Hydrophytic Plants and Wetland Identification in New York State

James A. Schmid
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Wetlands are reported by the National Wetland Inventory currently to occupy more than 1 million acres, about 3% of the land area of New York State, placing it 22nd among the States for existing land area considered to be wetlands and 30th of 50 in total area (Dahl 1990). These numbers reflect a dramatic apparent reduction in wetlands as a result of human activities over the past three centuries to less than half their former extent in the 48 conterminous United States (Schmid 2000). The estimated loss of 60% in New York places it 21st among the States for acres of historic wetlands lost to agricultural, industrial, and urban uses.

During the late 20th century the American public became aware of important values inherent in natural wetlands, where biogeochemical conditions differ profoundly from the uplands that comprise most of the nation's landscape. During the 1970s the New York State Legislature directed that the alteration of many wetlands henceforth be stringently regulated. State regulatory scrutiny of new construction also was extended into the uplands adjacent to regulated wetlands. General statistics on wetland abundance are not helpful to individual property owners who seek to comply with laws protecting wetlands on particular tracts of land, so the Legislature directed the Department of Environmental Conservation (NYSDEC) to publish maps showing the extent of regulated areas. More than 30 years later the drawing of regulatory boundaries around wetlands on specific tracts of land remains a controversial and technically challenging activity.

I discuss the use of vegetation as one of the requisite factors for identifying regulated wetlands. New York State has labeled certain plants as wetland indicators and others as upland indicators. The wetland indicator status of plants has received much study since the New York wetland statutes were enacted, and increased knowledge is reflected in the State's technical administrative guidance for identifying and delineating wetlands that continues to undergo revision. For more than two decades NYSDEC has made clear that vegetation alone is not a sufficient basis for freshwater wetland recognition in borderline areas lacking continuous excess water and waterlogged soils. Yet some Department staff to this day ignore the presence of non-hydric soils and the absence of prolonged wetness when exerting wetland jurisdiction over marginal plants growing high in the landscape. The resulting State-regulated wetland boundary can be dramatically different from the wetland boundary identified by Federal agencies with concurrent jurisdiction over the same wetland, despite the claimed similarity in wetland definition and delineation methods.

Tidal wetlands in New York are regulated by the Tidal Wetlands Act of 1973 (Article 25 of the Environmental Conservation Law, as amended). Tidal wetlands are readily identified by their ebbing and flowing waters, by constantly saturated soils, and by the presence of easily recognized plants, many of which are rarely encountered outside the tidal ecosystem. The Tidal Wetlands Act listed more than a dozen of the many kinds of plants characteristic of tidal marshes when defining regulated wetlands (Table 1).

Table 1. New York State Tidal Wetlands Act definitions, 1973 (Environmental Conservation Law Article 25-0103.1). See Figure 1 for definitions of wetland indicator status classes.

Tidal wetlands are defined to include:

Those areas which border on or lie beneath tidal waters*, such as but not limited to, banks, bogs, salt marsh, swamps, meadows, flats or other low lands subject to tidal action, including those areas now or formerly connected to tidal waters*

and

All banks, bogs, meadows, flats and tidal marsh subject to such tides and upon which grow or may grow any of the following kinds of plants:

Tidal Wetland Plant	**1997 NWI Wetland Indicator Status**
Shrubs	
Baccharis halimifolia (groundsel bush)†	FACW
Iva frutescens (hightide bush)	FACW+
Herbs	
Distichlis spicata (spike grass)	FACW+
Hibiscus moscheutos (marsh mallow)	OBL
Juncus gerardii (black grass)†	FACW+
Limonium carolinianum (sea lavender)	OBL
Salicornia spp. (saltworts) (2 spp. in NY)	OBL
Spartina alterniflora (low marsh cordgrass)	OBL
Spartina cynosuroides (big cordgrass)	OBL
Spartina patens (salt hay)	FACW+
Spartina pectinata (tall cordgrass)	OBL*
Typha angustifolia (narrowleaf cattail)†	OBL
Typha latifolia (broadleaf cattail)†	OBL

*Regulations at 6 NYCRR 661.4(hh) clarify this jurisdiction to encompass coastal shoals, bars, and flats to a depth as great as 1 foot below mean low water plus the underwater littoral zone to a depth of 6 feet.
†Listed by NYSDEC as a freshwater wetland plant in New York State (see Table 7).

