THE FLORA OF INDIAN SHELL RINGS FROM COASTAL SOUTH CAROLINA TO NORTHERN FLORIDA

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ABSTRACT

Native American shell rings are composed almost exclusively of shellfish remains, and occupy coastal sites. The nine shell rings and one shell mound selected in this study range approximately 40 kilometers north of Charleston, South Carolina to 10 kilometers north of St. Augustine, Florida. The vascular flora consists of 241 species within 182 genera in 80 families. The Poaceae and Asteraceae are the largest families in the flora. Soil salinity and daily flooding affect the distribution of vascular plants at the tidal shell rings. Calcareous soils influence species distribution at inland shell ring sites. Each taxonomic entry in the checklist is accompanied by an annotation, which includes frequency of occurrence, rarity status and pertinent synonyms.

KEY WORDS: Indian Shell Rings, flora, distribution, biodiversity.

RESUMEN

Los "shell rings" nativos de América están compuestos casi exclusivamente de restos de conchas marinas y ocupan lugares costeros. Los nueve "shell rings" y un "shell mound" seleccionados en este estudio van aproximadamente desde 40 kilómetros al norte de Charleston, Carolina del Sur hasta 10 kilómetros al norte de St. Augustine, Florida. La flora vascular consiste en 241 especies agrupadas en 182 géneros de 80 familias. Las Poaceae y Asteraceae son las mayores familias de la flora. La salinidad del suelo y las inundaciones diarias afectan la distribución de las plantas vasculares en los "shell rings" intermareales. Los suelos calcáreos influencian la distribución de las especies en los "shell ring" interiores. Cada entrada taxonómica del catálogo se acompaña de una anotación de la frecuencia, estado de rareza y los sinónimos pertinentes.

INTRODUCTION

The shell rings of the South Atlantic Coast are ring or arch-shaped ridges consisting primarily of shellfish remains, which were constructed by prehistoric Native Americans. They are located approximately between 32° 55' N (Sewee Shell Ring, SC) to 30 ° 05' N (Guana River State Park, FL).

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All known shell rings are located on estuaries or tidal creeks. They occupy high ground immediately adjoining salt marshes or occasionally are isolated in salt marshes a few hundred feet offshore. Interiors of shell rings at tidal sites are marshy, while the higher sites usually support a heavy growth of vegetation. The circular shell ridges range from about 33 to 66 m in outside diameter, 0.5 to 2.5 m in maximum height and 6.4 to 17.8 m in basal width. They are covered with vegetation and are composed almost exclusively of shells, mainly those of oysters. Shells of periwinkle, knobbed whelks, clams and mussels are present in reduced amounts (Dorroh 1971; DePratter 1976; Trinkley 1985).

Rings occur in complexes as well as in isolation. The largest known ring is at Sapelo Island, Georgia and is associated with two smaller rings. At the Skull Creek Shell Ring, Hilton Head Island, South Carolina, the rims of two rings are superimposed at one point (Hemmings 1970). Shell specimens from rings in South Carolina and Georgia have been radiocarbon dated and are approximately 3900 to 3100 years old (Calmes 1967; Waring & Larson 1968).

Numerous uses for the rings have been postulated, including ceremonial, recreational, and exploitative functions, e.g. fish traps, (Edwards 1965). Recent investigations suggest that at least some of the rings were habitation sites, with the rings gradually developing from kitchen refuse associated with house middens arranged in a circular fashion (DePratter 1976; Trinkley 1985). The relatively clear interiors of the shell rings may have functioned as areas of communal activity (Trinkley 1985).

The objective of this study is to determine the vascular flora at shell rings on the coast of South Carolina, Georgia, and Florida, the only sites on the east coast where shell rings are known to exist. Several calcareous plants, including the rare *Sageretia minutiflora*, grow almost exclusively at these sites.

Several well known individuals have examined shell mounds or rings along the Atlantic coast. William Bartram described the flora of shell mounds along the coast of South Carolina bordering the sounds and inlets near Hilton Head in 1773. Among the plants listed by Bartram at shell mounds were *Magnolia grandiflora*, *Pinus taeda*, *Laurus borbonia* (*Persea borbonia*), *Quercus sempervirens* (*Quercus virginiana*), *Corypha palma* (*Sabal palmetto*), *Prunus laurocerasus*, *Ilex aquifolium* (*I. opaca*), and *Juniperus americana* (*Juniperus virginiana*).

There are several studies of the vascular flora of shell mounds along the southeastern and Gulf coasts of the United States. Brown (1936) reported that the most common plants found on Louisiana shell mounds are *Juncus roemerianus*, *Spartina patens*, *Scirpus olneyi*, *Fimbristylis castanea*, *Iva frutescens*, and *Salicornia* spp., all salt marsh species. Laessle (1942) noted that certain plants occupying the Orange Point shell mound in Florida, "seem to persist on the highly calcareous soil," and are found, "nowhere else in the area."

