

# Patterns in the Flora of the Mid Atlantic States

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## Abstract

New Statewide checklists that provide a common nomenclature and comparable attribute information make possible a comparison of the assemblage of vascular plants found in New York, Pennsylvania, Maryland, New Jersey, and Delaware. When combined with available data based on the generalized mapping of wetlands and on the distribution of individual species, the floristic data can be interpreted to make clear both similarities and differences among these political units that encompass diverse biogeographical regions.

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Today I shall discuss the kinds of plants found in five Mid Atlantic States. I shall touch on some of the significant geographical and historical features of these States as habitats. I then shall characterize the floras of these States in the aggregate and individually, focusing on plant growth forms, nativity status, wetland fidelity, weeds, and rarities.

Approximately 5,200 kinds of higher plants have been reported as growing more or less wild in the five Mid Atlantic States of Delaware, Maryland, New Jersey, Pennsylvania, and New York (Figure 1, a 1982 regionalization used by the US Department of Agriculture for plant distribution and subsequently adopted by the National Wetland Inventory). Higher plants are those with specialized structures for conveying water and nutrients, such as trees, shrubs, vines, herbs, grasses, forbs, ferns, horsetails, quillworts, and clubmosses (but not mosses, lichens, liverworts, algae, or fungi). This discussion is derived from lists focused chiefly on genera and species, intentionally ignoring most subspecies and varieties (Schmid 2001a, 2001b, 2003a, 2003b, 2003c).

These five Mid Atlantic States constitute a diverse land area of irregular shape encompassing 111,502 square miles (288,800 sq. km) that extends nearly 500 miles north-south (800 km, 38° to 45° N. latitude) and 400 miles (645 km) east-west in maximum dimensions from the shores of the Atlantic Ocean inland to the Ohio and the St. Lawrence river systems (Figure 2).

All of New York and parts of northern Pennsylvania and New Jersey were glaciated, and thus virtually devoid of higher plants as recently as 20,000 years ago. Delaware is mostly Atlantic coastal plain, with but a tiny slice of piedmont. Pennsylvania has the least tidal shoreline and coastal plain. Four of the five States extend into the Appalachian Mountains; Pennsylvania and New York stretch as far west as the Great Lakes and the St. Lawrence River drainage.

The number of US Environmental Protection Agency Level III Ecoregions provides a rough indication of the basic ecological diversity within these States: Delaware, 3 ecoregions; New Jersey and Maryland, 6; New York, 8; and Pennsylvania, 11 (Omernik 1999). State ecoregion diversity ranges from 21% to 79% of the Mid Atlantic total. Collectively, the 14 ecoregions represented in these five Mid Atlantic States comprise 17% of the 84 ecoregions in the conterminous United States (Figure 3).

The five States vary in size, human population, and intensity of land use, as well as topography, climate, geology, environmental history, and the regulatory protection or discouragement of plants currently provided by state laws and regulations. Delaware, with 1,932 square miles (5,000 sq. km), is the smallest in land area; New York, with 47,377 square miles (123,000 sq. km), is nearly 25 times as large (Table 1). Pennsylvania is only 6% smaller than New York. Maryland is slightly larger than New Jersey and Delaware combined.

Table 1. Selected Characteristics of Five Mid Atlantic States

State	Land Area (sq. mi.)	% NWI Wetland	Human Population (April 2000)	Total Wild Plants	Native Plants	Introduced
DE	1,932	16.9	783,600	2,263	1,632	631
NJ	7,468	18.3	8,414,350	3,052	2,125	927
MD	9,837	6.5	5,296,486	3,314	2,302	1,012
PA	44,888	1.7	12,281,054	3,497	2,281	1,216
NY	47,377	3.2	18,976,457	3,742	2,367	1,375

These five States together comprise about 4% of the land area of the conterminous United States but were home to 17% of its human population as of 2003 (Figure 4). European settlement began here in the seventeenth century. The rank order of the five States in human population generally resembles the rank order of their land area: Delaware smallest, New York largest, with the exception of New Jersey, the most intensively urbanized State in the nation. New Jersey has nearly 60% more people but only three-quarters as much land area as Maryland. The five States encompass a major conurbation that extends from New York City through Trenton, Philadelphia, Wilmington, and Baltimore to the suburbs of

Washington, DC., as well as scattered other cities such as Pittsburgh. Yet all five have significant rural areas with farms and forests.

