# Delineations Call for Adjustment in Northeast Wetland Plant Indicator List

*Wetland delineations rely on an accurate list of wetland plants and an assessment of their degree of tolerance for dry conditions. Wetland consultants in Virginia suggest updates to the 1988 National List of Plants that Occur in Wetlands to improve its reliability for delineations.*

by Michael S. Rolband, Laura A.B. Giese, Carrie L. Williams, and Antoinette L. Pepin

The "three parameters"—hydrophytic vegetation, hydric soils, and wetland hydrology—form the basis of the U.S. Army Corps of Engineers' and the U.S. Environmental Protection Agency's (and many states') regulatory approach to identifying and delineating wetlands. The approach took root from a 1979 U.S. Fish and Wildlife Service report, *Classification of Wetlands and Deepwater Habitats in the United States,* also known as the Cowardin system.[1] All three parameters must be met for an area to be considered a wetland under federal jurisdiction. Wetland plant community composition, hydric soils, and wetland hydrology change along a continuum within the landscape, and their characteristics vary with regional wetland delineations.

The federal agencies added structure to the vegetation parameter by publishing lists of plants that are common to wetlands. The Cowardin report itself attempted to aid wetland identification by including a list of approximately 200 plants associated with wetlands, which appears as an appendix to the report. Later, the Fish and Wildlife Service, this time in cooperation with the Corps, EPA, and the Natural Resource Conservation Service, prepared the "1988 National List of Plants that Occur in Wetlands," commonly referred to as the 1988 National List.[2] The participating federal agencies reviewed literature and consulted many biologists and regional ecologists to compile a list of 6,728 vascular plant species that grow in wetlands in the United States and the Caribbean.

The agencies, realizing that the affinity for wetlands varies considerably among plant species, also assigned "wetland indicator categories" to the species on the 1988 National List, based on the species' expected frequency of occurrence in wetlands. The five categories—obligate wetland (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU), and upland (UPL)—describe the range of plants from those that virtually always appear in wetlands (and rarely in uplands) to those that depend almost exclusively on dry conditions. The three facultative categories found between the extremes can be more finely ordered by a positive or negative sign (as in "FACW+"). In addition, because most hydrophytic plants have broad ecological amplitudes and are tolerant of or adaptable to moisture regimes that vary across the country, 13 regional lists were also developed. Each region still covers a broad range of moisture conditions, but they do allow for more fine tuning of the list.

A draft revision to the plant list prepared by the Fish and Wildlife Service in 1996 encouraged renewed public review and comment on the proposed regional wetland indicator assignments. The 1996 draft list is an interim document that addresses intra-regional differences garnered from regional review panel meetings, with a focus on updating taxonomy and nomenclature. From that draft, a 1998 National List was prepared and is currently under review by the agency with no scheduled deadline for adoption. Therefore, the 1988 National List remains the document used by wetland regulatory bodies and private industries to identify and delineate wetlands. As with the 1988 National List, the 1996 draft and the 1998 list are based on qualitative data compiled from submitted review comments, published botanical manuals and literature, and field observations made by botanists and ecologists.

The wetland indicator status is particularly important to delineators because when the hydrology and soil parameters are satisfied, the jurisdictional boundary of a wetland (or determination of whether a wetland exists) depends on where the composition of a plant community changes from predominantly wetland plants to

**Michael S. Rolband, P.E., P.W.S., Laura A. B. Giese, Ph.D., P.W.S., Carrie L. Williams, and Antoinette L. Pepin, Ph.D., P.W.S., are wetland consultants with Wetland Studies and Solutions Incorporated, based in Chantilly, Virginia.**

predominantly upland plants. According to the Corps' 1987 manual, which is the standard by which federal jurisdiction is judged, more than 50 percent of the dominant species must have an indicator status of OBL, FACW, and/or FAC for an area to be considered a jurisdictional wetland, with some exceptions.[3]