These particular kinds of plants almost never grow outside waterlogged soils in the absence of human cultivation. Other common tidemarsh plants were not mentioned in the statute, but the State's mapping contractor reported using more than seventeen additional kinds of plants when identifying actual tidal wetlands (Table 2). Many of the tidal wetland plants grow also in freshwater wetlands in New York State. The tidal wetlands as far north as the Tappan Zee Bridge were outlined on 774 large-scale, aerial photograph-based maps (scale, 1:2,400; 1" = 200'), and landowners were given notice of their need for permits for development in and near tidal wetlands. These maps are of variable accuracy, and in my field experience more frequently undermap than overmap regulated tidal wetlands in coastal New York. In general they provide useful guidance to landowners and regulators in the nine New York counties where the State mapped tidal wetlands, but current conditions at any given location may not be accurately represented on maps more than 30 years old.

Table 2. Kinds of additional plants not mentioned in the 1973 Tidal Wetlands Act but deemed indicative of New York tidal wetlands by the State's mapping contractor (Martin *et al.* 1975). The contractor noted that *Baccharis* and *Phragmites* can grow considerable distances inland from tidal wetlands that were mapped. *Myrica* spp.-dominated islands reportedly were mapped as uplands.

Tidal Wetland Plant	**1997 NWI Wetland Indicator Status**
Shrubs	
Morella [*Myrica*] *pensylvanica* (northern bayberry)	FAC
Myrica gale (sweetgale)†	OBL
Rosa spp. (roses) (29 spp. in NY)	Full range (OBL-UPL)
Herbs	
Carex spp. (sedges) (330 spp. in NY)†	Full range (OBL-UPL)
Fucus spp. (brown marine algae)	(No NWI status; would be OBL if classified)
Leersia spp. (cut-grasses) (2 spp. in NY)†	OBL-FACW
Nuphar advena (spatterdock)†	OBL
Panicum virgatum (switchgrass)	FAC
Peltandra virginica (arrow-arum)†	OBL
Phragmites australis (common reed)†	FACW
Polygonum spp. (knotweeds) (37 spp. in NY)†	Full range (OBL-UPL)
Pontedaria [spp.] *cordata* (pickerelweed)†	OBL
Ruppia maritima (ditch-grass)	OBL
Sagittaria spp.(arrowheads) (9 spp. in NY)†	OBL
Scirpus spp. (bulrushes, club-rushes)†	OBL-FACW+
Zizania aquatica (wild rice)†	OBL
Zostera marina (eelgrass)	OBL

†Listed by NYSDEC as a freshwater wetland plant in New York State (see Table 7).

The Freshwater Wetlands Act of 1975 (Article 24 of the Environmental Conservation Law, §24-0101 *et seq*., as amended) extended State regulation inland to large nontidal wetlands in all 62 counties. NYSDEC freshwater wetland maps show the location and extent of freshwater wetlands regulated by New York State approximately on the NYS Department of Transportation (NYSDOT) version (lacking contour lines) of US Geological Survey topographic quadrangle maps (scale, 1:24,000; 1" = 2,000'). Like the tidal wetland maps, the freshwater wetland maps were prepared using aerial photographs, with limited field checking, but the areas displayed are only one percent as large as the tidal wetland maps, with consequent reduction in detail.

The freshwater wetland maps seek to identify all wetlands greater than 12.4 acres in size, the minimum threshold for State regulation outside the Adirondack Park, plus certain other, smaller wetlands specifically deemed to have "unusual local importance" (including all mapped freshwater wetlands in New York City). Areas left off the wetland maps are not subject to State regulation as wetlands, even though they may exhibit wetland features, unless State water quality certification is needed for Federal wetland permits or the State announces a proposed formal map amendment. Most farming and forestry activities were exempted from regulation by the Act, and many wetlands on farms were not mapped. Few municipalities in New York State have elected to regulate

wetlands smaller in size than the State's threshold, so the Corps of Engineers alone often is left to regulate small wetlands within Federal jurisdiction.

