

## RESEARCH ARTICLE

### The Vascular Flora of Smith Island, Chesapeake Bay, Maryland

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#### Abstract

Smith Island, Maryland, a 1150 hectare island lies in the center of the Chesapeake Bay (37.97N, 76.02W). Brackish and salt marsh vegetation are dominant on Smith Island that rarely rises a meter above high tide. The objective of this study was to document the vascular flora of Smith Island. The vascular flora of Smith Island, Maryland, consists of 144 species within 121 genera and 57 families. The Poaceae (22 species) and Asteraceae (22 species) are the largest families in the flora. *Cyperus* (6 species) and *Solidago* and *Trifolium*, each with 3 species, are the largest genera in the flora. No species in the flora are rare or endangered in Maryland. Species of foreign origin, 59 species, are numerous in the flora and compose 41% of the natural vegetation. Each taxonomic entry in the checklist is accompanied by an annotation, which includes the locality and habitat in which each species occurs and frequency relative to the study area.

**Keywords:** vascular flora, Chesapeake Bay, Smith Island, Maryland, USA.

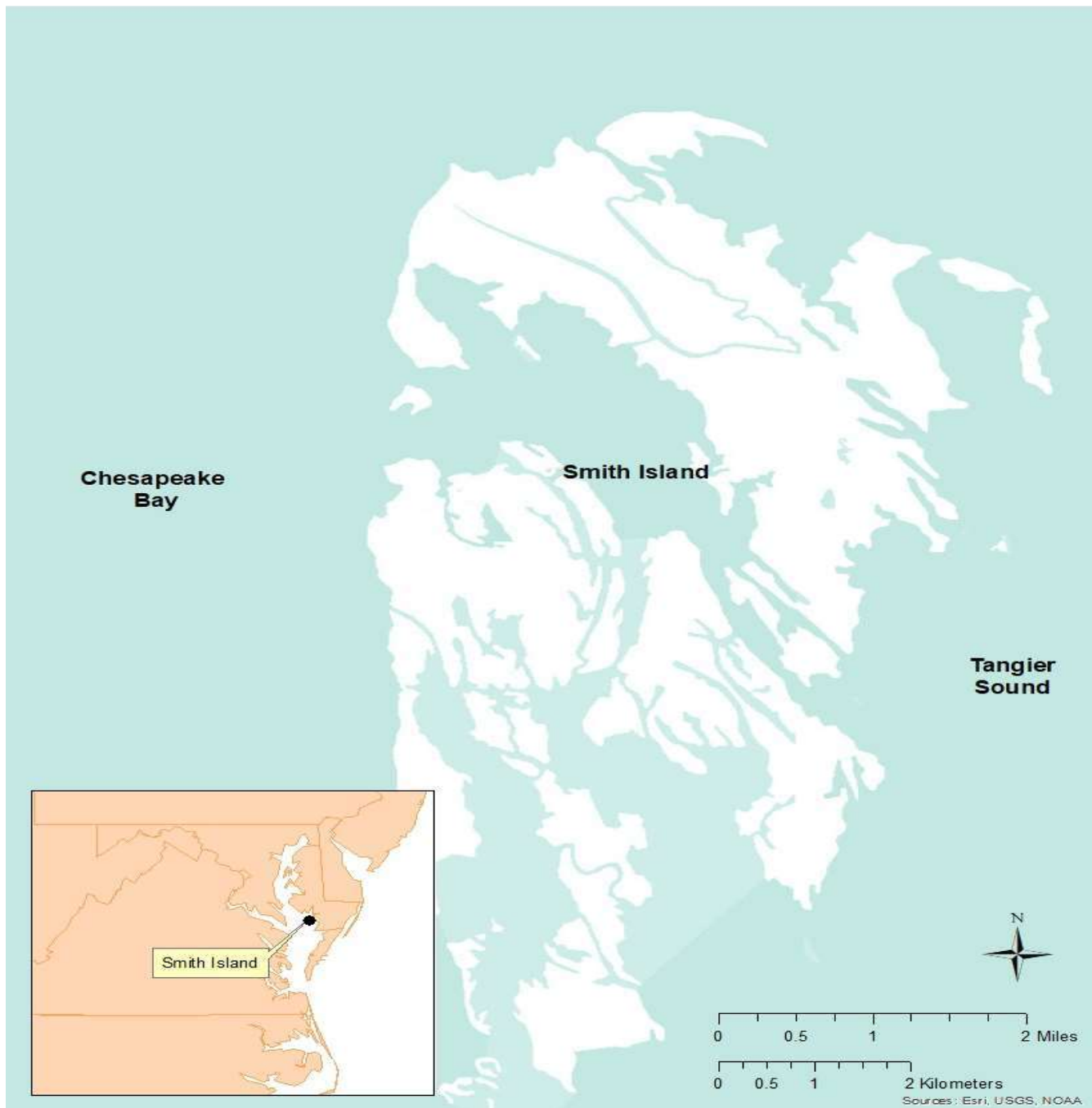
## Introduction

Smith Island, composing 1150 hectares, (37.97N, 76.02 W) lays approximately 20km southeast of Crisfield, Maryland in the Chesapeake Bay (Figure 1). The islands are primarily populated by salt and brackish marsh vegetation, as few sites on the island are more than one meter above high tide. The island's year round population was 364 individuals in 2000, the latest year for population data. Access to the island is by boat and utilized by the islanders when they travel to purchase supplies at Crisfield, Maryland, the nearest city on the mainland. Tourists generally visit the island from Memorial Day to Labor Day as "day trippers" since there are but three bed and breakfast lodgings on the island. Transportation on the island by the island's inhabitants is limited to a few cars, bicycles, golf carts and all-terrain vehicles.

Global warming "experts" advised the islanders in the early 1990's that Smith Island would be washed away by rising sea level by 2005. Similar reports in 2017 by CNN news by

global warming "experts" predicted that neighboring Tangier Island, Virginia, would be inundated and washed away by rising sea level within 50 years.