Griffen (1948) reported that the Florida shell middens are "extremely interesting," and that they support, "a more or less specialized vegetation." Kurz and Wagner (1957) studied the distribution of salt marsh vegetation along an elevation gradient at the Buzzards Island shell ring, South Carolina, but did not recognize the site as a shell ring. Eleuterius and Otvos (1979) surveyed a shell mound at Cedar Island, Mississippi, and reported a vascular flora of 62 species. They reported that a number of plants were calciphiles including *Aesculus pavia*, *Elymus virginiana*, *Matelea caroliniana*, *Sageretia minutiflora*, and *Yucca aloifolia*.

The most inclusive study of the vascular flora at Indian middens including shell mounds and rings is that by Dorroh (1971) along the South Carolina coast. A shell mound is a solid mass of shellfish remains; and a shell ring is a circular or arc-shaped ridge consisting of shellfish remains. Dorroh sampled eleven mounds and eight shell rings during the summer of 1970 by transects. At each site, a north south and east west compass line was followed, and species were identified if they were encountered at the transect and approximately two yards on either side of the transect. Dorroh's (1971) transect approach yielded 136 species in 59 families. The present study, a comprehensive inventory of 9 shell rings and one shell mound, yielded 241 species.

There are several archeological surveys of shell rings, including one by a future president, William McKinley, who described and measured three shell rings at Sapelo Island, Georgia, for the Smithsonian Institution in 1872 (Calmes 1967). Waring and Larson (1968) studied the shell rings at Sapelo Island and Porcher's Bluff, South Carolina, just north of Charleston. Cameron (1976) presented an ethnobotanical and floristic reconstruction of the Sapelo Island Shell Ring. Dr. Warren Moorehead examined the Chesterfield site, a horseshoe shaped structure along the Broad River near Port Royal Sound, South Carolina, (Flannery 1943). The Sewee Ring, a horseshoe shaped midden near the Santee River, South Carolina, was examined by Edwards (1965) who postulated that the site may have served as a fish trap by native Americans. Calmes (1967) examined the Ford's Skull Creek and Sea Pines rings at Hilton Head Island, South Carolina.

The Fig Island Shell Ring near the northeast end of Edisto Island, South Carolina, was examined by Hemmings (1970). Trinkley (1980, 1985) has done extensive work on the archeology of various shell rings and middens in South Carolina including Buzzards Island, and Crow Island at the Francis Porcher property north of Charleston.

METHODS

Nine shell rings and one shell mound were selected for the present study. These include four rings in South Carolina: Sewee, Buzzards Island, Ford's Skull Creek, Sea Pines and the Auld Mound; three rings in Georgia: Oemler,

Romerly Marsh and Sapelo Island; and two rings in Florida: Fort George and Guana River State Park (Figure 1). Of the four shell rings extant in Florida; two are in this study. In South Carolina there were over 100 shell rings but many of these no longer exist due to shell removal for road building. Criteria for selecting sites include permission from private, state and federal authorities, lack of human disturbance and accessibility. The study was initiated in February 1993 and was completed in October 1994. Each site was sampled a minimum of 6 times during the growing seasons of 1993 and 1994 for a total of about 40 field days. Herbarium vouchers of each taxon were prepared and deposited at the University of South Carolina Herbarium: some are also housed at the Brooklyn Botanic Garden (BKL), Missouri Botanical Garden (MO), and the New York Museum at Albany, N.Y. (NYS).

The species checklist (Appendix I) contains an inventory of the vascular plants that reproduce spontaneously and persist for more than one year without cultivation, including native taxa, naturalized and adventive weeds, and escapes from cultivation. The checklist is divided into the following categories: vascular cryptograms, gymnosperms, dicots, and monocots. Nomenclature follows Kartesz (1994); when differences occur, the name as presented in Radford et al. (1968) is listed as a synonym and enclosed in brackets. The concept of families follows Kartesz (1994).

Mineral analysis of the soils of the shell rings was provided by the Cornell Nutrient Analysis Laboratory, Cornell University.

RESULTS AND DISCUSSION

The vascular flora of ten shell sites (9 rings, 1 shell mound) from South Carolina to Florida consists of 80 families, 182 genera, and 241 species of which 216 (89.6%) are native (Table 1). There is a higher percentage (89.6%) of native flora at the shell middens than at Fort Moultrie, South Carolina, where 77% of the flora are native (Stalter & Lamont 1993). The native flora at the Outer Banks of North Carolina, Ocracoke Island to the Virginia border, is 78% (Stalter & Lamont 1997).

The Poaceae, with 30 genera and 49 species and the Asteraceae, with 24 genera and 29 species are the largest families in terms of taxa. Together they comprise 30% of all genera and 33% of all species. Other large families are the Fabaceae and Cyperaceae. The largest genus is *Dichanthelium* with 8 species followed by *Quercus* with 6 species. The rarest species encountered is *Sageretia minutiflora* (Radford et al. 1971), though this species is common at shell ring sites examined in the present study. A summary of the vascular flora is given in Table 1.

The Sewee Shell Ring, South Carolina, was visited by Dr. R. Mohlenbrock in 1979. Notable species on Mohlenbrock's list at the Sewee Shell Ring included small-leaved buckthorn (*Bumelia tenax*) and basswood (*Tilia caroliniana*).