The resulting NYSDEC freshwater wetland maps are informative, although it is not uncommon to find upon field inspection unrecognized wetlands---not only small parcels, but even tracts 30 to 100 acres in size---omitted from the official State maps, as well as significant tracts of dry land wrongly labeled as wetland. The State slowly is revising some of its roughly 1,000 freshwater wetland maps. The revisions proposed by NYSDEC during 2005 for 25 quadrangles in southern New York east of the Hudson River added 11,600 acres of previously omitted wetlands (averaging 467 acres per quadrangle, or about 8 acres per square mile). Some wetlands previously designated in error were deleted during the 2005 revisions. State-regulated wetlands outside the Adirondack Park are estimated currently to total about 1.3 million acres, with another 0.7 million acres eligible for regulation but not yet shown on State maps (oral communication, P. Riexinger, NYSDEC, February 2006).

At the scale of 1:24,000, map lines 0.025 inch wide represent a band 50 feet wide on the ground, an immense error in densely settled areas where property lots are small. Even greater inaccuracies can result during photointerpretation and from the transfer of boundaries from aerial photographs, especially onto basemaps lacking topographic contours. Thus the State regards its published freshwater wetland maps as "approximate" and places a note to that effect on each official map. Wetlands are subject to more precise, onsite field delineation when a property owner seeks to conduct regulated activities in and near them, so that field-flagged boundaries can be transcribed accurately by surveyors onto construction project drawings. The online NYSDEC February 2004 *Guide to Applicants* advises that landowners may engage consultants to prepare such field delineations for verification by NYSDEC staff. Formal map amendments typically are not deemed necessary for field revisions of official wetland boundaries enlarging or decreasing the regulatory limits over distances of 500 feet or less (0.25 inch on 1:24,000-scale maps; oral communication, P. Riexinger, NYSDEC, February 2006). NYSDEC regional office staff differ in their willingness to consider current field conditions when examining wetland boundaries in detail.

Environmental laws in the United States, both State and Federal, typically give a broad indication of what the elected officials would like to see regulated, and leave the details of implementation to administrative agencies. Few legislators have attempted to flag a wetland boundary. The 1975 Act is silent regarding the detailed procedure for locating a freshwater wetland regulatory boundary in the field, other than stating that the boundaries shall be set at the outer limit of Statute-defined vegetation and associated shallow waters. As mandated by the Act, NYSDEC addressed procedures for field delineation briefly in its April 1986 *Freshwater Wetlands Mapping Technical Methods Statement* and in greater detail in its July 1995 *Freshwater Wetlands Delineation Manual.* The same technical methods are specified for defining wetlands both inside and outside the Adirondack Park.

According to the 1975 statute, the vegetation of freshwater wetlands includes (herbaceous) marshes, (forested or shrub) swamps, sloughs, bogs, and vegetated flats (ECL §24-0107.1). The kinds of plants growing in wetlands obviously are centrally

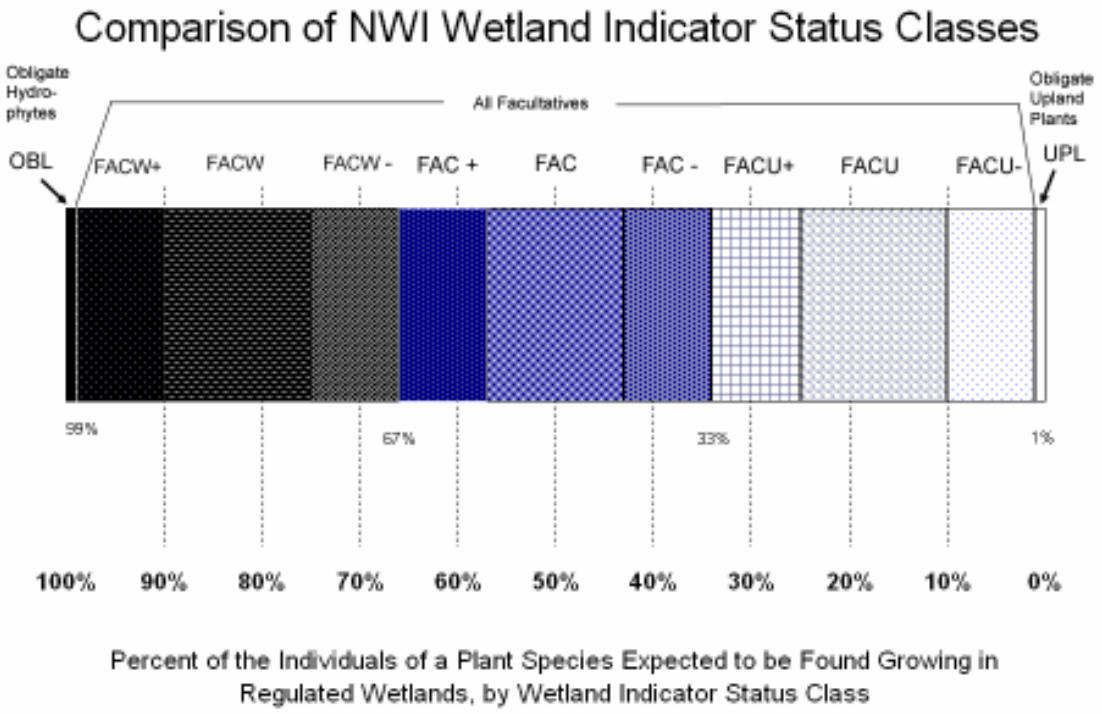
important when identifying most wetlands on the ground and when delineating their limits. The only regulated wetlands not required to support characteristic wetland plants are (1) areas with drowned upland vegetation (where the water is less than 6 feet deep) and (2) upland islands and waters completely surrounded by wetland or drowned vegetation where regulation is necessary to protect the adjacent wetlands. The nearly 50 kinds of freshwater aquatic or semi-aquatic plants listed in the 1975 Act are illustrative examples of species ("including, among others, …") that help define freshwater wetlands (Table 7).

