

**Development of Keys to Associations:
A Tool to Facilitate Vegetation Mapping, Inventories and
Sampling**

**A Cost-Share Proposal to the National Park Service
and the US Fish and Wildlife Service**

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February 6, 2001

Introduction

The National Vegetation Classification (NVC) is the first comprehensive and fine-scale classification of vegetation that is applicable across the entire country. The NVC is a much-needed tool that was developed to help biologists, conservation workers and managers make effective decisions. For the first time, managers can use this system to determine what types of vegetation occur at a site, to evaluate the quality of the occurrences, to assess the rarity of the types, and to use a common language to communicate across refuge and park boundaries, as well as with other agencies and organizations. The Federal Geographic Data Committee adopted the upper levels of the NVC as a reporting standard for all relevant federal agencies. The National Park Service adopted association level of the NVC in 1994 as a standard to map all Inventory and Monitoring parks in the country.

The NVC has been growing in scope and depth for many years as a result of collection and analysis of field data and existing literature. Over 5000 associations are recognized nation-wide. The NVC in the northeastern states (Maine to Virginia) is comprised of approximately 800 associations, with perhaps a total of 1000 to be expected when complete. Approximately 60% of the currently recognized 800 associations have at least the minimum amount of descriptive information required to confirm identity of a particular stand of vegetation.

ECOREGIONS AS UNITS OF ECOLOGICAL ASSESSMENT

Over the past four years, The Nature Conservancy (TNC), in partnership with the Association for Biodiversity Information and the network of heritage programs, has conducted a planning effort to identify conservation targets. The planning units decided upon for this effort were ecoregions - units of land that share the same ecological characteristics and similar vegetation types. In the northeast, The Nature Conservancy delineated 13 ecoregions wholly or partially in the region (Figure 1).

The eastern ecoregions are based on the subsection level of the Bailey Ecoregion map developed by the US Forest Service. To delineate the ecoregions, presence-absence information was collected for each NVC alliance and each subsection in the region (the smallest land units delineated in Figure 1). The information was collected by interviewing each heritage ecologist in the east about the distribution of each eastern alliance. For example, the spruce-fir forest alliance was attributed to all the subsections in the M212 province except the two subsections in the Catskills. The presence-absence information for all the alliances in all the subsections was analyzed using the program TWINSpan, and clusters of subsections were identified based on shared vegetation alliances. New ecoregional lines were drawn that were similar to, but not completely coincident, with the Bailey province level.

Because the new ecoregional boundaries delimit land units subjected to broadly similar ecological processes and share similar vegetation, the ecoregions are logical units within which to design keys to vegetation types. For example, the North Atlantic Coast ecoregion, previously unrecognized by Bailey, is characterized by coastal forests, dune vegetation, salt marshes, and the like.