TABLE 1. A summary of the vascular flora identified at ten shell sites from South Carolina to Florida.

	Ferns	Conifers	Dicots	Monocots	Total
Families	2	2	63	13	80
Genera	2	2	129	49	182
Species	2	2	164	73	241
Native Species	2	2	142	62	208
Non-native Species	0	0	20	6	26

Shumard's oak (*Quercus shumardii*), as well as climbing hydrangea (*Ducumeria barbara*), grew only in the nearby forest. The forest was leveled by Hurricane Hugo, September 21 and 22, 1989, and was severely burned by a devastating wildfire in 1991. The vegetation on the shell ring escaped the fire, but not the powerful winds of Hurricane Hugo.

Several factors may account for the assemblage of species on the shell sites at the time this study was conducted. Hurricane Hugo, September 1989, savaged three shell middens: Sewee, Auld and Buzzard's Island, South Carolina. Four study sites, Auld, Buzzard's Island, Roemerly Marsh and the Oemler Ring are islands surrounded by a sea of *Spartina alterniflora*. Two shell rings, Sewee and Sapelo Island border salt marshes; the vegetation of these two rings and the four previously mentioned island rings are strongly influenced by tidal inundation. Sea Pines, South Carolina, Ford Skull Creek, South Carolina, Fort George and Guana River State Park, Florida are inland rings not influenced by tidal flooding. The calcareous nature of the soil also affects species distribution. Human activity (disturbance) in the form of occasional mowing at Sea Pines, archaeological excavation by Waring and Larson (1968) at Sapelo Island and light cattle grazing at Sapelo Island, play a role in species distribution at these shell rings. A final obvious factor is climatic differences. The winters at St. Augustine, Florida, are milder than the winter climate at the most northern Sewee Shell Ring site.

Sewee, Auld and Buzzards Island, South Carolina, were ravaged by Hurricane Hugo, September 21 and 22, 1989. Hurricane Hugo, a category 4 hurricane, was one of the most powerful storms of this century to strike the South Carolina coast. The hurricane surge in the vicinity of Charleston, South Carolina, was 4m; the surge reached 6m at McClellenville, 50km northeast of Charleston. Hurricanes with winds as severe as those of Hugo strike portions of the South Carolina coast approximately once every 200 years (Anonymous 1974). The vegetation on the above three shell rings was severely damaged by wind. Additional damage to shell ring vegetation may have occurred in one or more of the following ways: inundation by the storm surge; salt water immersion and residual effect of salt water desiccation; smothering by deposition of soil and rafts of vegetation (Stalter & Lamont 1993).

Stalter and Lamont (1993) recorded 218 species at Fort Moultrie, South Carolina, a site just north of Charleston, one year after Hurricane Hugo, including coastal plants, e.g. *Quercus virginiana*, *Ilex vomitoria*, and *Juniperus silicicola* that are common along the southeast coast. Stalter and Lamont (1993) reported that many of the plants at Fort Moultrie and Fort Sumter survived Hurricane Hugo. *Liriodendron tulipifera* and *Podophyllum peltatum*, two species recorded by Gregory (1925) and Dorrah (1971) at the Auld Shell site were probably killed by Hurricane Hugo. Yet many species identified by Dorroh (1971) at the Auld site, e.g. *Quercus virginiana*, *Smilax spp.* survived Hurricane Hugo.

The Sea Pines, South Carolina Shell Ring is maintained by occasional mowing as an "archeological show piece" of the Sea Pines Development community. Common shrubs, e.g. *Myrica cerifera* and *Quercus virginiana* and saplings of *Quercus laurifolia*, abundant in the surrounding forest, have been removed from this shell ring. *Dichanthelium spp.*, *Oplismenus setarius* and *Arisaema spp.* provide conspicuous seasonal ground cover at this site in the absence of dense shrub cover. The nearby Ford Skull Creek Shell Ring, a historically "disturbed" inland shell ring, was once used as a source of oyster shells, as building materials. At the time the present study was conducted, the Ford Skull Creek Shell Ring was undisturbed. Past oyster shell harvesting may have an effect on the present floristic composition at this shell ring.

The Sapelo Island, Georgia, Shell Ring, the most floristically rich shell ring of this study, has been disturbed in the past. Waring and Larson (1968) excavated shells from a portion of this shell ring bordering the salt marsh. Today, feral cattle occasionally graze portions of the shell ring, though grazing appeared to be negligible at the time of the present study. The presence of exclosures at this shell ring, might enable future investigators to determine the impact of cattle grazing on the flora of this shell ring.

Two Florida shell rings, Fort George, 23km east of Jacksonville and Guana River State Park, just north of St. Augustine, are undisturbed inland shell rings. *Vernonia gigantea*, *Psychotria nervosa*, *Peperomia humilis* and *Bidens alba* var. *radiata* were found only at the Florida shell rings; they were not observed at the other shell rings. *Corallorhiza wisteriana* was observed in flower in mid February, 1994, at the Guana River site, while at Fort George, 55km north, *C. wisteriana* did not flower until late March, 1994. Yet, the climatic differences between the two sites are minimal (Anonymous 1974). The difference in flowering of *C. wisteriana* at the two sites may reflect significant differences in minimum temperature at these sites during the winter of 1994.