As noted in the 1975 Act, the association of some plants with permanently flooded lands is obvious---free-floating and rooted emergent herbs, submerged herbs, and bog mats. At least 99% of the individual plants of species classed since the late 1980s as *obligate hydrophytes* are expected to be found growing in wetlands (according to the best available scientific estimates [Reed 1997]), including virtually all free-floating and emergent herbs, submerged herbs, and bog mat plants. A few, scattered individuals of species labeled obligate hydrophytes may be observed growing in non-wetlands where bright brown soils are saturated only for brief periods. But dense stands of such species typically coincide with waterlogged or long-ponded habitats, easily recognized in the field. Nearly 600 species of obligate hydrophytes make up about 15% of the flora growing more or less wild in New York State.

Other categories of plants, sometimes but not always found in wetlands, may help define wetlands, but only in those locations where they coincide with what the Statute describes as "sufficiently water-logged soils to give them a competitive advantage". More than 1,400 species of plants (37% of the New York flora) typically are found growing *both* in wetlands *and* in uplands, and those species typically occupy both sides of a wetland boundary in the field. Such broadly tolerant plants are known collectively as *facultative hydrophytes,* inasmuch as they have the physiological ability to grow in wetlands and outside wetlands. Some of these species are more abundant in wetlands; others, in uplands, and their association with wetlands has received considerable scrutiny (Figure 1). In places dominated by facultative hydrophytes, major attention must be paid to field evidence of long-duration flooding and persistent waterlogged soils, whose extent typically is strongly influenced by topography, because the presence of facultative plants alone may not identify a wetland.

Finally, as the 1986 NYSDEC *Technical Methods Statement* recognized, some plants are found virtually exclusively in uplands and generally are reliable indicators of uplands. These include 48% of the wild flora of New York State (Schmid 2003). Only upland islands completely surrounded by wetlands or upland plants drowned by recent impoundment are defined by statute as wetlands subject to regulation. (The uplands within 100 feet of regulated freshwater wetlands also are subject to State regulation as Adjacent Areas in which activities may affect wetlands nearby.) Plants not listed by NWI are deemed to be upland plants.

Permit approval must be obtained by a landowner prior to encroachment into a regulated freshwater wetland or into the adjacent regulated Adjacent Area. For landowners seeking to change land uses on their specific block and lot, the State's