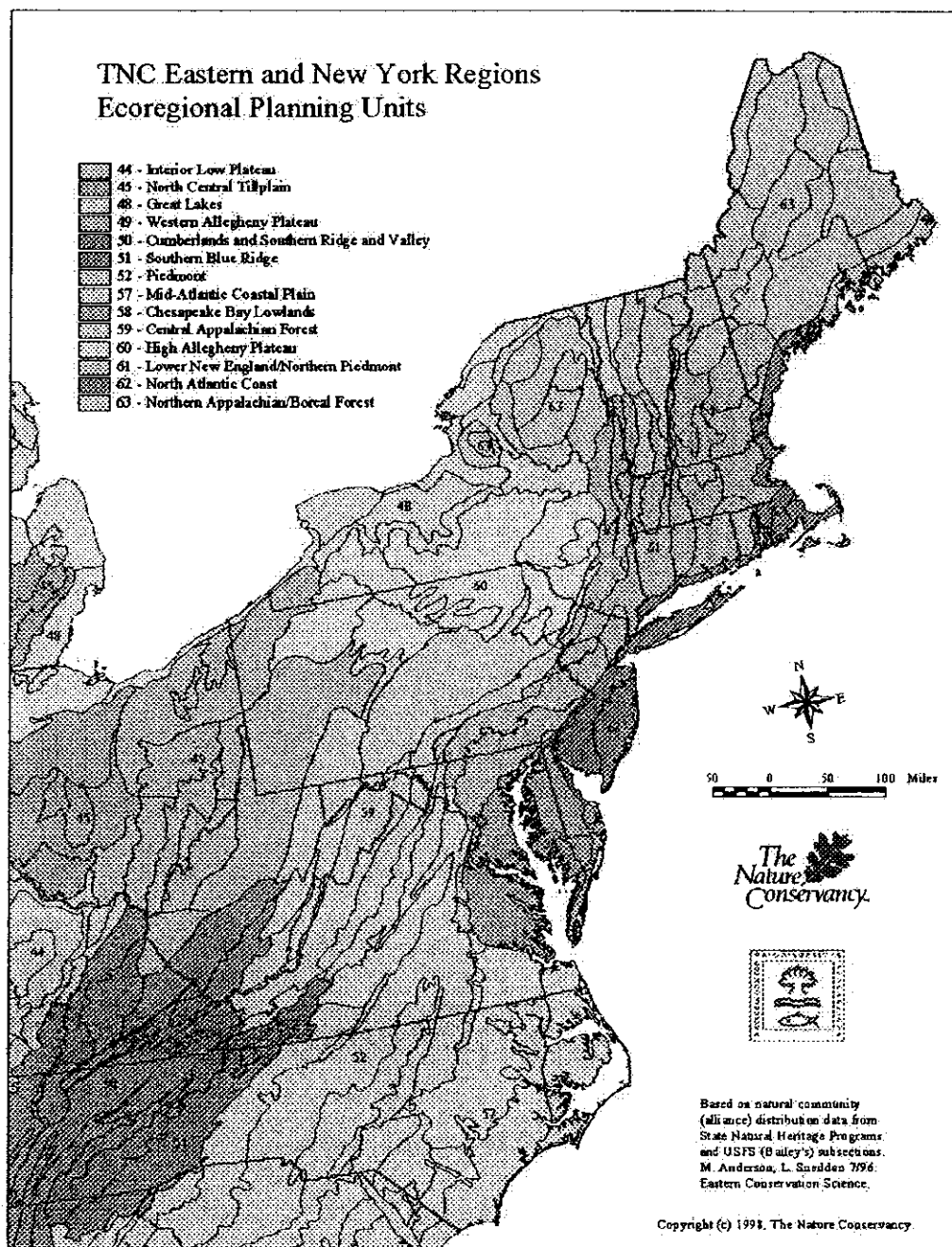


Figure 1

CURRENT STATUS OF THE NVC IN THE EAST

The ecoregional planning effort has been responsible for tremendous progress in the development of the NVC. Descriptions of each association targeted for conservation were written by the ecologists of TNC and heritage programs involved in the effort. At the same time, heritage programs in the northeastern states have been conducting independent field efforts resulting in numerous publications and major revisions to state classifications, upon which the NVC is based. New state classification documents or technical reports detailing vegetation types have been, or about to be released in Maine, Massachusetts, Pennsylvania, Vermont, Maryland, Delaware, and Connecticut.

Similarly, parks in the northeast have varying amounts of existing qualitative and quantitative information on vegetation at the park. A growing body of reports, maps, species lists and the like has not yet been systematically incorporated into the NVC. Existing data is especially important in the case of smaller historic parks with altered and heavily managed vegetation. Vegetation of anthropogenic origin or otherwise heavily influenced by human activity is under-represented in the NVC and is not usually sampled or studied by ecologists in heritage programs. Hence, incorporation of existing park-specific vegetation information will provide data that is complementary to that of heritage program and most academic studies.

In summary, a wealth of vegetation information has been compiled, analyzed, and described by Heritage Programs, Park staff, as well as academicians, and now awaits incorporation into the NVC.

Problem statement

Despite the comprehensive scope of the NVC and the wealth of newly available data, the complexity and "newness" of the NVC presents a certain amount of frustration to many users. Many associations lack more than very basic descriptions. New types are known but not yet incorporated into the classification. Tools to facilitate use of the classification have not yet been developed. As a result, the classification in its current state can be cumbersome to interpret and apply, both on the ground and from remote imagery. It is often a very difficult task for even the most experienced vegetation scientist to determine which association s/he is standing in, or to interpret aerial photo signatures. Even if provided a list of types that may potentially occur at a site, one must read through each description to compare differences among types and make a determination. Even then, the differences among types are often not transparent.

