 — 6 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Polypogon maritimus* Willd.
(POACEAE)

Widely scattered on dike system of Cockspur Island.

Tom Govus 985 — 8 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Pteris vittata* L.
(PTERIDACEAE)

Prolifically growing in masonry crevices of wall of Fort Pulaski, Cockspur Island. Widespread and a nuisance.

Tom Govus 986 — 13 July 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Pyracantha coccinea* MJ Roemer.
(ROSACEAE)

Growing along edge of woods near junction of entrance road with road to picnic area. Escape from cultivation. Only one plant seen.

Tom Govus 906 — 6 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Quercus hemisphaerica* Bartr. Ex Willd.
(FAGACEAE)

Only one tree seen, growing on lawn of old quarantine station, central Cockspur Island.

Tom Govus 987 — 7 May 1998

University of Georgia — Athens, GA USA

# Plant Collection Data - Govus 1998 - Fort Pulaski National Monument Inventory

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Quercus virginiana* P. Mill.
(FAGACEAE)

Growing in narrow strips of forest dividing open areas in boneyard area of southwest Cockspur Island. Mostly young trees.

Tom Govus 988 — 11 July 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Ranunculus pusillus* Poir.
(RANUNCULACEAE)

Growing in low wet grassy area near group camping area, north central Cockspur Island.

Tom Govus 989 — 10 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Raphanus raphanistrum* L.
(BRASSICACEAE)

Widely scattered on dike system south of fort, Cockspur Island. Probably established from hay used in rebuilding dike.

Tom Govus 990 — 9 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Rubus argutus* L.
(ROSACEAE)

Growing in thicket just south of Visitor Center, Cockspur Island.

Tom Govus 991 — 9 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Rubus trivialus* Michx.
(ROSACEAE)

Edge of wood just east of picnic area, Cockspur Island. Widespread on site near forest ecotones.

Tom Govus 992 — 8 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Rumex verticillatus* L.

(POLYGONACEAE)

Large patch (about 200 plants) growing in wet depression on spoil hammock at western end of McQueens Island, the end of Old Savannah-Tybee Railroad – Multipurpose Trail. Associates: *Quercus virginiana, Sapium sebiferum, Salix nigra, Ilex vomitoria, Pluchea rosea, Mikania scandens.*

Tom Govus 949 — 10 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Salvia lyrata* L.
(LAMIACEAE)

Widely scattered in open areas at the west end of the Old Savannah-Tybee Railroad Multipurpose Trail, spoil deposit, west McQueens Island.

Tom Govus 993 — 10 April 1998

University of Georgia — Athens, GA USA

# Plant Collection Data - Govus 1998 - Fort Pulaski National Monument Inventory

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Sanicula canadensis* L.
(APIACEAE)

Growing on central Cockspur Island in mature maritime forest, especially along trail to picnic area.

Tom Govus 994 — 10 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Scleria triglomerata* Michaux
(CYPERACEAE)

Growing in open sand under a cedar thicket on spoil bank just east of the north pier.

Tom Govus 891 — 5 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Senna obtusifolia* (L.) Irwin & Barneby
(CAESALPINIACEAE)

Plant growing on edge of dike, west of junction with entrance road. Only a few plants seen.

Tom Govus 910 — 6 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Sida spinosa* L.
(MALVACEAE)

Large patch growing along western edge of maintenance building; also scattered in lawn areas, Cockspur Island.

Tom Govus 995 — 13 July 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Sisyrinchium exile* Bickn.
(IRIDACEAE)

Scatterd in lawn area west of fort and around parking area, central Cockspur Island.

Tom Govus 996 — 12 July 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Solanum pseudogracile* Heiser
(SOLANACEAE)

Growing in various open sites along the Old Savannah-Tybee Railroad Multipurpose Trail, McQueens Island.

Tom Govus 997 — 10 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Solanum sisymbriifolium* Lam.
(SOLANACEAE)

Growing in spoil area near southwest corner of Cockspur Island. Associated with other weedy species.