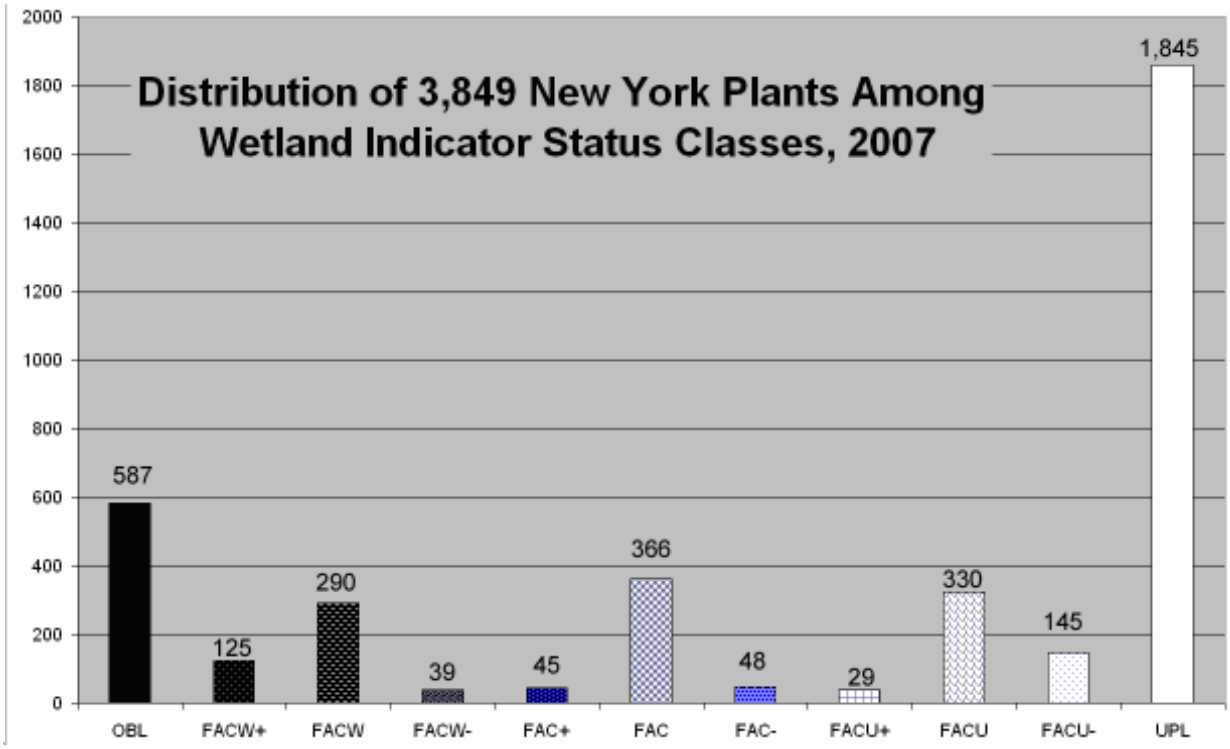


Figure 1. Wetland Indicator Status Categories of the National Wetland Inventory and Abundance of New York Plant Species in Each Region 1 Category. Unlisted species considered by NWI not to occupy any wetlands in the United States, based on current information, for simplicity are combined here with Region 1 (Northeast) UPL, NA, and NI plants. Tentative (asterisk) assignments are included here.

published maps often provide little guidance. By law (§24-301.7), the Department of Environmental Conservation staff is directed to flag actual wetland boundaries in the field upon the written request of a landowner. NYSDOT staff and consultants are expected to document wetland delineations using routine data forms per the 1996 *Memorandum of Understanding* between NYSDEC and NYSDOT (Daly and Zapata 1996, EAB 2001). In contrast, I have never encountered any standard field documentation sheets (either in the format of the 1995 NYSDEC Manual or that of the 1987 Corps Manual) completed for State-flagged wetlands in any NYSDEC permit file, and wonder whether anyone else may have done so.

Pursuant to the Clean Water Act (FWPCA §404; 33 USC §1344), the Army Corps of Engineers exerts Federal regulatory authority over construction activities in all tidal waters and many freshwater streams and wetlands in New York State. Federal jurisdiction may or may not overlap with State jurisdiction in any given wetland. There are no official maps that identify wetlands or watercourses regulated by the Corps. It is the responsibility of each landowner to identify and avoid Corps-regulated areas or to secure a permit for encroachment into them. Some likely regulated areas are shown as wetlands on National Wetland Inventory maps, as watercourses or wet places on US Geological Survey topographic quadrangles, and as hydric or hydric-inclusions map units and “wet spots” on county soil survey photomaps, but none of these sources is definitive for regulatory use. When the Corps processes a site-specific application for a formal Jurisdictional Determination or for a permit, it requires that any landowner’s consultant flag and document a proposed regulatory boundary, prior to field inspection by Corps staff. NYSDOT has worked with NYSDEC to establish a coordinated procedure for establishing a single wetland boundary for State and Federal jurisdictions on each transportation project site (Daly and Zapata 1996, EAB 2001). For other entities Federal and State wetland boundaries commonly are different on any specific tract of land. This situation provides employment for consultants, but it tends to confuse both the development community and those seeking to protect wetlands.