Eleuterius and Otvos (1979) report that *Juniperus silicicola*, *Aesculus pavia*, *Erythrina herbacea*, and *Morus rubra* are reliable indicators of the shell deposits on Indian middens. All of the aforementioned species were found at

one or more of the shell rings in the present study. *Sageretia minutiflora* and *Hexalectris spicata* may also be included as "indicator species" as these species favor the calcareous soils of Indian middens (Wunderlin 1998) but are found at non-ring sites as well.

The soils at the shell rings are neutral to slightly basic with a pH range of 6.82 at Sea Pines to 7.69 at Guana River State Park. Available Ca was high at all sites with a range of 1497 mg/Kg at Buzzard Island to 29,706 mg/Kg at Sea Pines. Available Mg ranged from 139.9 mg/Kg at Sapelo to 921.1 at Buzzards Island, while available Mn ranged from 5.4 at Fort George to 62.5 mg/Kg at Sea Pines. Available P ranged from 19.2 at Fort George to 221.0 mg/Kg at Sapelo, while K ranged from 42 at Guana River to 207 mg/Kg at Buzzards Island. Available nitrates ranged from undetectable at Buzzards Island to 190.61 at Sea Pines. The range of all these nutrients is highly variable among the sites.

Several shell rings occur as islands in salt marshes. The distribution of salt marsh species on the sides of these rings is related to tidal flooding and soil salinity. *Spartina alterniflora* occupies the lowest daily flooded base of the shell ring. Less flood tolerant salt marsh species are *Salicornia* spp., *Batis maritima*, *Distichlis spicata*, *Borrichia frutescens*, and *Spartina patens*. These form distinct zones above the more flood tolerant *Spartina alterniflora*. *Iva frutescens* and *Baccharis halimifolia* border *Borrichia* and *Spartina patens*, on the upland side. By contrast, the vegetation on shell rings not bordering salt marshes includes *Arisaema dracontium* and *A. triphyllum* at Sea Pines and Ford's Skull Creek, South Carolina, while *Corallorhiza wisteriana* and *Hexalectris spicata* were observed at the two Florida shell rings. *Psychotria nervosa*, *Peperomia humilis* and *Bidens alba* var. *radiata*, three subtropical species, were exclusively at the Florida shell ring sites, and are not part of the Carolina flora.

The most common woody species found on the salt marsh island shell rings are *Juniperus silicicola*, *Quercus virginiana*, *Sabal palmetto*, *Ilex vomitoria*, *Myrica cerifera* and *Smilax* spp. The most notable plant records, exclusive of the rare *Sageretia minutiflora*, are *Liriodendron tulipifera*, *Podophyllum peltatum*, and *Trillium* sp., known only from historical records at the Auld South Carolina Shell site (Gregorie 1925). Dorroh (1971) reported *Liriodendron* and *Podophyllum* at Auld in her study. These aforementioned taxa are usually not found at coastal barrier islands, although Stalter and Lamont (1987) reported a small population of *Podophyllum peltatum* and a single *Liriodendron tulipifera* at Assateague Island, Virginia. *Liriodendron*, *Podophyllum* and *Trillium* were absent at the Isle of Palms, South Carolina (Stalter 1976), Turtle Island, South Carolina (Stalter 1973), coastal Brookgreen Gardens, South Carolina (Stalter 1972), the Outer Banks of North Carolina (Stalter and Lamont 1997), and Fisherman Island, Virginia (Stalter et al. 1997). The *Liriodendron* at the Auld Shell mound

may have been toppled by Hugo's hurricane winds while *Podophyllum* may have been killed by saltwater inundation during the storm surge associated with Hurricane Hugo, September 1989. Radford et al. (1971) report that *Liriodendron*, *Podophyllum* and *Trillium* are present at Charleston County, South Carolina, though these taxa may have been collected at inland sites.

Many plants may be "rare", rare being defined as scarce, less than 5 populations, at a study site (Stalter & Lamont 1997). Stalter and Lamont (1997) recorded 336 "rare" plants, 45.3% of the flora, at the Outer Banks of North Carolina.

Plants are rare for a multiplicity of reasons. Plants may be rare because they exist at the edge of their normal range. Plants may be rare if they have narrow habitat requirements that are met in only a few areas, such as the calciphile, *Sageretia minutiflora*. Plant succession, climatic events such as drought, severe cold or hurricanes can reduce the number of species, especially plants in restricted habitats such as shell rings. Human activities such as development, introduction of non-native plants, pollution and overcollection of attractive plants such as *Corallorhiza wisteriana* may also contribute to the rarity of species (Stalter & Lamont 1998).