Although most agree that sea level has been gradually rising since 1900, there are conflicting rates of sea level rise. Blood et al (1991) and Rachlin et al (2017) reported that sea level has been rising 3mm/year since 1930 a product of global warming. Jenkins (2018) reported a recent sea level rise of 3.4mm/y. Rising global temperature can be correlated with an increase in CO<sub>2</sub> in the earth's atmosphere along with an increase in a second greenhouse gas, methane. Gradual sea level rise may inundate most of Smith Island by 2100 as most of the island lies one meter below present day high tide. With a predicted 0.83 meter sea level rise by 2100, most of the island will be inundated. Accordingly, the objective of this study was to document the vascular flora of Smith Island.



**Figure 1.** Smith Island, Maryland, in Chesapeake Bay. Map provided by Matt Whitbeck and Miles Simmons, Chesapeake Marshlands NWR Complex.

### Plant Communities

Five naturally occurring plant communities occur at Smith Island, successional

field community, shrub community, extensive salt marsh community (that often encroaches on yards) an extensive brackish marsh community and a small coastal dune community. A sixth

community, the ruderal community occupies mowed roadsides, town dump, lawns, cemetery, and disturbed soil around habitations.

### **The Salt Marsh Community**

The extensive Salt Marsh Community is the dominant community at Smith Island. Salt marsh taxa occasionally grow in profusion in the lawns of habitations. Common species listed in order of their flood tolerance are *Sporobolus alterniflorus* (*Spartina alterniflora*), *Salicornia virginica* (*Salicornia depressa*), *Limonium carolinianum*, *Distichlis spicata*, *Juncus gerardii*, *Sporobolus pumilus* (*Spartina patens*) and *Iva oraria*. Other members of the community are *Agalinus maritima*, *Symphotrichum tenuifolium*, *Heliotropium curassavicum*, and *Suaeda linearis*. *Baccharis halimifolia* grows above *Iva* and only experiences tidal flooding during severe nor-easters and hurricanes. *Fimbristylis castanea* grows in portions of the high salt occasionally flooded by tides. *Panicum virgatum* may border salt marshes. Two notable salt marsh taxa here

are *A. maritima* and *H. curasavicum*, which have rarely been encountered by Stalter in southeastern salt marshes (Stalter, 1973, Stalter, 1984, Stalter and Lamont, 1990, Stalter and Odum, 1993, Stalter and Lamont, 1997, Stalter and Lamont, 1998, Stalter, Levya and Kincaid, 1999). Soil and water salinity and tidal flooding influence the distribution of salt marsh species along a tidal elevation gradient (Stalter 1973).