Unlike tidal wetlands, where both the State and the Corps had some regulatory experience prior to turning inland, many freshwater wetlands in some seasons are difficult to define even in the field, much less to map precisely from high-altitude aerial photographs. Inland wetlands, unlike tidal wetlands, may not support definitive vegetation, such as the unique plant communities that inhabit lands kept permanently wet by the tides. Long-ponded wetlands and open waters often are easily recognized from aerial photographs, but many forested inland wetlands are never ponded---especially near their margins. The broadly tolerant plant communities of freshwater wetland margins do not always change dramatically at the limits of long-saturated areas wherein the biogeochemical processes unique to waterlogged soils are found. When inspected in the field, many freshwater wetlands do not display saturation or inundation every day or during every season. Conversely, some non-wetlands can be temporarily ponded during high-precipitation periods. Moreover, the kinds of trees, shrubs, and herbaceous plants that grow in freshwater wetlands, especially near the wetland boundary, may grow equally well in uplands where excess water does not persist for long periods after precipitation and where the soil environment never becomes depleted of oxygen and thus fails to exhibit the characteristic colors of hydric soil.

The plants listed in the 1975 Act and by the NYSDEC as defining freshwater wetlands in New York warrant close inspection in the context of New York wild plants as a whole. Some of the listed species and genera are true aquatics, which indeed require great quantities of water. Waterlilies (*Nymphaea* spp.) and duckweeds (*Lemna* spp.) are examples of listed genera that grow in permanent water bodies. I seldom encounter claims that the water bodies where these plants grow are not freshwater wetlands. About 90% of the plant species individually named in the Freshwater Wetlands Act consist of true aquatics and other obligate hydrophytes seldom found outside wetlands (Table 7).

Others among the Act's listed kinds of plants, however, in fact do *not* consist of plants which, in the repeated language of the statute's definitions, "depend on seasonal or permanent flooding or sufficiently waterlogged soils to give them a competitive advantage over other species." Rather, among the 29 *genera* of plants named by the Act, some contain species not confined to wetlands. Large numbers of the individual plants comprising such species may or may not grow in wetlands; plants of several species in the listed genera are virtually never found in wetlands. By noting that wetland-defining trees, shrubs, and wet meadow vegetation must "depend upon seasonal or permanent flooding or sufficiently water-logged soils to give them a competitive advantage" over other kinds of vegetation, the Act recognizes that these kinds of marginal plants, absent hydric soils and wetland hydrology, do not define wetlands.

The individual plants of some species cannot tolerate prolonged soil wetness and are virtually never found growing in wet areas. These are *obligate upland plants*. The New York statute fails to name specifically any plants that signify non-wetlands. This task was left to NYSDEC.

During the 1970s and 1980s a great deal of effort was expended nationwide by Federal agencies to work out a consistent and replicable procedure for identifying wetlands in the field for regulation pursuant to the Clean Water Act. There is no difficulty identifying always ponded wetlands in the field or in recognizing the wettest part of most freshwater wetlands. The key question becomes, where is the limit of a wetland in the absence of an obvious or dramatic change in slope and where the never ponded wetland margin is seldom even saturated? In many freshwater wetlands the plant communities do not change at the limit of prolonged wetness or hydric soils; instead, many species broadly overlap wetlands and uplands. For example, red maple (*Acer rubrum*, named in the 1975 Act) according to the US Forest Service (2005) today is the most abundant species of tree in the mid Atlantic States including New York. Red maples grow in landscape depressions among sedge tussocks ponded half the year, but they also grow equally well on hill slopes and along city sidewalks. Clearly, facultative hydrophytes like red maple by themselves are not sufficient for identifying freshwater wetlands or for setting wetland boundaries in the field. Because all of the land surface (both upland and wetland) is wet during precipitation events, while some wetlands may not be wet during all seasons or in every year, other key questions in marginal areas are, how long must free water be present to warrant applying the term wetland and the stringent regulatory controls on land use that such designation imposes, and how can such areas practicably be recognized in the field?