**Expanded Wetland Indicator Categories**

| Abbreviation | Wetland Indicator Category | Estimated Probability of Occurrence in Wetlands[a] | Estimated Probability of Occurrence in Uplands |
|---|---|---|---|
| OBL | Obligate Wetland | >99% | <1% |
| FACW+ | Facultative Wetland | 89 to 98.99% | 1 to 11% |
| FACW | Facultative Wetland | 78 to 88.99% | 11 to 22% |
| FACW- | Facultative Wetland | 67 to 77.99% | 22 to 33% |
| FAC+ | Facultative | 56 to 66.99% | 33 to 44% |
| FAC | Facultative | 45 to 55.99% | 44 to 55% |
| FAC- | Facultative | 34 to 44.99% | 55 to 66% |
| FACU+ | Facultative Upland | 23 to 33.99% | 66 to 77% |
| FACU | Facultative Upland | 12 to 22.99% | 77 to 88% |
| FACU- | Facultative Upland | 1 to 11.99% | 88 to 99% |
| UPL | Obligate Upland | < 1% | > 99% |

[a] The 1988 National List does not provide ranges of occurrence for the facultative indicator categories (FACW, FAC, and FACU) that have positive (+) or negative (-) signs; therefore we divided the ranges for the facultative indicator categories into three equal sub-ranges.

## An Accurate List?

During our 11 years of delineating wetlands in Northern Virginia, Maryland, and the District of Columbia, we began to notice patterns of plant species occurrences in our area that differ from the occurrences indicated in the national and regional lists. We believe these patternss, if codified, may result in changes to the outline of federally delineated wetlands. We first noticed anecdotally that a number of the plant species appearing in wetlands were not consistent with their assigned indicator status—most were found in drier habitats than expected and a few in wetter habitats. We decided to attempt to quantify our findings in a review of the occurrence of individual plant species in wetlands as compared to the species' assigned indicator status under the 1988 National List.

We began by compiling information obtained during wetland delineations performed, consistent with the Corps' 1987 manual, over the course of more than seven years (November 1995 through February 2003). We sampled vegetation, soils, and hydrology at representative locations in the wetlands and adjacent uplands, as required for all wetland delineations. Data collected from 3,750 sample locations in approximately 1,680 wetlands on more than 1,200 sites were included in the study. Approximately 45 percent of the sample locations were from wetlands that included a variety of types (mostly palustrine), 50 percent were from upland areas, and 5 percent were from marginal areas. The majority of the sites were located in Northern Virginia, within the counties of Fairfax, Loudoun, and Prince William. Also included as a small percentage were sites in adjacent Virginia counties, the state of Maryland, and the District of Columbia. All of the sites examined were located within the region covered by the 1988 National List for the Northeast Region (Region 1).[4]

We analyzed the data with the help of a software package called "WetForm,"[5] which converts notes taken by wetland professionals in the field during wetland delineations to the standard form outlined in the Corps' 1987 manual. With the help of the WetForm database and its sorting capabilities, we computed the number of times an individual plant species occurred in wetland and non-wetland locations that nonetheless contained wetland hydrology and/or hydric soils.

We first examined the dominant species in our plots. We were interested in dominant species (those that contribute more to the character of a plant community than other species) because wetland determination requires evaluation of the dominant species in each vegetation layer. We then created a "theoretical indicator status" for each plant species, based on the percentage of times we found it as a dominant species in a wetland. We also assigned it to a "theoretical wetland indicator category," using ranges we extrapolated from the official expanded wetland indicator categories used in the 1988 National List for the Northeast Region. Each plant's status was compared to the official indicator status.

## From Wet to Drier

Our samples encompassed a large portion of wetland plants found in the region. Of the 696 species listed by the 1988 National List as species appearing in the Northeast Region, we found 221 species (representing 32 percent of the wetland species in the region) to be dominants within our 3,750 sample locations. Although we found a broad range in the number of times each plant species occurred as dominant (it varied from 1 to 1,840), 91 species occurred 50 or more times and with an even distribution; we therefore used only the 91 plants in our estimations.

We estimated that the theoretical indicator status for 22 of the 91 species had a probability of occurring in a wetland similar to the official indicator status described in the 1988 National List. The status of 56 species changed, but not significantly—we found 46 common in drier than expected conditions, and 10 in wetter conditions, but such a change did not alter a wetland's hydrophytic vegetation determination. The status of another 13 species changed significantly—the assigned theoretical category could result in the hydrophytic vegetation parameter not being satisfied, altering the delineation assessment, and therefore the area not being classified as a jurisdictional wetland. All of these species

shifted to a drier theoretical indicator (except for *Arthraxon hispidus*, which has no 1988 indicator). The species included six trees, one shrub, one forb, three grasses, one fern, and one vine.