Sea level along the Atlantic coast was 120 meters lower than today 12,000 years ago. Dolan et al. (1980) report that sea level continued to rise for 8,000 years, "reaching within a few meters of the present level 4–5000 years ago." Sea level has risen several meters in the past 2,000 years, and over the past 100 years, sea level has risen over 30 cm (Dolan et al. 1980). It is possible that some of the present salt marsh island shell rings may have been initially located on upland sites when they were built by Native Americans, several thousand years ago, when the sea level was several meters lower than it is today (Dolan et al. 1980). All the present shell ring sites selected in this study may have been built close to, or on the coast, where oysters were abundant. However, the precise location of the shell rings examined in this study relative to the coastline, salt marsh creeks and/or salt marshes at the time of their construction cannot be accurately determined.

APPENDIX I

ANNOTATED CHECKLIST OF SPECIES

The vascular plant taxa found at ten shell sites have been arranged according to the following categories: vascular cryptogams, gymnosperms, dicots, and monocots. Within each category, families and lower taxa are arranged alphabetically. Nomenclature primarily follows Kartesz (1994).

Each entry includes the following information sequence: scientific name; pertinent synonym, enclosed in brackets; and frequency relative to the shell rings, using the categories: rare (scarce, less than 5 populations), infrequent (uncommon, occasional, 5 to 20 populations), frequent (common, more than 20 populations).

POLYPODIOPHYTA

POLYPODIACEAE

Pleopeltis polypodioides (L.) Andrews and Windham spp. *michauxiana* (Weatherby) Andrews & Windham [*Polypodium polypodioides* (L.) Watt. var. *michauxianum* Weatherby]; infrequent

ASPLENIACEAE

Asplenium platyneuron (L.) BSP.; frequent

PINOPHYTA

CUPRESSACEAE

Juniperus virginiana L. var. *silicicola* (Small) E. Murray [*Juniperus silicicola* (Small) Bailey]; infrequent

PINACEAE

Pinus taeda L.; infrequent

MAGNOLIOPHYTA MAGNOLIOPSIDA (DICOTS)

ACANTHACEAE

Ruellia caroliniensis (J.F. Gmel.) Steudel; infrequent

ACERACEAE

Acer rubrum L.; infrequent

AMARANTHACEAE

Iresine rhizomatosa Standley; rare

ANACARDIACEAE

Toxicodendron radicans (L.) Kuntze [*Rhus radicans* L]; frequent

Rhus copallinum L. [*Rhus copallina* L.]; infrequent

ANNONACEAE

Asimina triloba (L.) Dunal; rare

APIACEAE

Sanicula canadensis L.; infrequent

AQUIFOLIACEAE

Ilex vomitoria Aiton; infrequent

ARALIACEAE

Aralia spinosa L.; rare

ASCLEPIADACEAE

Cynanchum angustifolium Pers.; [*Cynanchum palustre* (Pursh) Heller]; infrequent

Matelea gonocarpa (Walter) Shinners [*M. suberosa* (L.) Shinners]; rare

ASTERACEAE

Ambrosia artemisiifolia L.; rare

Arnoglossum ovatum (Walt.) H.E. Robins. [*Cacalia lanceolata* Nutt.]; rare

Aster tenuifolius L.; infrequent

Baccharis angustifolia Michx.; rare

Baccharis halimifolia L.; frequent

Bidens alba (L.) DC. var. *radiata* (Schultz-Bip.) Ballard ex T.E. Melchert [*Bidens pilosa* L. var. *radiata* Schultz – Bip.]; frequent at Florida Shell Rings

Bidens bipinnata L.; infrequent

Borrichia frutescens (L.) DC.; frequent

Carduus smallii (Britton) Ahles. [*Cirsium horridulum* Michx.]; rare

Leucanthemum vulgare Lam. [*Chrysanthemum leucanthemum* L.]; infrequent

Conyza canadensis (L.) Cronq. var. *pusilla* (Nutt.) Cronq.; infrequent

Elephantopus tomentosus L.; frequent

Erechtites hieracifolia (L.) Raf.; frequent

Erigeron quercifolius Lam.; frequent

Eupatorium capillifolium (Lam.) Small; frequent

Eupatorium hyssopifolium L.; frequent

Eupatorium serotinum Michx.; rare

Euthamia graminifolia (L.) Nutt. [Solidago *graminifolia* (L.) Salisbury]; infrequent

Gamochaeta purpurea (L.) Cabrera [*Gnaphalium purpureum* L. var. *purpureum*]; infrequent

Hieracium gronovii L.; infrequent

Iva frutescens L.; infrequent

Lactuca floridana (L.) Gaertn.; infrequent

Lactuca graminifolia Michx.; infrequent

Mikania scandens (L.) Willd.; frequent

Smallanthus uvedalia (L.) MacKenzie ex Small [*Polymnia uvedalia* (L.) L.]; rare

Solidago sempervirens L. var. *mexicana* (L.) Fern.; frequent

**Sonchus asper* (L.) Hill; frequent

Verbesina occidentalis (L.) Walter; rare

Vernonia gigantea (Walt.) Trel.; rare

BATACEAE

Batis maritima L.; rare

BERBERIDACEAE

Podophyllum peltatum L. Reported by Gregorie (1925) and Dorroh (1971) at Auld, SC; not recently observed

