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final report**

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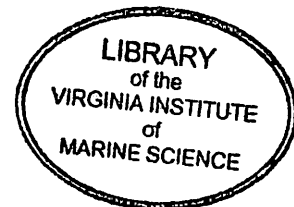
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**Identification of Historic Locations of Aeschynomene virginica  
within the Tidal Freshwater Zone of the  
Pamunkey River, Virginia**

**Final Report Submitted To**

**Malcolm Pirnie, Inc.**

**Submitted By**



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**Dec., 1993**

Identification of Historic Locations of Aeschynomene virginica  
within the Tidal Freshwater Zone of the Pamunkey River, Virginia

## INTRODUCTION

The historical distribution and population densities of a federal listed threatened plant species, the northern joint vetch (Aeschynomene virginica), was determined and mapped in the tidal regions of the Pamunkey River, Virginia, where a potential water withdrawal structure is being evaluated.

## STUDY AREA

The study area was defined as the Pamunkey River from Hill Marsh, the upstream limit of salt intrusion (Brooks, 1983), and continuing upstream to the US 360 bridge crossing which demarcates the upstream limit of tidal reach on the Pamunkey River. Total length of the study area was approximately 80 kilometers (Figure 1).

## SITE DESCRIPTION

The Pamunkey River is part of the headwater system of the York River, one of the main tributaries of Chesapeake Bay. The climate of the area is humid, subtropical (Brooks, 1983) and has a growing season of 175 days (based on consecutive days >32 F for 9 years in 10; National Cooperative Soil Survey, 1980). The annual average temperature of the river basin is 56.3 F (13.5 C) with the annual highs coming in August (25.7 C (78.3 F)) and lows in February (0.9 C (33.6 F)). The water temperature of the river basin shows seasonal trends that follow the ambient air temperatures with a one to two week lag time. Highs come in August (approx. 27.5 C (81.5 F)) and lows in February (approx. 5.5 C (41.9)). Precipitation in the area is 95.9 cm (45 inches) and is highest in July and August and lowest between September and January (Brooks, 1983).

Freshwater discharge into the headwaters of the Pamunkey River is measured at Hanover, Va., approx. 55 km (36 miles) upstream from the US 360 bridge. Over 39 years the discharge ranged from 0.34 m/sec. to 1,140 m/sec. (12 ft/sec. to 4.03 x 10

ft/ sec.). Mean daily average discharge is 28.74 m/sec. (1 x 10 ft/sec.)(Brooks, 1983). Since the river has a mean low water volume of 1.098 x 10 m (3.88 x 10 ft )(Brooks, 1983), the residence time of the freshwater entering the system, ignoring tidal effects, is approximately 104 days.

The shoreline of the study site consists of approximately 116.9 km (72.6 miles) of fastlands (upland-wetland or upland-estuary interfaces). This includes 4.5 km (2.8 miles) of high shores with steep bluffs, usually indicative of high energy upland-estuary interfaces, and 146.1 km (90.7 miles) of low shore (marsh-estuary interface). South of the site are 55.6 km (34.5 miles) of marsh shore and 48.1 km (29.9 miles) of fastland shore, including 3.7 km (2.3 miles) of steep bluffs (Hobbs et al., 1975).

The tidal freshwater marshes on both sides of the river are populated with freshwater hydrophytes. The populations represented two distinct ecotones: submerged to immersed vegetated zone (dominated by Nuphar luteum) and an emergent zone (dominated by a large diversity of herbaceous species).

Submerged to Immersed Zone: Dominated by yellow spatter dock (Nuphar luteum), the zone extends from the mean tide line to spring low water. It varies in width from a few meters on the west side of the river to nearly a kilometer on the east side. Other species found in this zone, albeit in very small numbers, included Pontederia cordata, Polygonum punctatum, Scirpus americanus, and Zizania aquatica.

Emergent Zone: The zone extends from the mean tide line to the mean high tide mark. The zone was dominated by mixed herbaceous and/or graminoid vegetation. The south shore was dominated by Zizania aquatica, Juncus effusus, Pontederia cordata, and Scirpus americana. Large populations of Eriocaulon parkeri, Eleocharis parvula, and Sagittaria subulata form extensive mats throughout the zone. Other species present, but not dominant, included Boehmeria cylindrica, Helenium autumnale, Polygonum punctatum, Cinna arundinacea, Acorus calamus, Impatiens capensis, Lobelia cardinalis, Orontium aquaticum, Ludwigia palustris, and Pilea pumila.