These five states combined host about 20% of the wild flora of the conterminous United States. The rank order of the five States by total numbers of wild plants is the same as their rank order by land area: Delaware, New Jersey, Maryland, Pennsylvania, and New York. New York's 3,742 kinds of plants make its flora only 65% more diverse than Delaware's (2,263), despite New York's vastly greater land area. Species diversity in New Jersey, Maryland, and Pennsylvania more closely resembles that of New York than Delaware (Figure 5).

The floras of the Mid Atlantic States are sufficiently large that sustained effort is required for scholars to master the wild plants of any one of them. About 31% of the Mid Atlantic wild plants are common to all five States (1,629 kinds). Nearly as many kinds (1,462; 28%) are reported from only one of the five States.

When the higher plants of these five Mid Atlantic States are classed by growth form, 82% (4,280) are herbaceous (non-woody). Shrubs and woody vines account for 11% (577 kinds); trees, 7% (364 kinds; Figure 6). The proportion of kinds in each growth form does not differ substantially in any State from the proportions in the flora as a whole (Figure 7). States with more land area have more kinds of plants in each growth form (Figure 8). Nearly one-third (32%) of the trees and herbs are common to the five Mid Atlantic States, but only 22% of the shrubs and woody vines. Unique to only one of the five States are 27% of the trees and herbs, 37% of the shrubs and woody vines.

Non-native plants comprise more than one third of the total reported wild flora of these five Mid Atlantic States (Figure 9). The proportion of accidentally and intentionally introduced species ranges from fewer than 28% of all the kinds of higher plants in Delaware to nearly 37% of the plants of New York (Figure 10). If locally extirpated and rare native species were removed from the tallies, the proportion of the total flora attributed to non-natives would be even higher (in New York State, for example, 48%). Many of our plants are non-natives! The proportion of native and introduced plants does not differ substantially among the five States by growth form (Figure 11).

Substantial wetlands constitute less than 5% of the land area of the five Mid Atlantic States, ranging from 1.7% in Pennsylvania to 18.3% in New Jersey according to National Wetland Inventory estimates (Schmid 2002). The extent of wetlands is greatest in New York (1,600 sq. mi.; 2,580 sq. km) and New Jersey (1,430 sq. mi.; 2,308 sq. km; Figures 12 and 13). Wetlands today are recognized as having ecological importance and value

to human society greatly in excess of their coverage of the landscape, and many kinds of human disturbances in wetlands now are regulated.

The National Wetland Inventory has classified wild plants according to their likelihood of occurrence in wetlands. This classification is important because hydrophytic plants are one of the key field parameters utilized to identify areas stringently regulated as wetlands pursuant to the federal Clean Water Act and comparable State laws. More than half (54%) of the species in these Mid Atlantic States are considered obligate upland (that is, non-wetland) plants, fewer than 1% of whose individuals are expected to grow in wetlands (Figure 14). Only 15% are classed as obligate hydrophytes, more than 99% of whose individuals grow in wetlands. Obligate hydrophytes constitute 2% of trees, 6% of shrubs/woody vines, and 17% of herbs in the aggregated Mid Atlantic flora. A local plant community dominated by obligate hydrophytes almost certainly will turn out to be a regulated wetland.

That leaves nearly one third (31%) of the wild species as facultative hydrophytes, the widely tolerant plants which inhabit both wetlands and uplands. In many places these are the most abundant plants in the landscape of both wetlands and adjacent non-wetlands. There are nine subcategories of these borderline plants, subcategories intended by the National Wetland Inventory to distinguish species seldom found in wetlands from those most commonly (but not always) found there across the northeastern United States (Figure 15).