BIGNONIACEAE
Bignonia capreolata L.f. [*Anisostichus capreolata* (L.) Bureau]; infrequent
Campsis radicans (L.) Seemann; infrequent

BORAGINACEAE
Heliotropium curassavicum L.; rare

BRASSICACEAE
**Cardamine hirsuta* L.; infrequent
Descurainia pinnata (Walter) Britton ssp. *brachycarpa* (Richardson) Delting [*D. brachycarpa* (Richardson) O.E. Schultz]; rare
Lepidium densiflorum Schader; rare
Lepidium virginicum L.; frequent

BUDDLEJACEAE
Polypremum procumbens L.; infrequent

CACTACEAE
Opuntia humifusa (Raf.) Raf. [*O. compressa* J.F. Macbride]; infrequent
**Opuntia monacantha* (Willd.) Haw. [*O. vulgaris* P. Mill.]; rare

CAMPANULACEAE
Triodanus perfoliata (L.) Nieuwl. [*Specularia perfoliata* (L.) A. DC.]; frequent

CAPRIFOLIACEAE
**Lonicera japonica* Thunb.; infrequent
Lonicera sempervirens L.; infrequent
Viburnum nudum L.; rare

CARYOPHYLLACEAE
Arenaria lanuginosa (Michx.) Rohrb.; rare
Arenaria serpyllifolia L.; infrequent
**Cerastium fontanum* Baumg. subsp. *vulgare* (Hartman) Greuter & Burdet [*C. holosteoides* Fries var. *vulgare* (Hartman) Hylander; *C. vulgatum* L.]; infrequent
Silene antirrhina L.; rare
**Spergularia marina* (L.) Griseb. [*S. salina* J. & K. Presl]; infrequent

CELASTRACEAE
Euonymus americanus L.; rare

CHENOPODIACEAE
Atriplex patula L.; infrequent
**Chenopodium album* L.; infrequent
**Chenopodium ambrosioides* L.; frequent
**Salicornia maritima* Wolff & Jefferies [*Salicornia europaea* auct.non L.]; infrequent
Salicornia virginica L.; frequent
Suaeda linearis (Elliott) Moq.; infrequent

CONVOLVULACEAE
Dichondra carolinensis Michx.; infrequent
Ipomoea pandurata (L.) G.F.W. Mey.; infrequent
Ipomoea sagittata Poir.; frequent

CORNACEAE
Cornus asperifolia Michx.; rare
Cornus florida L.; rare
Cornus stricta Lam. [*C. foemina* P. Mill.]; infrequent

CUSCUTACEAE (Formerly Convolvulaceae)
Cuscuta gronovii Willd.; rare

ERICACEAE
Vaccinium corymbosum L. [*V. atrococcum* (A. Gray) Porter]; rare

EUPHORBIACEAE
Acalypha gracilens A. Gray; rare
**Chamaesyce maculata* (L.) Small [*Euphorbia maculata* L.; *E. supina* Raf.]; infrequent
Cnidoscolus stimulosus (Michx.) Engelm. & A. Gray; frequent
Euphorbia cyathophora Murray [*E. heterophylla* L. var. *cyathophora* (Murray) Griseb.]; rare

FABACEAE
Cassia nictitans L.; infrequent
Cercis canadensis L.; rare
Clitoria mariana L.; rare
Crotolaria rotundifolia Walt. ex. J.F. Gmel. [*C. angulata* auct. non P. Mill.]; rare
Desmodium nudiflorum (L.) DC.; rare
**Desmodium tortuosum* (Sw.) DC.; infrequent
Erythrina herbacea L.; frequent
Galactia regularis (L.) BSP.; infrequent
Lespedeza sp.; infrequent
Lespedeza stuevei Nutt.; infrequent
**Melilotus officinalis* (L.) Lam.; infrequent
**Wisteria sinensis* (Sims) DC.; rare

FAGACEAE
Quercus laurifolia Michx.; rare
Quercus myrtifolia Willd.; rare
Quercus nigra L.; rare
Quercus phellos L.; rare
Quercus stellata Wangenh.; rare
Quercus virginiana Miller; frequent

GERANIACEAE
Geranium carolinianum L.; infrequent

HAMAMELIDACEAE
Hamamelis virginiana L.; rare
Liquidambar styraciflua L.; rare

HIPPOCASTANACEAE
Aesculus pavia L.; frequent

JUGLANDACEAE
Carya glabra (P. Mill.) Sweet; infrequent
Juglans nigra L.; rare

LAMIACEAE
Salvia lyrata L.; frequent
Teucrium canadense L.; frequent
Trichostema dichotomum L.; rare

LAURACEAE
Persea borbonia (L.) Sprengel; infrequent
Sassafras albidum (Nutt.) Nees.; infrequent

LOGANIACEAE
Gelsemium sempervirens (L.) St.-Hil.; infrequent
Polypremum procumbens L.; infrequent
Spigelia marilandica L.; rare