The tree and shrub species that shifted to a drier indicator status generally grow in floodplains in our study area. Often only the hydrophytic vegetation parameter is met in these floodplains (floodplains are a special case for delineation because of alluvial deposition of material, which changes the soil profile and potentially the hydrology). Trees and shrubs can grow extensive root systems that are able to tap the water source at a depth exceeding the 12-inch criteria for defining wetland hydrology. Therefore at least within the region covered by this study, these floodplain species have exhibited an ability to grow outside of wetlands. Their probability of occurring in a wetland is therefore lower and may warrant a change in indicator status. The phenology of forbs, grasses, and ferns affords them greater ability to become established during short term changes in climate. Vines may be rooted in an adjacent non-wet environment and extend into the wetland area.

Certain Corps districts allow the "FAC-neutral test" to be used to determine if wetland hydrology is present. For the FAC-neutral test, FAC species can be considered as neutral in determining the percentage of dominant wetland species, and a secondary indicator of hydrology decision can be based

**Plant species showing a significant shift in indicator status**

| Scientific Name | # of Occurrences[a] | % in Wetland | % with Hydrology | % with Hydric Soils | Official Indicator[b] | Theoretical Indicator |
|---|---|---|---|---|---|---|
| **Plant species for which the theoretical indicator significantly differed from the official indicator status** | | | | | | |
| Tree | | | | | | |
| *Acer negundo* | 248 | 31 | 54 | 40 | FAC+ | FACU+ |
| *Acer rubrum* | 1840 | 43 | 66 | 50 | FAC | FAC- |
| *Carpinus caroliniana* | 312 | 41 | 55 | 51 | FAC | FAC- |
| *Liquidambar styraciflua* | 488 | 38 | 54 | 46 | FAC | FAC- |
| *Nyssa sylvatica* | 315 | 39 | 55 | 46 | FAC | FAC- |
| *Platanus occidentalis* | 171 | 37 | 61 | 43 | FACW- | FAC- |
| Shrub | | | | | | |
| *Lindera benzoin* | 548 | 41 | 47 | 46 | FACW- | FAC- |
| Forb, Grass, Fern, Vine | | | | | | |
| *Arthraxon hispidus* | 192 | 62 | 81 | 69 | NI | FAC+ |
| *Eulalia viminea* | 360 | 42 | 67 | 48 | FAC | FAC- |
| *Euthamia graminifolia* | 68 | 43 | 62 | 48 | FAC | FAC- |
| *Setaria glauca* | 75 | 23 | 35 | 33 | FAC | FACU+ |
| *Thelypteris noveboracensis* | 56 | 34 | 48 | 39 | FAC | FAC- |
| *Toxicodendron radicans* | 1046 | 37 | 61 | 43 | FAC | FAC- |
| **Plant species for which the theoretical indicator status could affect a FAC-neutral test** | | | | | | |
| Tree | | | | | | |
| *Betula nigra* | 66 | 47 | 70 | 49 | FACW | FAC |
| *Diospyros virginiana* | 204 | 28 | 57 | 41 | FAC- | FACU+ |
| *Fraxinus pennsylvanica* | 994 | 51 | 72 | 58 | FACW | FAC |
| *Platanus occidentalis* | 171 | 37 | 61 | 43 | FACW- | FAC- |
| *Quercus palustris* | 532 | 61 | 77 | 69 | FACW | FAC+ |
| *Ulmus americana* | 743 | 48 | 71 | 55 | FACW- | FAC |
| Shrub | | | | | | |
| *Cornus amomum* | 120 | 64 | 84 | 67 | FACW | FAC+ |
| *Lindera benzoin* | 548 | 41 | 57 | 46 | FACW- | FAC- |
| *Vaccinium corymbosum* | 117 | 59 | 78 | 65 | FACW- | FAC+ |
| Forb, Grass, Fern, Vine | | | | | | |
| Agrostis alba | 134 | 58 | 77 | 67 | FACW | FAC+ |
| *Agrostis stolonifera* | 134 | 61 | 82 | 67 | FACW | FAC+ |
| *Arisaema triphyllum* | 95 | 54 | 77 | 62 | FACW- | FAC |
| *Bidens polylepis* | 85 | 55 | 84 | 61 | FACW | FAC+ |
| *Boehmeria cylindrica* | 152 | 66 | 84 | 66 | FACW+ | FAC+ |
| *Cyperus strigosus* | 68 | 46 | 71 | 49 | FACW | FAC |
| *Echinochloa crusgalli* | 132 | 56 | 80 | 56 | FACW-[c] | FAC+ |
| *Lonicera japonica* | 1623 | 22 | 46 | 34 | FAC- | FACU+ |
| *Onoclea sensiblis* | 52 | 54 | 75 | 57 | FACW | FAC |
| *Polygonum pensylvanicum* | 58 | 62 | 84 | 64 | FACW | FAC+ |
| *Setaria glauca* | 75 | 23 | 35 | 33 | FAC | FACU+ |