## METHODS

Historical data concerning A. virginica was reviewed for the study area.

Plant nomenclature follows Gleason and Cronquist, 1991. Species distributions were confirmed with Harvill et al., 1992.

### SPECIES DESCRIPTION

A. virginica is a tall (0.5-2.0 m) annual legume; stems erect, bristly, branched; leaves even-pinnate (a few may be odd-pinnate), 2-12 cm long; leaflets 30-56, 1 nerved, entire, 2-3 mm wide, oblong; pedicels 3-8 mm long, with sessile toothed bractlets about 4 mm long and 2-3 mm wide immediately below flowers; pea-shaped flowers 1-6, yellow with red veins, standard (uppermost petal) 10-15 mm long; legume fruit a legume, 2-7 cm long, stipe 1-1.5 cm long; joints 4-10, sparsely pustulate hairy, breaking into 1-seeded segments (modified from Gleason and Cronquist, 1991; Terwilliger, 1991).

### HABITAT

Found on sandy or muddy river banks and tidal shores (Hershner and Perry, 1988; Gleason and Cronquist, 1991; Terwilliger, 1991). Usually found associated with grazing or other activities that remove or decrease vegetation cover (Hershner and Perry, 1988; Terwilliger, 1991). Found in areas often dominated by a diverse mixture of emergent macrophytes, including Bidens laevis, Chamaecrista fasciculata var. macroperma, Hibiscus moscheutos, Leersia oryzoides, Polygonum punctatum, P. arifolium, and Zizania aquatica.

### LIFE HISTORY

Seeds germinate by early June and reach up to 0.5 m by mid-summer. Flowering begins in early August and persist throughout October. Fruits develop in September through October. The legumes break into one seeded segments and are disseminated by flotation. Seed banking appears to be involved as many stands of A. virginica reappear at isolated sites after a period of absence (modified from Terwilliger, 1991). A. virginica prefers grazed, eroded, or otherwise sparsely vegetated areas.

Therefore, it is more than likely shade intolerant and/or competes poorly with the many perennial species of the marshes.

## DISTRIBUTION

Southern New Jersey south to Craven County, North Carolina. Has been extirpated from Delaware and Pennsylvania. In our region it has been recorded from the coastal plain in oligohaline and tidal freshwater marshes of the Chickahominy, Mattaponi, Pamunkey, Rappahannock, and Potomac Rivers. The population of A. virginica has declined from over 10,000 plants at one point in the past to about 700 individuals in 1986 (modified from Terwilliger, 1991). Specimens of A. virginica have been recorded within the study area (Hershner and Perry, 1988).

## STATUS

Globally and state ranked as very rare and imperiled with 6 to 12 occurrences or few remaining individuals; or because of some factor(s) making it vulnerable to extinction (G2, S2, respectively) (Appendix 1). It has recently been assigned federal **Threatened** status under Section 4(a)(1) of the endangered Species Act (16 U.S.C. 1531 et seq.) and federal regulations (50 CFR part 424) (see Federal Register, Vol. 57, No. 98, May 20, 1992, pg. 21569-21574, 50 CFR part 17) (see Appendix 2 for definitions of state and federal status terms).

## DISTRIBUTION ON THE PAMUNKEY RIVER

A. virginica has been recorded at three sites along the Pamunkey River from as far downstream as Sweet Hall Marsh and as far upstream as Whitehouse (Figure 2) (Hershner and Perry 1988). All sites had viable populations in the summer of 1991 (personal observations).

## LITERATURE CITED

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Figure 1. Pamunkey River, Virginia. The tidal freshwater zone begins on the west edge of Hill Marsh and continues WNW upstream to the Rte. 360 bridge.