In short, the lack of user-friendly tools hinders use of the NVC for inventory, monitoring and management.

Proposal

We propose to develop descriptions and user-friendly keys to associations for A) the Lower New England / Northern Piedmont ecoregion and B) the North Atlantic Coast / Chesapeake Bay ecoregions.

Our goal is to produce keys that do not rely on detailed knowledge of all plant species, but instead incorporate obvious environmental characteristics, selected prominent plant species, and other readily observed attributes that a reasonably competent field biologist would be able to interpret with a minimum of effort. Such a key is possible because although associations are based on plant species composition, their classification relies on environmental setting and vegetation structure as well. See the sample key produced for Assateague Island National Seashore in Appendix 1.

Approach

Information from heritage program reports and classifications, data collected during the ecoregional planning efforts, data existing at individual parks and selected other literature sources, will be used to revise and further develop the eastern portion of the NVC. No additional field effort will be required. The NPS NRBib will be used to identify pertinent existing information at each park, and park staff will be contacted for other additional data that may not be listed in NRBib. Hard copies of reports will be requested from individual parks and from library at the Boston Science Office of NPS.

Integration of information will involve the manual comparison of descriptions, and the data used to produce the descriptions, to existing NVC associations. Association descriptions will be revised (or developed where necessary) to include pertinent environmental information, species composition, range, physiognomy, and "crosswalk" or synonymy to published names. New descriptions will be circulated to heritage ecologists, appropriate park staff, and academic colleagues for review. See sample description in Appendix 2.

Expected results

Results anticipated from this work are the following:

- 1) Hard-copy reports for the North Atlantic Coast / Chesapeake Bay and the Lower New England / Northern Piedmont ecoregions will provide clear, concise summary descriptions of associations for all natural and semi-natural vegetation within each ecoregion. Descriptions will include environmental setting, range, species composition, and physiognomy. Altered vegetation such as fields, roadsides, and other vegetation maintained in other than its natural condition will also be classified and described at a coarser level. For example, the eastern portion of the NVC contains only two broadly defined associations that are applied to all meadows comprised of European forbs and grasses.
- 2) Ancillary descriptive information will include taxonomic hierarchy (class, subclass, group, formation, and alliance), global rank, state distribution, heritage program synonymy, average scale of occurrence (matrix, large patch, small patch, or linear), and literature sources.
- 3) A measure of distribution will be provided. Associations that are found only within that ecoregion are "restricted", those occurring in one or two adjacent ecoregions are "limited", those whose center of distribution occurs outside the ecoregion are "peripheral" and those of broad distribution are "widespread".
- 4) User-friendly keys to the associations will be developed for each ecoregion.

- 5) We estimate that upon completion of this project that 80% or more of all associations likely to occur in each ecoregion will be identified, described and integrated into keys. On average, we suspect that only 20% or fewer of stands encountered on parks or refuges will not be covered by any description.

Applications

The products summarized here will have numerous applications:

- 1) The National Park Service Vegetation Mapping Program aims to develop detailed vegetation maps of each Inventory and Monitoring park in the country. The US Fish and Wildlife Service is undertaking a Comprehensive Planning process and is also pursuing the development of vegetation maps for refuges. Funding for the NPS Vegetation Mapping program has increased recently, but still, mapping of all parks in the northeast will not be complete for many years, and maps of US Fish and Wildlife refuges are in planning stages. However, park and refuge resource managers are developing and implementing detailed inventory and monitoring plans and have a need for classification information now. The availability of dichotomous keys to vegetation within an ecoregion will provide park and refuge staff the capability of determining what associations are present in the park long before many mapping efforts even begin.
- 2) Global ranks and assessment of distribution of the associations will enhance the abilities of resource managers in allocating staff, time, and money more efficiently and effectively. For example, an association that is restricted in range may not be recognized as such because it occurs in large patches or large numbers. Even though an association appears to "be everywhere" in a park, its overall range may be quite restricted and should be of concern to managers. Conversely, an association may appear to be very rare in a park but is actually peripheral to its major range outside the ecoregion.
- 3) The Vegetation Mapping Program relies on an existing classification at the start of the mapping effort in order to interpret aerial photo signatures. Simply identifying polygons of similar color and texture may result in not recognizing a number of associations. Because the NVC is based on ecological parameters as well as plant species composition, the resulting map is not a simple "cover type" map. For example, yellow oak associations occurring on calcareous bedrock outcrops may have a number of deciduous trees as co-dominants, with yellow oak being characteristic but not necessarily dominant. Such ecological information is critical to understand in order to accurately map vegetation using the NVC. The availability of a key will allow for the identification of all the types that are potentially present in the park, and how to recognize them, before mapping begins.
- 4) Mapping clusters of parks or refuges has the potential for great economy of scale. Workers can gain familiarity with sites sharing the same vegetation types, and diminish the learning curve for any individual site. Ecoregion-based products proposed here will inform the Mapping Program by identifying those parks that would most appropriately be clustered, since they are based on ecoregions previously established to share the same vegetation types at the alliance level.
- 5) Targeting field sampling with the aid of ecoregion keys has the potential for substantial cost savings. Vegetation types that are easily keyed out (and thus well known and well

documented) can be sampled with a minimum of field work. Stands that are not easily keyed may suggest new types that should be specifically targeted for sampling.

- 6) The classification is based on physiognomic as well as floristic attributes of vegetation, and as such will provide information that is compatible with, and useful for, the development of fire models.

Time line

Completion of this project is expected within approximately two years of receipt of funds, with one phase (either A or B as noted above) to be completed the first year.

	Budget	
	LNE/NP	NAC/CHB
REGIONAL SALARIES	\$24,494.00	\$32,902.00
TRAVEL	\$600.00	\$1,200.00
COPIES	\$500.00	\$800.00
REGIONAL DIRECT COSTS	\$25,594.00	\$34,902.00
INDIRECT COSTS	\$5,118.80	\$6,980.40
REGIONAL SUBTOTAL	\$30,712.80	\$41,882.40
HERITAGE DIRECT COSTS	\$12,200.00	\$12,000.00
HERITAGE INDIRECT COSTS	\$2,440.00	\$2,400.00
HERITAGE TOTAL	\$14,640.00	\$14,400.00
PROJECT TOTAL	\$45,352.80	\$56,282.40
NPS SHARE	\$22,676.40	\$28,141.20
US FWS SHARE	\$22,676.40	\$28,141.20

National Parks and US Fish and Wildlife Refuges by Ecoregion

NORTH ATLANTIC COAST / CHESAPEAKE BAY		
NATIONAL PARKS		
Weir Farm		CT
Cape Cod		MA
Boston Harbor Islands		MA
Gateway		NY & NJ
Sagamore Hill		NY & NJ
Fire Island		NY
Assateague Island		MD
Piscataway Park (National Capital Parks East)		MD
George Washington's Birthplace		VA
Frederick Spotsylvania		VA
Richmond		VA
Colonial*		VA
Petersburg*		VA
FISH AND WILDLIFE REFUGES		
Pond Island		ME
Rachel Carson		ME
Great Bay		NH
Parker River		MA
Thacher Island		MA
Monomoy		MA
Massasoit		MA
Mashpee		MA
Nantucket		MA
Sachuest Point		MA
John H. Chafee		RI
Trustum Pond		RI
Ninigret		RI
Nomans Land		RI
Block Island		RI
S.B. McKinney		CT
Amagansett		NY
Target Rock		NY
Oyster Bay		NY
Conscience Point		NY
Wertheim		NY
Seatuck		NY
Lido Beach		NY