### **Brackish Marsh Community**

The Brackish Marsh Community occurs where water salinity ranges from less than 0.1 ppt to 10 ppt. (Stalter 1973). Highest salinity generally occurs in summer during drought when water evaporation concentrates salt. Some of the more common marsh plant species are *Juncus gerardii*, *Schoenoplectus pungens*, *Hibiscus moscheutos* (*Hibiscus lasiocarpus*), *Kosteletskya virginica*, and *Phragmites australis*. *Sporobolus alterniflorus* is a minor component of the brackish marsh community. When *S. alterniflorus* occurs, it borders the bay and is the

most flood tolerant species of the brackish marsh.

### **Successional Field Community**

The Successional Field Community is the smallest community at Smith Island. It is best developed adjacent to the town dock. Grasses notably *Panicum dichotomiflorum*, *Poa annua* and *Bromus spp.* occur here. Additional taxa include salt marsh species notably *Iva oraria*, *Juncus gerardii*, and *Atriplex patula* where land is occasionally flooded by tides. Many species here are also found in the ruderal community.

### **Coastal Dune Community**

A small Coastal Dune Community occupies two sites on the western side of the island is only accessible by boat. Common vascular plant species here are *Sporobolus pumilus*, *Solidago sempervirens*, *Panicum amarum*, and *Euphorbia polygonifolia*. *Ammophila breviligulata* which is the dominant component of the dune community in the northeast is rare here. Salt spray, bright sun and

sandy soil are favorable factors that enable the dune species to thrive here.

### **Ruderal Community**

The Ruderal Community occupies lawns, town dump, disturbed soil around habitations and maintained roadside rights-of-way. This community has the greatest number and highest percentage of non-native vascular plant species. Some of the more common species are *Ambrosia artemisiifolia*, *Baccharis halimifolia*, *Cerastium fontanum*, *C. viscosum*, *Euphorbia maculata*, *Chenopodium album*, *Chloris verticillata*, *Arenaria serpyllifolia*, *Cynodon dactylon*, *Daucus carota*, *Lamium amplexicaule*, *Lepidium virginicum*, *Oenothera biennis*, *Phytolacca americana*, *Plantago spp.*, *Polygonum spp.*, *Stellaria media*, *Veronica arvensis*, and *V. persicaria*.

### **Climate**

Moderated by its central location in Chesapeake Bay, the climate of Smith Island is milder than that of sites directly northward or inland (Figure 1). Detailed climate data for

Tangier Island, Virginia, the nearest station to Smith Island, can be found in the monthly publication of the National Oceanic and Atmospheric Administration (Garwood 1996). Mean annual temperature is 58.8°F (14.9°C). January is the coldest month averaging 37.2F (2.9C), while July averages 79.2F (26.2C) The annual precipitation is about 36 inches (914mm). The average length of the frost-free period is greater than 230 days. Nor'easters may occur from late fall to mid spring. Strong northeast winds may also account for unusually high tides that flood most of the island. Drought is frequent and may be especially injurious to vegetation if it is prolonged and occurs during the growing season.

## Methods

Collecting trips were made to the study area approximately once a month during the growing seasons from April 2013 through September 2018. Objectives for each trip included the collection of voucher specimens and

accumulation of information on abundance and apparent habitat preference for each species.

More than 500 specimens form the basis for this study (Table 1). Taxonomically problematic specimens were sent to various experts for annotation. Experts consulted include Eric Lamont (Asteraceae) John Nelson (Juncaceae, Poaceae and Polygonaceae), and Gordon Tucker (Cyperaceae). A set of voucher specimens has been deposited at the A.C. Moore Herbarium, University of South Carolina. Partial duplicate sets of Cyperaceae have been deposited in the herbarium at Northern Illinois University. Accession numbers to all taxa deposited at the A.C. Moore Herbarium will be assigned by Curator John Nelson, A. C. Moore Herbarium at the University of South Carolina where the primary set of plant specimens are housed. These will be available upon request from the senior curator.