The National Wetland Inventory has begun further to subdivide wetland indicator status designations for some species according to distinctive ecological subregions, of which four have been designated in the Mid Atlantic States. Only approximate, preliminary boundaries have been established for these subregions (Figure 16). The primary purpose of the localized indicators is to recognize that certain species of facultative hydrophytes are more consistently abundant in wetlands within specific ecosystems than across the northeastern States as a whole. This work has proceeded slowly, plagued by federal budget cuts and political controversy over federal efforts to regulate land use. The tallies discussed here are based on the regionwide wetland indicator status classes for the 15 northeastern States (plus the District of Columbia) that comprise NWI Region 1 (Figure 1). To date too few subregional indicators have been established to affect these statistics, but on marginal sites the use of subregional indicators can have dramatic effects on the defined extent of regulated wetlands within individual parcels of land.

The distribution of species among wetland indicator status categories is strikingly different for native and for introduced plants in the Mid Atlantic States (Figure 17). Non-native species are much more strongly associated

with uplands than are native Mid Atlantic plants. Among natives, 40% are upland plants; among introduced species, 80%. Among natives, 20% are obligate hydrophytes; among introduced plants, 3%. Facultative hydrophytes make up 40% of the native species, but only 17% of the non-natives. This is one of the more fascinating observations I have made regarding the data, and I have not encountered any other mention of it in the literature.

Weeds---those plants considered invasive and troublesome to humans---represent nearly 18% of the entire wild flora in these five Mid Atlantic States. Within each State the percentages of the flora reported as weeds creating problems for humans range from 20% (769) in New York to 25% (566 kinds) in Delaware (Figure 18). Five hundred six kinds of plants are reported as weeds or potential weeds in all five States (54% of the total weeds). One hundred thirty-eight kinds of plants are currently reported as problem or potential problem weeds in only one State (15% of the reported weedy plants). Most weeds are herbaceous (83%), but shrubs/vines (11%) and trees (6%) also are found among the weeds. The allocation of weeds among growth forms is the same as that of the flora as a whole.

Of the 939 kinds of plants currently reported by one or more sources as problematic, invasive, or potentially invasive weeds in one or more of the five States, two-thirds are introduced and one-third native (Figure 19). The establishment and spread of non-native plants have received increasing attention in recent years. Many crop and ornamental plants were intentionally brought to North America beginning with European colonists nearly 400 years ago; others arrived inadvertently and are still becoming established, whether or not people want them to do so. Some native and many non-native plants thrive in lands disturbed by human activities. Some showy ornamental plants, having escaped from the naturally coexisting predators and parasites that kept their numbers in check in their original habitats, have also escaped human cultivation and displaced natives in wild ecosystems of the Mid Atlantic States.

Laws controlling weed seeds have been enacted at both the State and federal levels, but relatively few species have been formally designated as noxious weeds from an agricultural perspective. Agricultural quarantines aim to prevent the spread of known problem weeds in farm fields, especially non-natives. Homeowners long have wrestled with a different suite of weeds from those typical of cropland, readily purchasing herbicides and garden labor. Unlike most people across most of the face of the earth for the past several thousand years, however, most Americans today do not spend most of their working hours pulling weeds to insure their food supply.

Invasive plants, again primarily non-natives, increasingly are being recognized by the managers of wild lands such as parks and nature preserves as major threats to the preservation of valued biological resources. Some invasives of negligible significance in farm fields are rampant in scrub and woodland communities. Likewise, established stands of non-natives pose a major impediment to managers seeking to restore native grasses, wetlands, and other indigenous ecosystems. Although attention is starting to be focused on the invasive weeds of non-agricultural areas, few laws yet address such plants (Schmid 2004). Some in the nursery trade have viewed with alarm recent efforts to identify and publicize problem invasive plants. The showy non-native purple loosestrife (*Lythrum salicaria*) can still be found in Mid Atlantic garden centers, as well as in many wetlands where it displaces native herbs (Figure 20).

In contrast to the all-too-successful weeds that thrive in our people-influenced landscapes, some native plants are rare and dwindling or already locally extirpated. Some of these have been afforded a measure of legal protection. Unlike wild game animals, however, which under Anglo-American law are deemed to be the property of the State, plants are considered to be the property of private landowners, so their protection is widely viewed as an infringement on private property rights. Sixteen species found in one or more of the Mid Atlantic States have been formally listed by the US Fish and Wildlife Service as Endangered (7) or Threatened (9) with endangerment pursuant to the federal Endangered Species Act. Such plants are to be protected when the federal government undertakes construction projects, and also are to be protected by private landowners. Proposed federal listings typically are hotly contested in the public arena, and major political battles have been waged over specific enforcement efforts.