# Pamunkey River

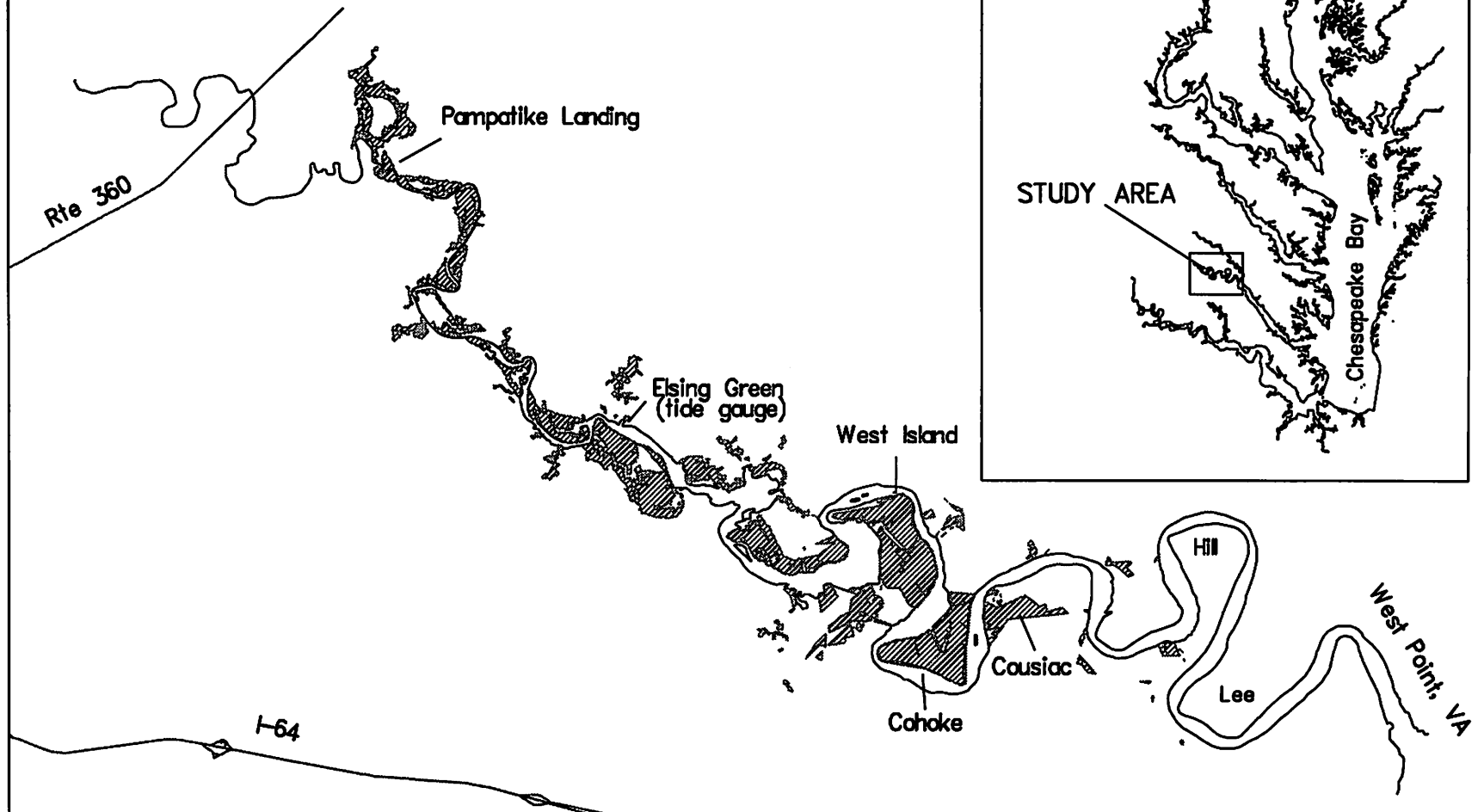