The annotated checklist contains an inventory of the vascular plants that reproduce spontaneously and persist for more than one year without cultivation, including native species,

naturalized and adventive weeds, and escapes from cultivation (Table 1). In the checklist plants are arranged first by division, and then alphabetically by family, genus and species. Each entry includes the following information sequence: scientific name; pertinent synonym, enclosed in brackets; plant community (see discussion above); frequency relative to the study area, using the categories: rare (scarce, less than 5 populations), infrequent (uncommon, occasional, 5 to 20 populations), frequent (common, more than 20 populations). Estimates of species frequency are based upon our personal observations. Indication of species rarity across all of Maryland is based upon the Maryland Natural Heritage Program (indicated in the checklist as MNHP) list of rare plant species (Ref-2006).

Nomenclature primarily follows (Weakley 2015). The older name in Gleason and Cronquist (1991) immediately follows, enclosed in brackets, as many botanists may be more familiar with the names in the older manual. Native status follows Weakley (2015).

## Results and Discussion

The vascular plant flora consists of 144 species within 121 genera and 57 families. One hundred six taxa, 75% of the flora, occupy ruderal sites, the roadside right of ways, lawns, town dump, and gardens. An annotated list of species is presented in Table 1. Eighty five species, 59% of the flora are native to the region. A summary of the vascular plant species is given in Table 2.

The major families are the Poaceae (22 species) and Asteraceae (22 species). The largest genus in the flora is *Cyperus* (6 species). *Trifolium* and *Solidago* are represented by 3 species. Thirty One percent of the species comprising the total flora are contained in the Poaceae and Asteraceae. No spore plants, Lycopods or ferns grow here. Frequent salt water inundation may explain their absence. Pomegranate, *Punica granatum*, an ornamental shrub that produces delicious fruit, is planted at many home sites on the island. No Federal or Maryland rare vascular plant species have been identified on Smith Island. No species of

southern affinity reach their northern range limit at Smith Island nor do any northern species reach their southern limit here.

Sea level rise may completely inundate Smith Island in the future. Studies by the author on abandoned rice fields in South Carolina south of Smith Island, indicates a shift in vegetation from primarily a fresh water flora (Alexander 1915) to a brackish water flora in 2019 due to rising sea level. Species diversity has declined in the two least saline marshes as salt marshes support fewer taxa than freshwater marshes.

At the abandoned rice fields, Georgetown County, South Carolina the number of taxa at Airport marsh declined from 47 in 1968-1969 (Baden 1971) to twenty seven in 2013-2015. There was also a decline in numbers at the least saline site, Alderly from fifty six in 1968-1969 (Baden 1971) to forty one in 2013-2015. The presence of *Sporobolus alterniflorus* a salt marsh associate at Alderly observed for the first time in 2013-2015 is further evidence of sea level rise.

In summary, non-native species comprise 41% of the flora. These vascular plant species occur principally in ruderal sites, lawns, the dump, and along the roadside right-of-way. Sea level is currently rising 3.0 to 3.6 mm/y and may increase if levels of carbon dioxide and methane continue to increase in the future. With a predicted sea level rise of 2.7 feet (0.83 m) by the end of the 21<sup>st</sup> century species diversity will decline and it is doubtful whether if many ruderal taxa, trees and shrubs (*Iva* and *Baccharis* the exception) will be present at Smith Island at the end of this century.

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### **Table 1. Annotated Checklist of Species, Smith Island, Chesapeake Bay, Maryland**

The vascular plant taxa 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 Weakley (2015). Each entry includes the following information sequence: scientific name; pertinent synonym, enclosed in brackets; plant community (see discussion above); frequency relative to the study area, using the categories: rare (scarce, less than 5 populations), infrequent (uncommon, occasional, 5 to 20 populations), frequent (common, more than 20 populations). Non-native species are preceded with an asterisk.

#### **Pinophyta**

##### **Cupressaceae**

*Juniperus virginiana* L. var. *virginiana*. Successional field, rare

##### **Pinaceae**

\**Picea abies* L. Ruderal, rare

\**Pinus strobus* L. Ruderal, rare

*Pinus taeda* L. Ruderal, rare

##### **Taxodiaceae**

*Taxodium distichum* L. Ruderal, one individual, rare

#### **Magnoliophyta-Magnoliopsida**

##### **Aceraceae**

*Acer saccharinum* L. Ruderal, homesites, infreq.