Native plant protection laws vary significantly among the five Mid Atlantic States. New Jersey, Maryland, and Pennsylvania have formally identified Endangered and Threatened plants of which each State's government is directed to take notice in the course of its construction and regulatory (permit) activities. The most comprehensive of these laws is that of Maryland. Endangered, Threatened, and commercially valued (and hence vulnerable) native plants are afforded some protection against indiscriminate picking by the public within New York State. There is no endangered species law at all in Delaware, so the only direct protection for rare plants in that State is provided by federal law. Efforts at enforcement vary. Few local governments have enacted ordinances either protecting or encouraging native plants or discouraging invasives.

Prompted by The Nature Conservancy, each of the five Mid Atlantic States now has a natural heritage program in its natural resources department which is tracking the statewide abundance and status of rare native plants.

Only slowly do State regulators take account of botanical findings to revise official lists of protected species, generating many gaps in theoretical legal protection. Some 60% of the native plants in the Mid Atlantic States are deemed extirpated, rare, or imperiled in one or more States (Figure 21), but such aggregate statistics should be interpreted with caution. Willow oak (*Quercus phellos*), for example, is formally listed as Endangered in Pennsylvania (which has little coastal plain) and in New York (coastal New York is near the extreme northern end of this species' natural range) but is a common tree in the Atlantic coastal plain from New Jersey, Delaware, and Maryland southwestward to the Mississippi Valley and eastern Texas (Figures 22, 23, and 24). The percentage of native plants whose continued survival in the State is of concern varies from 31% of the native flora (707 kinds) in Pennsylvania to 49% (793 kinds) in Delaware (Figure 25). Only 4% of the Mid Atlantic rarities are trees. Shrubs and woody vines comprise 9%, and herbaceous plants the remaining 87%. Not all State rare plants are protected, even in those States that have undertaken some measure of legal protection (Figure 26).

The significance of higher plants to people changes at State lines, not just at the edges of ecosystems. For biogeographers, botanists, and plant ecologists working in multiple States, attention often must be devoted to the varying regulatory significance of plants as well as to their taxonomy and habitat relationships in natural and manmade ecosystems.

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#### List of Figures

1. Five Mid Atlantic States in National Wetland Inventory Region 1 (Reed 1997)
2. Relief Map of the eastern United States with Glacial Limit (Birrell n.d.)
3. Level 3 USEPA Ecoregions in Five Mid Atlantic States (Omernik 1999)
4. Population Density in the United States, 1990 (Bowen 1997)
5. Higher Plant Diversity versus Land Area in Five Mid Atlantic States
6. Trees, Shrubs, and Herbs in the Five Mid Atlantic States
7. Growth Forms by State
8. Kinds of Trees, Shrubs, and Herbs, by State
9. Native and Introduced Higher Plants in Five Mid Atlantic States
10. Native and Introduced Plants, by State
11. Native and Introduced Plants, by Growth Form and State
12. Percent of Land Area in Wetlands, by State
13. Major wetlands in the five Mid Atlantic States (Dahl 1991)
14. National Wetland Indicator Status of Plants in Five Mid Atlantic States
15. Comparison of NWI Wetland Indicator Status Classes
16. Region 1 National Wetland Inventory Subregions
17. Native and Introduced Plants in NWI Indicator Status Classes
18. Native and Non-native Plants Reported as Weeds, by State
19. Weedy and Non-weedy Native and Introduced Plants
20. Purple Loosestrife (*Lythrum salicaria*; B. Slattery)
21. Rare and Non-rare Native Plants in Five Mid Atlantic States
22. Willow Oak (*Quercus phellos*; M. A. Dirr)

23. Synthesis of North American Flora Distribution Map, Willow Oak (Kartesz & Meacham 1999)
24. Silvics of Forest Trees Distribution Map, Willow Oak (Fowells 1965)
25. Rare and/or Unprotected Plants as Percentage of Native Flora, by State
26. Unprotected and Protected RarePlants, by State