MAGNOLIACEAE
Liriodendron tulipifera L. Reported by Gregorie (1925) and Dorroh (1971) at Auld, SC. Probably destroyed by Hurricane Hugo in 1989.
Magnolia grandiflora L.; infrequent
Magnolia virginiana L.; infrequent

MELIACEAE
**Melia azedarach* L.; rare

MENISPERMACEAE
Cocculus carolinus (L.) DC.; rare
Menispermum canadense L.; rare

MORACEAE
**Morus alba* L.; rare
Morus rubra L.; infrequent

MYRICACEAE
Myrica cerifera L.; frequent

NYSSACEAE
Nyssa sylvatica Marsh.; infrequent
Nyssa biflora Walt. [*N. sylvatica* Marsh. var. *biflora* (Walt.) Sarg.]; infrequent

OLEACEAE
Fraxinus caroliniana P. Mill.; rare
**Ligustrum amurense* Carr.; infrequent
Osmanthus americanus (L.) A. Gray; infrequent

ONAGRACEAE
Oenothera fruticosa L.; frequent
Oenothera laciniata Hill; infrequent

OXALIDACEAE
Oxalis dillenii Jacq.; infrequent
Oxalis stricta L.; infrequent

PASSIFLORACEAE
Passiflora lutea L.; infrequent

PHRYMACEAE
Phryma leptostachya L.; rare

PHYTOLACCACEAE
Phytolacca americana L.; frequent

PIPERACEAE
Peperomia humilis A. Dietr.; rare

PLUMBAGINACEAE
Limonium carolinianum (Walt.) Britt. [*L. nashii* Small]; infrequent

POLYGONACEAE
Rumex hastalalus Baldw.; frequent

RANUNCULACEAE
Clematis crispa L.; infrequent
**Clemantis terniflora* DC. [*Clematis dioscoreifolia* Levl. and Vaniot]; infrequent
Clematis virginiana L.; rare

RHAMNACEAE
Berchemia scandens (Hill) K. Koch; infrequent
Frangula caroliniana (Walt.) Gray [*Rhamnus caroliniana* Walt.]; rare
Sageretia minutiflora (Michx.) C. Mohr. [*Rhamnus minutiflora* Michx.]; infrequent

ROSACEAE
Crateagus uniflora Muenchh.; rare
Prunus caroliniana (P. Mill.) Ait. [*Laurocerasus carolinina* (P. Mill.) M. Roemer]; infrequent
Prunus serotina Ehrht.; infrequent
Rubus trivialis Michx.; frequent

RUBIACEAE
Galium pilosum Aiton; infrequent
Psychotria nervosa Sw. [*Psychotria undata* Jacq.]; rare

RUTACEAE
Zanthoxylum clava-herculis L.; infrequent

SAPOTACEAE
Sideroxylon tenax L. [*Bumelia tenax* (L.) Willd.]; infrequent

SCROPHULARIACEAE
Gratiola pilosa Michx.; rare
Nuttallanthus canadensis (L.) D.A. Sutton. [*Linaria canadensis* (L.) Chaz.], frequent
**Verbascum thapsus* L.; frequent
**Veronica arvensis* L.; frequent

SOLANACEAE
Physalis walteri Nutt. [*P. viscosa* L. subsp. *maritima* (M. A. Curtis) Waterfall]; infrequent

TILIACEAE
Tilia americana L. var. *caroliniana* (P. Mill.) Castigl. [*T. caroliniana* P. Mill]; rare

ULMACEAE
Celtis laevigata Willd.; infrequent
Celtis tenuifolia Nutt. [*C. oxidentalis* L. var. *georgiana* (Small) Ahles]; rare

VERBENACEAE
Callicarpa americana L.; infrequent
Verbena scabra Vahl; rare

VIOLACEAE
Viola sororia Willd.; rare

VITACEAE
Ampelopsis arborea (L.) Koehne; infrequent
Parthenocissus quinquefolia (L.) Planch.; frequent
Vitis aestivalis Michx.; infrequent
Vitis rotundifolia Michx.; infrequent

MAGNOLIOPHYTA - LILIOPSIDA

AGAVACEAE
**Yucca aloifolia* L.; infrequent

ARACEAE
Arisaema dracontium (L.) Schott; infrequent
Arisaema triphyllum (L.) Schott; rare

ARECACEAE
Sabal palmetto Lodd. ex. Schultes; infrequent

BROMELIACEAE
Tillandsia usneoides (L.) L.; infrequent

COMMELINACEAE
Tradescantia ohiensis Raf.; infrequent

CYPERACEAE
Cladium jamaicense Crantz [*C. mariscus* (L.) Pohl]; infrequent
Cyperus globulosus Aublet; infrequent
Cyperus retrorsus Chapm.; infrequent
Eleocharis albida Torr.; rare
Fimbristylis castanea (Michx.) Vahl; infrequent
Rhynchospora colorata (L.) H. Pfeiffer [*Dichromena colorata* (L.) Hitchc.]; rare
Scirpus robustus Pursh; rare
Scleria triglomerata Michx. [*S. nitida* Muhl.]; infrequent

DIOSCOREACEAE
Dioscorea villosa L.; rare

IRIDACEAE
Sisyrinchium rosulatum E. Bickn.; rare

JUNCACEAE
Juncus bufonius L.; infrequent
Juncus roemerianus Scheele; infrequent

LILIACEAE
**Alium vineale* L.; infrequent
Trillium sp. Reported by Gregorie (1925) at Auld site; not recently observed.