##### **Adoxaceae**

*Sambucus nigra* L. subsp. *canadensis* (L.) R. Bolli (*Sambucus canadensis* L.) Ruderal, rare

##### **Aizoaceae**

*Sesuvium portulacastrum* L. Salt marsh, freq.

### **Amaranthaceae**

*Atriplex prostrata* Boucher ex DC [*A. patula* L. var. *hastata*, auct. Non (L.) A. Gray] Salt marsh, freq.

\**Chenopodium album* L. Ruderal, freq.

### **Anacardiaceae**

*Rhus copallinum* L. Fields, thickets; freq. Successional field, infreq.

*Toxicodendron radicans* (L.) Kuntze [*Rhus r.* L.] Successional field, freq.

### **Apiaceae**

\**Pastinaca sativa* L. Ruderal, infreq.

### **Apocynaceae**

*Apocynum cannabinum* L. Ruderal, infreq.

### **Aquifoliaceae**

*Ilex opaca* Ait. Successional field, rare

### **Araliaceae**

\**Hedera helix* L. Ruderal, freq.

### **Asteraceae**

*Ambrosia artemisiifolia* L. Ruderal, freq.

*Baccharis halimifolia* L. Ruderal and successional field, freq.

*Conyza canadensis* L. Ruderal, freq.

*Eclipta prostrata* L. [*Eclipta alba* L.] Ruderal, infreq.

*Erechtites hieraciifolius* L. Ruderal, infreq.

*Erigeron strigosus* Muhl. Ruderal, infreq.

*Eurybia divaricata* L. [*Aster divaricatus* L.] Ruderal, rare

*Euthamia caroliniana* L. Ruderal, infreq.

*Euthamia tenuifolia* (L.) Greene ex Porter and Britton (*Solidago tenuifolia* Pursh) Successional field, infreq.

\**Galinsoga parviflora* Cav. Ruderal, infreq.

*Gamochaeta purpurea* L. [*Gnaphalium purpureum* L.] Successional field, infreq.

\**Lactuca serriola* L. Ruderal, infreq.

*Pluchea odorata* L. Brackish marsh, infreq.

*Pseudognaphalium obtusifolium* L. Successional field, ruderal, infreq.

\**Senecio vulgaris* L. Ruderal, infreq.

*Solidago altissima* L. Ruderal, infreq.

*Solidago rugosa* Mill. ssp. *rugosa* Ruderal, infreq.

*Solidago sempervirens* L. Brackish marsh and salt marsh, freq.

\**Sonchus oleraceus* L. Ruderal, infreq.

*Symphotrichum tenuifolium* L. (*Aster tenuifolius* L.) Salt marsh, freq.

\**Taraxacum officinale* Weber Ruderal and successional field, freq.

\**Tragopogon dubius* Scopoli Ruderal, infreq.

### **Boraginaceae**

*Heliotropium curassavicum* L. Salt marsh, freq.

### **Brassicaceae**

\**Brassica nigra* L. Ruderal, freq.

\**Lepidium didymum* L. [*Coronopus didymus* L.]. Ruderal, freq.

*Descurainia pinnata* Walt. Ruderal and successional field, infreq

\**Lepidium campestre* L. Ruderal, infreq.

*Lepidium virginicum* L. Ruderal, infreq.

### **Caprifoliaceae**

\**Lonicera japonica* Thunb. Ruderal and successional field, infreq.

\**Sambucus nigra* L. Ruderal, rare

### **Caryophyllaceae**

\**Cerastium fontanum* Baumg. Ruderal and successional field, freq.

*Cerastium viscosum* L. Ruderal and successional field, freq.

\**Holosteum umbellatum* L. Ruderal, rare

*Spergularia marina* L. Salt marsh, freq.

\**Stellaria media* L. Ruderal and successional field, freq.

### **Chenopodiaceae**

\**Atriplex patula* L. Salt marsh, freq.