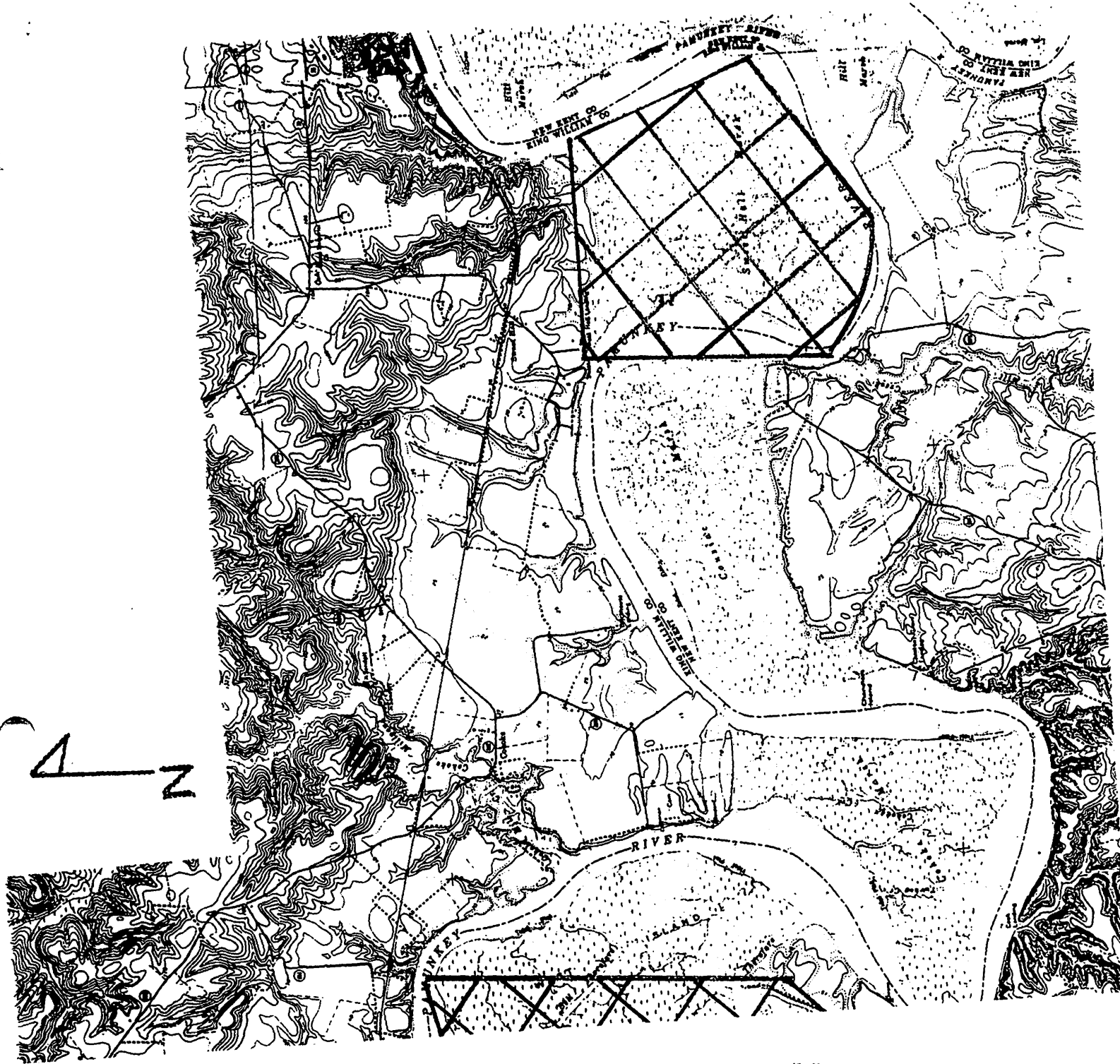
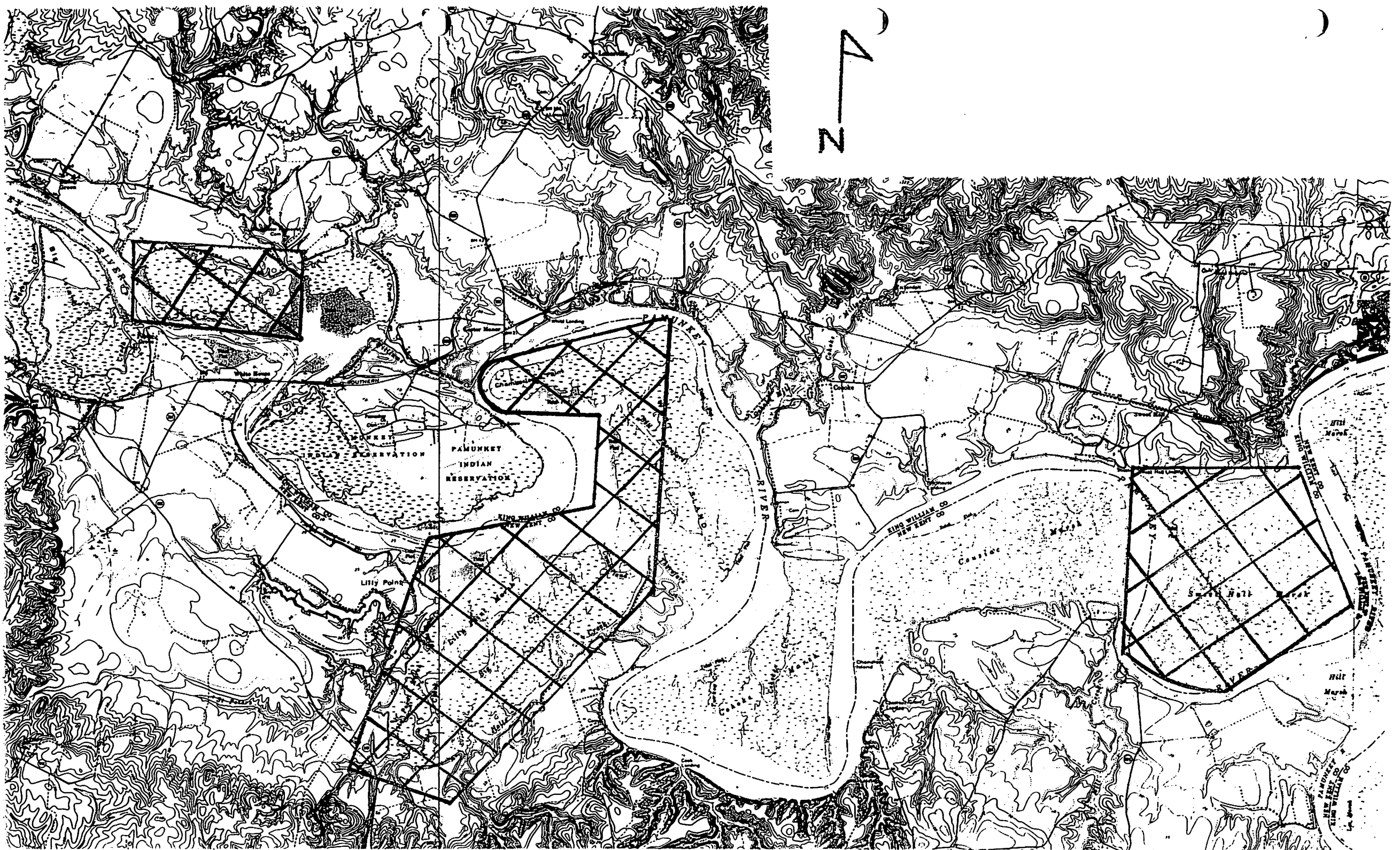