ORCHIDACEAE
Corallorhiza wisteriana Conrad; infrequent
Hexalectris spicata (Walt.) Barnh.; infrequent

POACEAE
Andropogon glomeratus (Walter) B.S.P. [*A. virginicus* L. var. *abbreviatus* (Hackel) Fern. & Griscom]; infrequent
Andropogon virginicus L.; frequent
Arundinaria gigantea (Walter) Muhl. subsp. *tecta* (Walter) McClure; infrequent
Arthraxon hispidus Thunb. var. *cryptatherus* (Hackel) Honda.; infrequent
**Bromus tectorum* L.; infrequent
Cenchrus carolinianus Walt. [*C. incertus* M.A. Curtis]; rare
Chasmanthium laxum (L.) Yates [*Uniola laxa* (L.) B.S.P.]; infrequent
**Dactyloctenium aegyptium* (L.) Willd.; infrequent
Dichanthelium acuminatum (Sw.) Gould & Clark [*Panicum acuminatum* Sw. (sensu lato) incl. *P. auburne* Ashe; *P. meridionale* Ashe; *P. leucothrix* Nash]; infrequent
Dichanthelium consanguineum (Kunth) Gould & Clark [*Panicum consanguineum* Kunth]; infrequent
Dichanthelium latifolium (L.) Gould & C.A. Clark [*Panicum latifolium* L.]; infrequent

Dichanthelium laxiflorum (Lam.) Gould [*Panicum laxiflorum* Lam.; *P. xalapense* H.B.K.]; rare
Dichanthelium malacophyllum (Nash) Gould [*Panicum malacophyllum* Nash]; rare
Dichanthelium oligosanthes var. *scriberanum* (Nash) Gould [*Panicum scriberianum* Nash]; rare
Dichanthelium sabulorum (Lam.) Gould & Clark var. *patulum* (Scribn. & Merr.) Gould & Clark. [*Panicum lancearium* Trin.]; infrequent
Dichanthelium scabriusculum (Ell.) Gould & Clark. [*Panicum scabriusculum* Ell. *P. aculeatum* A. Hitchc. & Chase]; rare
Distichlis spicata (L.) Greene; infrequent
Echinochloa walteri (Pursh) Heller; rare
Elymus virginicus L. var. *halophilus* (Bickn.) Wieg.; infrequent
Eragrostis hirsuta (Michx.) Nees; infrequent
Eragrostis spectabilis (Pursh) Steud. infrequent
Eustachys petraea (Swartz) Desv. [*Chloris petraea* Sw.]; infrequent
Melica mutica Walt.; infrequent
Muhlenbergia capillaris (Lam.) Trin.; infrequent
Muhlenbergia schreberi J. F. Gmel.; rare
Oplismenus setarius (Lam.) Roemer & Schultes [*O. hirtellus* (L.) Beauv. subsp. *setarius* (Lam.) Mez ex Ekman]; frequent
Panicum amarum Ell. [*P. amarulum* A. Hitchc. & Chase]; rare
Panicum boscii Poir. [*P. boscii* var. *molle* (Vasey) Hitchc. and Chase]; infrequent
Panicum dichotomiflorum Michx.; infrequent
Panicum virgatum L.; infrequent
Paspalum distichum L.; infrequent
Paspalum setaceum Michx. var. *ciliatifolium* (Michx.) Vasey [*P. ciliatifolium* Michx.; *P. longipedunculatum* LeConte]; rare
Phalaris caroliniana Walt.; rare
Piptochaetium avenaceum (L.) Parodi [*Stipa avenacea* L.]; infrequent
**Poa annua* L.; infrequent
**Polypogon monspeliensis* (L.) Desf.; frequent
Setaria geniculata (Lam.) Beauv.; infrequent
Sphenopholis intermedia (Rydb.) Rydb.; rare
Sphenopholis obtusata (Michx.) Scribn.; rare
Spartina alterniflora Loisel.; frequent
Spartina patens (Ait.) Muhl.; frequent
Sporobolus indicus (L.) R. Br. [*S. poiretti* (R. & S.) Hitchc.]; frequent
Sporobolus virginicus (L.) Kunth; infrequent
Stenotaphrum secundatum (Walt.) Kuntze; infrequent
Tridens flavus (L.) A. Hitchc. [*Triodia flava* (L.) Smyth]; infrequent
Triplasis purpurea (Walt.) Chapman; frequent
Vulpia octoflora (Walt.) Rydb. [*Festuca octoflora* Walt.]; infrequent

SMILACACEAE

Smilax bona-nox L.; infrequent
Smilax glauca Walt.; rare
Smilax laurifolia L.; infrequent
Smilax rotundifolia L.; infrequent

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