*Salicornia virginica* L. [*Salicornia europaea* L.] Salt marsh, rare

*Suaeda maritima* L. Salt marsh, infreq.

### **Convolvulaceae**

*Calystegia sepium* L. Successional field, infreq.

\**Convolvulus arvensis* L. Successional field, infreq.

### **Cornaceae**

*Cornus florida* Ruderal, rare

### **Cuscutaceae**

*Cuscuta* sp. Brackish and salt marsh, freq.

**Ebenaceae**

*Diospyros virginiana* L. Ruderal, rare

**Euphorbiaceae**

*Euphorbia maculata* L. Ruderal, rare

**Fabaceae**

\**Melilotus albus* L. Ruderal and successional field, freq.

*Strophostyles helvola* L. Ruderal and successional field, infreq.

\**Trifolium arvense* L. Ruderal and successional field, freq.

\**Trifolium hybridum* L. Ruderal and successional field, freq.

\**Trifolium pratense* L. Ruderal, freq.

\**Trifolium repens* L. Ruderal and successional field, freq.

\**Vicia sativa* L. ssp. *nigra* L. Ruderal and successional field, freq.

**Fagaceae**

*Quercus phellos* L. Ruderal, rare

**Hamamelidaceae**

*Liquidambar styraciflua* L. Ruderal, rare

**Geraniaceae**

*Geranium maculatum* L. Ruderal, rare

**Juglandaceae**

\**Carya illinoensis* (Wang.) K. Koch. Ruderal, rare

\**Juglans nigra* L. Ruderal, rare

**Lamiaceae**

\**Lamium amplexicaule* L. Ruderal and successional field, freq.

\**Lamium purpureum* L. Ruderal and successional field, freq.

**Magnoliaceae**

*Liriodendron tulipifera* L. Ruderal, rare

**Malvaceae**

*Kosteletzkya pentacarpos* L. [*Kosteletzkya virginica* L.] Brackish marsh, infreq.

**Moraceae**

\**Morus alba* L. Successional field, infreq.

**Myricaceae**

*Morella cerifera* [*Myrica cerifera* L.] Successional field, freq.

**Oleaceae**

\**Ligustrum vulgare* L. Ruderal and successional field, freq.

### **Onagraceae**

*Oenothera biennis* L. Ruderal and successional field, freq.

### **Orobanchaceae**

*Agalinis maritima* Rafinesque Salt marsh, freq.

### **Oxalidaceae**

*Oxalis stricta* L. Ruderal, infreq.

### **Phytolaccaceae**

*Phytolacca americana* L. var. *americana* Ruderal and successional field, freq.

### **Plantaginaceae**

*Nuttallanthus canadensis* L. Ruderal infreq.

\**Plantago lanceolata* L. Ruderal and successional field, freq.

*Plantago rugelii* Dcne. Ruderal and successional field, freq.

\**Veronica arvensis* L. Ruderal, freq.

\**Veronica persica* Poir, Ruderal,

freq.

### **Plumbaginaceae**

*Limonium carolinianum* Walt. Salt marsh, infreq.

### **Polygonaceae**

*Persicaria hydropiperoides* Mich. Ruderal, freq.

*Persicaria pensylvanica* L. Ruderal, infreq.

\**Polygonum aviculare* L. Ruderal, freq.

\**Rumex acetosella* L. Ruderal and successional field, freq.

\**Rumex crispus* L. Ruderal, infreq.

### **Portulacaceae**

\**Portulaca oleracea* L. Ruderal, freq.

### **Ranunculaceae**

\**Clematis terniflora* DC. var *terniflora* [*Clematis dioscoreifolia* Lev. & Vaniot] Ruderal, Rare

### **Rosaceae**

*Prunus serotina* Ehrh. Ruderal, infreq.

\**Pyrus calleryana* Decne. Ruderal, rare

\**Rosa multiflora* Thunb. ex Murr. Ruderal and successional field, infreq.

### **Rubiaceae**

*Galium aparine* L. Ruderal and successional field, infreq.

### **Ruppiaceae**

*Ruppia maritima* L. Chesapeake Bay, Freq.

### **Salicaceae**

\**Populus alba* L. Ruderal and successional field, infreq.

\**Populus nigra* Ruderal and successional field, infreq.