Figure 2

Figure 2. Historical distribution of Aeschynomene virginica on the Pamunkey River.  
Scale 1 to 50,000.



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MIDDLE RIVER INDIAN RESERVATION  
PAMUNKEY INDIAN RESERVATION

PAMUNKEY INDIAN RESERVATION

Lilly Point

KING WILLIAM CO  
NEW KENT CO

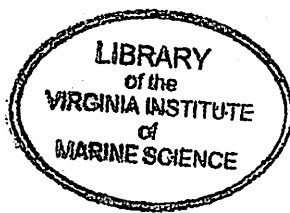
Conestoga

South Hill

Hill Marsh

Hill Marsh

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APPENDIX 1

Explanation of rare plant RANK and STATUS codes.  
(from Ludwig, 1992)

## LIST FORMAT

The rare plant list and the watchlist are ordered alphabetically by scientific name. Each listing has an identical format which presents six fields: scientific name, common name, global rank, state rank, federal status, and state status. To aid in the interpretation of the list, a brief explanation of each field follows:

### Column 1. Scientific name:

In all but a few cases, nomenclature follows J.T. Kartesz, A Synonomized Checklist of the Vascular Flora of the United States (in press). Since the user may not have access to this reference, a line is provided below the scientific name. This line provides the user with a synonymy when other names are used in popular regional botanical references including the 2nd edition of the Atlas of the Virginia Flora by A.M. Harvill, Jr., T.R. Bradley, C.E. Stevens, T.F. Wieboldt, D.M.E. Ware, and D.W. Ogle, 1986. The synonymy field is also used to give other pertinent taxonomic information, and note when the nomenclature does not follow Kartesz.