[a]Out of 3,750 data points.
[b]Based on 1988 National List for Region 1.
[c]Current indicator of FACU is a typographical error, as recorded by A.L. Pepin, Correction of indicator status for *Echinochloa crusgalli* (barnyard grass), Virginia Association of Wetland Professionals "Wetland Update" (newsletter) 7 (2000): 4–5.

on the number of dominant species wetter or drier than FAC. We found 20 species with theoretical indicators that could affect a wetland determination based on the FAC-neutral test. The secondary indicator test of hydrology is used when no primary indicators are present (e.g., visual observation of inundation or saturation,) and two secondary indicators of hydrology are necessary to satisfy the hydrology parameter. In many circumstances, the FAC-neutral test is the only secondary indicator present, demonstrating that a change in the indicator status of these plants would provide a more accurate account. The majority of the 20 species shifted from FACW (a wetland indicator) to FAC. Three species shifted from a facultative indicator to an upland indicator. The theoretical indicators would result in a drier FAC-neutral test, with a possible loss of a secondary indicator of hydrology, and potentially a different outcome in whether a sample location was determined to be wetland.

## A Note on Drought

The Northern Virginia region, along with much of the Mid-Atlantic and other parts of the country, has been experiencing a drought for the last four years. The Southeast Regional Climate Center indicates that the region has been in a drought since 1998; information obtained from the National Weather Service Forecast Office for Baltimore/Washington indicates that from 1995 through 2002, average temperatures have been 0.69 degrees Fahrenheit higher than the overall average temperature.[6] These sources also indicate that annual precipitation for several of the years within the study period has been approximately 15 percent below the annual average precipitation. The dearth of precipitation over the last four years would have a considerable effect on wetland hydrology; we therefore considered that the theoretical indicator status of these plants may have shifted due to the drought (i.e., wetland hydrology not being detected in areas where wetland conditions are normally present). The relatively short time frame of the drought, however, would likely affect only non-woody species. We do not think the drought affected our results, especially with regards to plants associated with hydric soil—hydric soils do not exhibit a visual change in hydric characteristics after such a short period of time, and they would continue to be field-identified as hydric. The species that had significant theoretical indicator changes (drier) were generally found in hydric soils less than 50 percent of the time.

## Subregional Information Needed

Our study offers a preliminary quantitative review on the occurrence of individual plant species in wetlands. While we found that most of the species' theoretical indicator status compared favorably with the species' official indicator status assigned by the 1988 National List, a number of them were quite different, and almost all significant changes resulted in plants exhibiting tolerance or adaptations for drier conditions than recorded in the official list. Many of these differences are likely due to subregional differences in plant communities, rather than a problem with plant lists overall. Our findings underscore the importance of incorporating subregional information when preparing the next National List, and perhaps they call for further location-based subdivisions to increase the sensitivity of the list to species' habitat requirements. ■


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## References

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3. Environmental Laboratory, "Corps of Engineers Wetlands Delineation Manual," technical report Y-87-1 (U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, 1987). Also available online at http://www.wes.army.mil/el/wetlands/pdfs/wlman87.pdf.
4. The Northeast Region (Region 1) includes the District of Columbia and the states of Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, New Jersey, Pennsylvania, Delaware, Ohio, West Virginia, Maryland, Virginia, and Kentucky.
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