E.B. Forsythe		NJ
Cape May		NJ
Supawna Meadows		NJ
John Heinz		PA
Bombay Hook		DE
Prime Hook		DE
Susquehanna		MD
Eastern Neck		MD
Patuxent		MD
Glen Martin		MD
Blackwater		MD
Mason neck		VA
Marumscot		VA
Rappahanock River Valley		VA
Wallops Island		VA
Chincoteague		VA
Eastern Shore VA		VA
Fisherman Island		VA
Presquile		VA
James River		VA
Plum Tree Island		VA
Featherstone		VA
LOWER NEW ENGLAND / NORTHERN PIEDMONT		
NATIONAL PARKS		
St. Gaudens		NH
Marsh Billings Rockefeller		VT
Minute Man		MA
Saugus Iron Works		MA
Roosevelt Vanderbilt		NY
Saratoga		NY
Morristown		NJ
Delaware Water Gap		PA
Gettysburg		PA
Eisenhower		PA
Valley Forge		PA
Hopewell Furnace		PA
Upper Delaware Scenic and Recreational River		PA, NY
Thomas Stone		VA
Booker T. Washington		VA
Appomatox Court House		VA

C&O Canal		
George Washington Memorial Parkway:		
	Arlington House / Robert E. Lee	
	Clara Barton	
	Glen Echo Park	
	Great Falls	
	Potomac Heritage National Scenic Trail	
	Theodore Roosevelt Island	
	LBJ Memorial Grove	
Manassass National Battlefield		
Monocacy National Battlefield		
National Capital Parks East:		
	Anacostia	
	Fort Washington	
	Frederick Douglass	
	Greenbelt Park	
	Mary Mcleod Bethune	
	Oxon Cove	
Prince William Forest Park		
Rock Creek Park		
Wolf Trap Farm Park		
FISH AND WILDLIFE REFUGES		
Conte??		
John Hay	NH	
Karner Blue	NH	
Wapack	NH	
Oxbow	MA	
Great Meadows	MA	
Wallkill River	NJ	
Great Swamp	NJ	

Appendix 1

Sample key – Assateague Island National Seashore

1a. Vegetation woody, tall (height 2m or taller)	2
1b. Vegetation generally shorter than 2m	8
2a. Vegetation predominantly needle-leaved	3
2b. Vegetation predominantly deciduous	5
3a. Vegetation more or less densely shaded.....	4
3b. Vegetation more open, with patches of bare sand prevalent	<i>Pinus taeda</i> / <i>Hudsonia tomentosa</i> Woodland
4a. Soils characterized by duff overlying sands; not influenced by water table	<i>Pinus taeda</i> / <i>Myrica cerifera</i> / <i>Vitis rotundifolia</i> Forest
4b. Soils characterized by moderately deep muck, surface water often present	<i>Pinus taeda</i> / <i>Myrica cerifera</i> / <i>Osmunda regalis</i> Forest
5a. Tree species dominant (<i>Prunus serotina</i> , <i>Aronia arbutifolia</i>) (although individuals may exhibit multiple trunks)	6
5b. Shrub species dominant	7
6a. Soils not influenced by water table.....	<i>Prunus serotina</i> / <i>Myrica cerifera</i> / <i>Smilax rotundifolia</i> Forest
6b. Soils wet	<i>Acer rubrum</i> - <i>Nyssa sylvatica</i> - <i>Magnolia virginiana</i> Forest
7a. Soils deep mucks with surface water common; hydrophytes present	<i>Myrica cerifera</i> / <i>Hydrocotyle</i> spp. Shrubland
7b. Soils drier (but still may be influenced by water table)	<i>Myrica cerifera</i> - <i>Baccharis halimifolia</i> / <i>Spartina patens</i> Shrubland
8a. Vegetation characterized by shrubs (>25% cover) < 2m tall, or vines	9
8b. Vegetation characterized by herbs	14
9a. <i>Myrica pensylvanica</i> dominant shrub	10
9b. Vegetation not as above.....	11
10a. Vegetation of foredunes; patchy, sparse, with open sand patches common	