### Column 2. Common name:

A common name is provided for the convenience of the user. Common names for plants are not standardized and many taxa have no entirely satisfactory common name.

### Column 3. Global rank:

Global ranks are assigned by a consensus of the network of natural heritage programs, scientific experts, and The Nature Conservancy to designate a rarity rank based on the rangewide status of a species or variety. This system was developed by The Nature Conservancy and is widely used by other agencies and organizations as the best available scientific and objective assessment of a taxon's rarity and level of threat to its existence. The ranks are assigned after considering a suite of factors including number of occurrences, numbers of individuals, and severity of threats.

G1 = Extremely rare and critically imperiled with 5 or fewer occurrences or very few remaining individuals; or because of some factor(s) making it especially vulnerable to extinction.

G2 = Very rare and imperiled with 6 to 20 occurrences or few remaining individuals; or because of some factor(s) making it vulnerable to extinction.

G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range; or vulnerable to extinction because of other factors. Usually fewer than 100 occurrences are documented.

G4 = Common and apparently secure globally, though it may be rare in parts of its range, especially at the periphery.

G5 = Very common and demonstrably secure globally, though it may be rare in parts of its range, especially at the

periphery.

GH = Formerly part of the world's biota with expectation that it may be rediscovered.

GX = Believed extinct throughout its range with virtually no likelihood of rediscovery.

GU = Possibly rare, but status uncertain and more data needed.

G? = Unranked, or, if following a ranking, rank uncertain (ex. - G3?).

G\_Q = the taxon has a questionable taxonomic assignment, such as a G3Q.

G\_T = signifies the rank of a subspecies or variety. For example, a G5T1 would apply to a subspecies of a species that is demonstrably secure globally (G5) but the subspecies warrants a rank of T1, critically imperiled.

#### Column 4. State rank:

State ranks are assigned in a manner similar to that described for global ranks, but consider only those factors within the political boundaries of Virginia. For example, whereas a plant which is endemic to Virginia (found nowhere else) will have the same global and state ranks, a plant which may be common in the northeastern United States, but only known from a few occurrences in Virginia will have different global and state ranks. By comparing the global and state ranks, the status, rarity, and the urgency of conservation needs can be ascertained.

S1 = Extremely rare and critically imperiled with 5 or fewer occurrences or very few remaining individuals in Virginia; or because of some factor(s) making it especially vulnerable to extirpation in Virginia.

S2 = Very rare and imperiled with 6 to 20 occurrences or few remaining individuals in Virginia; or because of some factor(s) making it vulnerable to extirpation in Virginia.

S3 = Rare to uncommon in Virginia with between 20 and 100 occurrences; may have fewer occurrences if found to be common or abundant at some of these locations; may be somewhat vulnerable to extirpation in Virginia.

S4 = Common and apparently secure with more than 100 occurrences; may have fewer occurrences with numerous large populations.

S5 = Very common and demonstrably secure in Virginia.

SH = Formerly part of the Virginia biota with expectation that it may be rediscovered.

SX = Believed extirpated from Virginia with virtually no likelihood of rediscovery.

SE = Exotic; not believed to be a native component of Virginia's flora.

SR = Reported for Virginia, but without persuasive documentation which would provide a basis for either accepting or rejecting the report.

SU = Possibly rare, but status uncertain and more data needed.

S\_? = Rank uncertain, for example a S2? denotes a species or variety which may range from S1 to S3, another example



is SE?, meaning a taxon may or may not be native to Virginia.

Column 5. Federal Status:

Federal Status is determined by the U. S. Fish and Wildlife Service. This includes all species and varieties which are listed as endangered or threatened by the U. S. government and receive protection under the federal Endangered Species Act. The list also notes those taxa which are proposed for listing or assigned to categories 1, 2, or 3.