\**Salix babylonica* L. Ruderal, rare

### **Scrophulariaceae**

\**Verbascum thapsus* L. Ruderal and successful field, freq.

### **Solanaceae**

\**Lycopersicon esculentum* L. Ruderal, rare

\**Solanum nigrum* L. Ruderal and successional field, freq.

### **Ulmaceae**

*Ulmus americana* L. Ruderal, rare

### **Vitaceae**

*Parthenocissus quinquefolia* L. Ruderal and successional field, freq.

### **Magnoliophyta - Liliopsida**

#### **Alliaceae**

\**Allium vineale* L. Ruderal and successional field, infreq.

#### **Asparagaceae**

\**Asparagus officinalis* L. Ruderal, infreq.

### **Commelinaceae**

\**Commelina communis* L. Ruderal, infreq.

### **Cyperaceae**

*Carex striata* Mich. Ruderal and salt marsh,  
freq.

*Cyperus echinatus* L. Ruderal, infreq.

*Cyperus excultus* L. var. *leptostachyos* Boech. Ruderal, infreq.

*Cyperus filicinus* Vahl. Ruderal, infreq.

*Cyperus odoratus* L. Ruderal, infreq.

*Cyperus odoratus* L. var. *englemannii* (Steudel) R. Carter, S.D. Jones & J. Wipff. Ruderal, infreq.

*Cyperus polystachyos* Rottb. Ruderal and successional field, freq.

*Schoenoplectus pungens* Vahl. Brackish marsh, freq.

*Bolboschoenus robustus* (Pursh) Soják [*Scirpus robustus* Pursh] Brackish marsh, infreq.

### **Juncaceae**

*Juncus gerardii* Loisel. Salt marsh, freq.

### **Poaceae**

\**Aira caryophyllea* L. Ruderal, freq.

*Andropogon virginicus* L. Successional field, freq.

\**Bromus inermis* Leyss. Ruderal, infreq.

*Bromus pubescens* Muhl. Ex Willd. [*Bromus pungens* L.] Ruderal, infreq.

\**Bromus tectorum* L. Ruderal, infreq.

\**Cynodon dactylon* L. Ruderal and successional field, freq.

\**Dactylis glomerata* L. Successional field, infreq.

*Digitaria sanguinalis* L. Ruderal, freq.

*Distichlis spicata* L. Salt marsh, infreq.

\**Echinochloa crusgalli* L. Ruderal, infreq.

\**Eleusine indica* L. Ruderal, infreq.

*Elymus virginicus* L. var. *halophilus* Ruderal and successional field, infreq.

\**Lolium perenne* L. Ruderal, freq.

*Panicum dichotomiflorum* Mich. Ruderal, freq.

*Panicum virgatum* L. Ruderal and successional field, freq.

\**Phragmites australis* (Cav.) Trin. ex Steud. Brackish marsh, freq.

\**Poa annua* L. Ruderal, freq.

*Polypogon monspeliensis* (L.) Desf. Ruderal, infreq.

*Schizachyrium scoparium* Mich. Successional field, freq.

*Sporobolus alterniflorus* Loisel. [*Spartina alterniflora* Loisel.] Salt marsh, freq.

*Sporobolus pumilus* (Roth) P.M. Peterson & Saarela Salt marsh, freq.

[*Spartina patens* (Aiton) Muhl.]

*Tridens flavus* L. Ruderal and successional field, freq.

### **Ruppiaceae**

*Ruppia maritima* L. Chesapeake Bay, freq.

### **Typhaceae**

*Typha angustifolia* L. Brackish marsh, freq.

**Table 2.** Summary of the Vascular Flora at Smith Island, Maryland.

	<b>Lycopods</b>	<b>Ferns</b>	<b>Conifers</b>	<b>Dicots</b>	<b>Monocots</b>	<b>Total</b>
<b>Families</b>	0	0	3	46	8	57
<b>Genera</b>	0	8	0	90	27	121
<b>Species</b>	0	0	5	103	36	144
<b>Native Species</b>	0	0	3	72	25	85
<b>Introduced Species</b>	0	0	2	46	11	59

<sup>1</sup>Native and introduced species that reproduce spontaneously.



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