-*Myrica pensylvanica* / *Diodia teres* Shrubland
- 10b. Vegetation of more stable substrate; bunch grasses (*Schizachyrium scoparium*, *Andropogon virginicus*) and herbs *Eupatorium hyssopifolium*, *E. rotundifolium*, *Gnaphalium* common.....*Myrica pensylvanica* / *Schizachyrium scoparium* ssp. *littorale* - *Eupatorium hyssopifolium* Sparse Shrubland
- 11a. *Myrica cerifera* dominant shrub.....*Myrica (cerifera, pensylvanica)* - *Vaccinium corymbosum* Shrubland
- 11b. Vegetation not as above 12
- 12a. Vines dominant..... *Smilax glauca* - *Toxicodendron radicans* Shrubland
- 12b. Shrubs dominant 13
- 13a. Dwarf-shrubs dominant.....*Hudsonia tomentosa* / *Panicum (amarum, amarulum)* Dwarf-shrubland
- 13b. Shrubs > 0.25m tall dominant..... *Baccharis halimifolia* - *Iva frutescens* / *Spartina patens* Shrubland
- 14a. Herbaceous vegetation restricted to salt or brackish marshes (influenced by tidal flooding) 15
- 14b. Herbaceous vegetation not tidally influenced..... 21
- 15a. *Spartina alterniflora* present in quantity or in lesser amounts with *Distichlis spicata*..... 16
- 15b. *Spartina alterniflora* nearly to totally absent 18
- 16a. *Spartina alterniflora* monotypic with little bare substrate.....*Spartina alterniflora* / *Ascophyllum nodosum* Herbaceous Vegetation
- 16b. Vegetation not as above 17
- 17a. *Distichlis spicata* prevalent *Spartina alterniflora* / *Ascophyllum nodosum* Herbaceous Vegetation, *Distichlis spicata* variant
- 17b. Large algal mats present; *Salicornia* spp. usually present ..*Salicornia* spp. *Sarcocornia perennis* - *Spartina alterniflora* Herbaceous Vegetation
- 18a. *Juncus roemerianus* dominant *Juncus roemerianus* Herbaceous Vegetation
- 18b. *Spartina patens* prevalent 19
- 19a. *Scirpus robustus* prevalent *Spartina patens* - *Distichlis spicata* - *Borrichia frutescens* Herbaceous Vegetation, *Scirpus robustus* variant

19b. <i>Scirpus robustus</i> absent.....	20
20a. Tall graminoids prevalent	<i>Typha angustifolia</i> - <i>Hibiscus moscheutos</i> Herbaceous Vegetation
20b. Short grasses prevalent	<i>Spartina patens</i> - <i>Distichlis spicata</i> - <i>Borrchia frutescens</i> Herbaceous Vegetation
21a. Vegetation very sparse, dominated by forbs.....	<i>Cakile edentula</i> ssp. <i>edentula</i> - <i>Salsola caroliniana</i> Herbaceous Vegetation
21b. Vegetation > 10% cover	22
22a. Vegetation of dry sandy beaches and flats	23
22b. Vegetation of sheltered areas influenced by seasonal water table	24
23a. Vegetation of foredunes, <i>Ammophila breviligulata</i> present in quantity.....	<i>Ammophila breviligulata</i> - <i>Panicum (amarum, amarulum)</i> Herbaceous Vegetation
23b. Vegetation of overwash areas, <i>Scirpus pungens</i> or <i>Spartina patens</i> present in quantity	<i>Spartina patens</i> - <i>Scirpus pungens</i> - <i>Solidago sempervirens</i> (upland) Herbaceous Vegetation
24a. Tall graminoid, depauperate, strongly dominated by <i>Phragmites australis</i>	<i>Phragmites australis</i> Herbaceous Vegetation
24b. Vegetation of greater diversity	25
25a. <i>Panicum virgatum</i> prevalent to strongly dominant	<i>Panicum virgatum</i> - <i>Spartina patens</i> Herbaceous Vegetation
25b. <i>Panicum virgatum</i> minor to absent	26
26a. <i>Drosera intermedia</i> very common; <i>Scirpus pungens</i> minor to absent.....	<i>Juncus dichotomus</i> - <i>Drosera intermedia</i> Herbaceous Vegetation
26b. <i>Drosera intermedia</i> absent; <i>Scirpus pungens</i> common.....	<i>Scirpus pungens</i> - <i>Fimbristylis castanea</i> Herbaceous Vegetation