Tom Govus 892 — 5 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Solidago canadensis* L
(ASTERACEAE)

Widely distributed along edge of roads and grassy openings, central Cockspur Island.

Tom Govus 893 — 5 November 1997

University of Georgia — Athens, GA USA

# Plant Collection Data - Govus 1998 - Fort Pulaski National Monument Inventory

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Spermolepis echinata* (Nutt. ex DC) Heller
(APIACEAE)

Growing in open sandy sites along the edge of the fire road, north Cockspur Island.

Tom Govus 998 — 8 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Spiranthes praecox* (Walt.) S. Wats.
(ORCHIDACEAE)

Scattered in lawn area just north of old quarrantine station, north central Cockspur Island.

Tom Govus 999 — 9 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Stachys floridana* Shuttlew.
(LAMIACEAE)

Large patches along edge of woods and dike north of old cistern and Hambright Battery. Growing with *Vinca minor.*

Tom Govus 889 — 5 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Stenotaphrum secundatum* (Walt.) Kunze
(POACEAE)

Growing near edge of drainage canal behind Visitor Center, Cockspur Island.

Tom Govus 1000 — 10 July 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Tribulus terrestris* L.
(ZYGOPHYLLACEAE)

Growing on rooftop of Fort Pulaski, in grassy areas near stairway at southwest corner, Cockspur Island. This collection apparently represents a state record.

Tom Govus 1001 — 13 July 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Trifolium arvense* L.
(FABACEAE)

Widespread in grassy areas around public boad ramp, eastern end of McQueens Island.

Tom Govus 1002 — 4 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Ulmus americ ana* L.
(ULMACEAE)

Several large trees (>3 ft dbh) along nature trail, just west of parking area in mature portion of maritime forest, Cockspur Island.

Tom Govus 1003 — 13 July 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Verbena bonariensis* L.
(VERBENACEAE)

Widely scattered in open sandy spoilbank area on western Cockspur Island, just south from Coast Guard Station.

Tom Govus 1004 — 4 April 1998

University of Georgia — Athens, GA USA

# Plant Collection Data - Govus 1998 - Fort Pulaski National Monument Inventory

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Verbena hastata* L.
(VERBENACEAE)

Growing with *Stachys floridanda* just north of old cistern near Battery Hambright, eastern edge of dike. Edge of young maritime forest.

Tom Govus 888 — 5 November 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Vicia angustifolia* L.
(FABACEAE)

Widely scattered in open sandyspoil bank area on western Cockspur Island, just south from Coast Guard Station.

Tom Govus 1005 — 11 July 1997

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Vicia villosa* ssp. *villosa* Roth
(FABACEAE)

Edge of shrub thickets and mowed grassy areas near Coast Guard Station, Cockspur Island.

Tom Govus 1006 — 7 May 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Vicia tetrasperma* (L.) Schreb.
(FABACEAE)

Edge of shrub-scrub area just southeast of maintenance building, south central Cockspur Island.

Tom Govus 1006 — 7 May 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Vitis aestivalis* Michx.
(VITACEAE)

Edge of mowed area, growing on *Myrica* shrub layer just east of maintenance building, south central Cockspur Island.

Tom Govus 1008 — 7 May 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Vulpia sciurea* (Nutt.) Henr.
(POACEAE)

Growing in openings of *Juniperus silicicola* on narrow hammocks north and east of fort, Cockspur Island.

Tom Govus 1009 — 11 April 1998

University of Georgia — Athens, GA USA

**FORT PULASKI NATIONAL MONUMENT**
**CHATHAM COUNTY, GEORGIA**

*Youngia japonica* (L.) DC.
(ASTERACEAE)

Growing on edge of trail to picnic area, fifty meters west of junction with nature trail. Grassy opening adjacent young maritime forest.

Tom Govus 903 — 6 November 1997

University of Georgia — Athens, GA USA