LE = Listed Endangered. A taxon is threatened with extinction throughout all or a significant portion of its range.

LT = Listed Threatened. A taxon is likely to become endangered in the foreseeable future.

PE = Proposed Endangered. A taxon is proposed for listing as endangered.

PT = Proposed Threatened. A taxon is proposed for listing as threatened.

C1 = Candidate, Category 1. There is enough available information to propose the taxon for listing, but listing is "precluded by other pending proposals of higher priority". The U.S. Fish and Wildlife Service is "directed to make prompt use of the emergency listing if the well-being of any such species is at significant risk."

C2 = Candidate, Category 2. The taxon is possibly rare, but there are not enough data available to support listing.

3A = A taxon for which there is evidence of extinction.

3B = A taxon name which is not valid under current taxonomic understanding.

3C = The taxon has proven to be abundant, widespread, and/or unthreatened so that listing is currently inappropriate.

\* = An \* following the status denotes that the species or variety is possibly extinct.

Column 6. State Status:

State status indicates those plants which are listed as state endangered or threatened under the authority of the Virginia Department of Agriculture and Consumer Services. The Department of Agriculture and Consumer Services is currently developing a recommended list of legally endangered and threatened species based upon the recommendations derived from a 1989 Virginia Endangered Species Symposium, and the Division of Natural Heritage. This list will be presented to its Board for consideration at a later date. The Board's actions will likely result in numerous changes to the current list.

LE = Listed Endangered

LT = Listed Threatened

PE = Proposed Endangered

PT = Proposed Threatened

C = Candidate for listing as threatened or endangered.

**APPENDIX 2**

**Definitions of state and federal STATUS terms  
(from Terwilliger, 1992)**

### Definitions of Virginia legal status and candidate categories.

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Endangered	Any species which is in danger of extinction throughout all or a significant portion of its range, other than a species of the class Insecta deemed to be a pest and whose protection under the provisions of the article (§3.1-1021) would present an overriding risk to the health or economic welfare of the Commonwealth.
Threatened	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
Protected	All wild animals under the jurisdiction of the Virginia Department of Game and Inland Fisheries, except as otherwise permitted.
Special Concern	Any species which is restricted in distribution, uncommon, ecologically specialized, or threatened by other imminent factors.
Candidate Species	A species formally recommended by the Director of the Department of Conservation and Recreation or other reliable data sources in writing to and accepted by the Commissioner for presentation to the Board of Agriculture and Consumer Services for listing under the Virginia Endangered Plant and Insect Act.

Definitions are from Code of Virginia § 3.1-1029, § 29.1-521, and § 29.1-563; VR 325-01, § 14.

### Definitions of federal legal status and candidate categories.

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Endangered	Any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary (of Interior) to constitute a pest whose protection under the provisions of this Act would present an overwhelming and overriding risk to man.
Threatened	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
Category 1	Taxa for which substantial information exists to support proposal to list the taxon as endangered or threatened.
Category 2	Taxa for which information exists to support proposal to list the taxon as endangered or threatened, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules.
Category 3	Taxa that were once being considered for listing as endangered or threatened, but are not currently receiving such consideration.
Subcategory 3A	Taxa for which persuasive evidence of extinction is available. If rediscovered, such taxa might warrant high priority for addition to the List of Endangered and Threatened Wildlife.
Subcategory 3B	Taxonomic names that, on the basis of current taxonomic understanding, usually as represented in published revisions and monographs, do not represent taxa meeting the legal definition of species in the Endangered Species Act. Future investigation could lead to re-evaluation of the listing qualifications of such entities.
Subcategory 3C	Taxa that are now considered to be more abundant and/or widespread than previously thought. Should new information suggest that any such taxon is experiencing a numerical or distributional decline, or is under a substantial threat, it may be considered for transfer to category 1 or 2.

Definitions of "endangered" and "threatened" from Endangered Species Act of 1973, as amended through the 100th Congress. Definitions of candidate categories condensed from 50 CFR 17 as reported in *Federal Register* volume 54 (4:January 6, 1989), pp. 554-555.