Appendix 2

Sample vegetation description

Pinus taeda / *Myrica cerifera* / *Vitis rotundifolia* Forest (CEGL006040)

COMMON NAME	Loblolly Pine / Waxmyrtle / Muscadine Forest
SYNONYM	Coastal loblolly pine forest
TNC SYSTEM	Terrestrial
PHYSIOGNOMIC CLASS	I. Forest
PHYSIOGNOMIC SUBCLASS	IA. Evergreen forest
PHYSIOGNOMIC GROUP	IA8. Temperate or subpolar needle-leaved evergreen forest
FORMATION	IA8b. Rounded-crowned temperate or subpolar needle-leaved evergreen forest
ALLIANCE	<i>Pinus taeda</i> Forest Alliance
CLASSIFICATION CONFIDENCE LEVEL	2

RANGE This association occurs discontinuously along the coast from Delaware south to North Carolina.

ENVIRONMENTAL DESCRIPTION This association occurs on the outer coastal plain and on barrier islands in sheltered backdunes protected from salt spray and overwash. The substrate is moderately to rapidly drained sands or sandy loams which are nutrient poor. In some areas the water table may be very close to the surface.

USFWS WETLAND SYSTEM Not applicable

MOST ABUNDANT SPECIES

Strata

Tree canopy
Tall shrub
Vine / liana

Herbaceous

Species

Pinus taeda
Myrica cerifera, *Vaccinium corymbosum*
Vitis rotundifolia, *Toxicodendron radicans*, *Smilax rotundifolia*
Chasmanthium laxum

DIAGNOSTIC SPECIES *Pinus taeda*, *Vitis rotundifolia*, *Chasmanthium laxum*

VEGETATION DESCRIPTION

This association is a mid-Atlantic coastal upland loblolly pine forest dominated by *Pinus taeda*. Canopy associates may include *Prunus serotina*, *Acer rubrum* or *Sassafras albidum*. The tall shrub layer is comprised of *Myrica cerifera* and *Vaccinium corymbosum*. Vines and lianas are usually present in abundance; *Vitis rotundifolia* is most commonly present, but *Toxicodendron radicans*, *Smilax rotundifolia*, *S. glauca*, and *Parthenocissus quinquefolia* are usually found in abundance as well. The herbaceous layer may be sparse, particularly if shrubs and vines are dense, but *Chasmanthium laxum* may be fairly abundant in this association. Other herbs include *Panicum amarum*, *Eupatorium hyssopifolium*, and *Elephantopus nudatus*. In southern Virginia and North Carolina, *Quercus virginiana* and *Gelsemium sempervirens* may also be present, but *Quercus virginiana* is never abundant and when present is usually restricted to the understory.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G2G3

RANK JUSTIFICATION These forests are restricted to a narrow geographic range in regions particularly vulnerable to development pressure.

COMMENTS Logging of predominantly live oak maritime forests in North Carolina is suspected to have caused expansion of forests dominated by *Pinus taeda* (Bratton and Davison 1987; Schafale and Weakley 1990), and logging likely impacted the maritime forests of Assateague Island as well (Higgins et al. 1971). However, disturbance brought on by high winds and coastal storms has always been a part of coastal systems and natural coastal and maritime forests dominated by *Pinus taeda* are likely to have always occurred.

The following descriptions are synonymous with the *Pinus taeda* / *Myrica cerifera* / *Vitis rotundifolia* Forest: *Pinus taeda* / *Myrica* coastal forest association in Delaware (Clancy 1993); mature loblolly pine forest of dry sites at Cape Hatteras (Bratton and Davison 1987); the *Pinus taeda* community described from Assateague Island, Virginia (Harvill 1967); the pine woodland and the pine-deciduous hardwood woodland of the Virginia portion of Assateague Island (Stalter 1990); the upland forest of Virginia described by Klotz (1986); and the mature loblolly pine stand at Angola Neck, Delaware (Fleming 1978). Portions of the maritime deciduous forest in North Carolina (Schafale and Weakley (1990), the woodland community of Assateague Island (Hill 1986), and of the mesic forest and maritime forest at Virginia Beach (Clampitt 1992) are included within this association.

This association has floristic affinity with communities of the *Quercus virginiana* Forest Alliance, but is differentiated by a strong dominance by *Pinus taeda* and lack of species of southern maritime forests such as *Sabal minor* and *Osmanthus americanus*. This

association also shares a number of species in common with the *Prunus serotina* / *Myrica cerifera* / *Smilax rotundifolia* Forest but is differentiated by a strong dominance by *Pinus taeda*, a structure characterized by generally taller and straighter trees, a better developed herbaceous layer, and in general, a more protected position in back dunes. This association is also closely related to the *Pinus taeda* - *Quercus (nigra, falcata)* Forest Alliance but lacks the prevalence of oak species in the canopy and/or subcanopy.

<u>State</u>	<u>State Rank</u>	<u>State Name</u>
DE	S?	
MD	S?	
NC	S?	Maritime Deciduous Forest, in part (Schafale and Weakley 1990)
VA	S?	

<u>TNC Ecoregion</u>	<u>Status</u>	<u>Pattern</u>	<u>Distribution</u>
57	C		PERIPHERAL
58	C	LARGE PATCH	LIMITED
62	C	SMALL PATCH	PERIPHERAL

REFERENCES

- Bratton, S.P. and K. Davison 1987. Disturbance and succession in Buxton Woods, Cape Hatteras, North Carolina. *Castanea* 52: 166-179.
- Clampitt, C.A. 1992. The upland plant communities of Seashore State Park, Virginia Beach, Virginia. *Virginia Journal of Science*. 42: 419-435.
- Clancy, K. 1993. A preliminary classification of the natural communities of Delaware (draft). Delaware Natural Heritage Inventory, Div. of Parks and Recreation, Dover, DE. 30 p.
- Fleming, L.M. 1978. Delaware's Outstanding Natural Areas and their Preservation. Delaware Nature Education Society, Hockessin, DE. 422 pp.
- Harvill, A.M., Jr. 1967. The vegetation of Assateague Island, Virginia. *Castanea* 32: 105-108.

July 22, 2003

Beth Johnson
National Park Service
Coastal Institute
Greenhouse Road, Room 105
University of Rhode Island
Kingston, RI 02881

Dear Beth:

We are pleased to have completed the draft reports of the keys and classifications for the North Atlantic Coast, Lower New England, and Chesapeake Bay ecoregions. I have enclosed the following:

- 1) A CD containing all electronic files, and hard copies of:
- 2) North Atlantic Coast Classification
- 3) Keys to the North Atlantic Coast Classification
- 4) Chesapeake Bay Classification
- 5) Keys to the Chesapeake Bay Classification
- 6) Lower New England Classification
- 7) Keys to the Lower New England Classification

more
curry

3 day meeting
w)

I would be happy to receive any comments before September 1 so that I can prepare the final reports.

Thank you, Beth, for your help and your support!

Sincerely,



Lesley Sneddon
Senior Regional Ecologist
NatureServe

Diane Pavlek: 4 ecoregions

cc: John Karish

(Chris Lea classification document)
for NCR
crosswalked to NVC by meeting
- Jim Vandenhorst



NatureServe

A Network Connecting Science With Conservation

1101 Wilson Boulevard, 15th Floor
Arlington, Virginia 22209
tel 703.908.1800 fax 703.908.1917
www.natureserve.org

Elizabeth Johnson
NE Region Inventory and Monitoring Coordinator
National Park Service
Coastal Institute, Room 105
1 Greenhouse Road
University of Rhode Island
Kingston, RI 02881

Re: Supplemental Agreement No. 1 to Cooperative Agreement 4560-B-0009

December 11, 2003

Dear Ms. Johnson:

In regard to Supplemental Agreement No. 1 to Cooperative Agreement 4560-B-0009, entitled, "User-friendly keys to associations of Lower New England / Northern Piedmont and North Atlantic Coast / Chesapeake Bay Ecoregions", I am requesting a no-cost extension from the original end-date of September 30, 2003 to February 29, 2004.

Thank you for your consideration and I look forward to hearing from you.

Sincerely,

Amanda Morris
Science Operations Manager

cc: Lesley Sneddon
Mirela Smole