Federal guidance was summarized in the 1987 *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987). The Corps today also accepts the vegetation methodology from the 1989 Interagency *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (FICWD 1989), along with certain other, post-1987 technical field indicators of hydrophytic plants, hydric soils, and wetland hydrology. The Federal wetland boundary for many years has been set where field evidence of one or more of the three defining parameters---hydrophytic vegetation, hydric soils, and/or prolonged hydrology---*cannot* be observed or documented. This is the Federal three-parameter approach. It makes use of the technical work to recognize hydric soils in the field performed by soil scientists in the Natural Resources Conservation Service (formerly the Soil Conservation Service) of the US Department of Agriculture and the lists of hydrophytic plant species (not genera) compiled by regional panels for the National Wetland Inventory (NWI) in the Fish and Wildlife Service of the US Department of the Interior. The 1987 Manual provides data forms for documenting conditions along wetland boundaries. Recently the Corps adopted a formal protocol for measuring and interpreting field data on water elevations in the soil to establish field evidence of presence of the hydrology presumptively necessary for bacteria during the growing season to create anaerobic, hydric soil conditions (USACE 2005). Significant effort may be required in marginal areas to demonstrate the presence or absence of wetland hydrology (Table 3). I do not discuss here the recognition of hydric soils, typically the most stable of the three wetland parameters (see USDA-NRCS 2006), or the field measurement of wetland hydrology.

Table 3. Required duration of consecutive inundation or surface soil saturation during the growing season for identifying regulated nontidal wetlands (Corps 1987 Manual, p. 36).

Zone	Duration	Name of Hydrologic Zone
I.	100%	**Permanently inundated** aquatic habitat (>6.6 feet mean water depth)
II.	>75% to <100%	**Semipermanently to nearly permanently inundated or saturated wetland** (mean water depth up to 6.6 feet)
III.	>25% to 75%	**Regularly inundated or saturated wetland**
IV.	>12.5% to 25%	**Seasonally inundated or saturated wetland**
V.	5% to 12.5%	**Irregularly inundated or saturated areas;** many such areas are not wetlands
VI.	<5%	**Intermittently or never inundated or saturated** areas; not regulated wetlands

Note: For methods and interpretation of shallow groundwater measurements, see USACE (2005). Duration of growing season is measured in days. Growing season is formally defined as that portion of the year when soil temperatures at 19.7 inches below the surface are higher than 41°F), and can be approximated by the number of frost-free days shown in the *National Atlas of the United States*. Snow and ice cover, saturation, or inundation only during the winter may not satisfy the hydrology requirement for regulated wetlands.

In addition to mapping prominent wetlands nationwide, the National Wetland Inventory focused on distinguishing the plant species confined to wetlands from those less strongly associated with wetland habitats. NWI developed a regionalized classification for higher plants (exclusive of liverworts, mosses, and algae) that assigns an expected percentage of individual plants in each species to wetland habitats. The consensus estimates for each species are based on review by regional panels using field experience and the best available information, including comments from field biologists. The class definitions and the species assignments to classes underwent considerable revision during the 1980s and 1990s. Current class definitions, which have not changed for nearly twenty years, are illustrated in Figure 1. The numbers of New York plant species associated with each wetland class are displayed in Figure 2. By design, only wetland species were listed by NWI. For a species to receive an UPL label in any region from NWI, it had to be classed as at least a facultative hydrophyte in another region. Plants omitted from the NWI list entirely are deemed non-wetland plants throughout the United States. Because they are restricted to hydrophytes, the NWI lists omit nearly half the species of wild plants found in New York State.

The NWI Region I list is a useful guide to those higher plants (trees, shrubs, herbs, ferns, and fern-allies) that potentially grow in New York wetlands. The most recent version (1997) of the NWI list begins to provide subregional wetland indicator status for a few species tailored to the distinctive physiographic regions of the State. The Region 1 list includes many species from other States in the northeast which do not grow in New York. NWI has not yet published any wetland indicator status classifications for lower plants (liverworts, mosses, or algae). The incomplete work of the NWI has received low priority during recent years.

In New York State the Legislature in 1975 focused more attention on vegetation than on soils and hydrology when seeking to define regulated freshwater wetlands. An airphoto-based, statewide inventory of freshwater wetlands had been initiated at Cornell University prior to the 1975 Act. Vegetation is readily visible from aerial photographs and is of primary importance when analyzing wildlife habitat. The Cornell inventory focused on the wetlands visible on photographs, and its purpose was management of fish and wildlife resources, not land use regulation (Cole and Fried 1981). Its map products were modified and completed by NYSDEC staff and adopted as the best available guide to the location of regulated freshwater wetlands. To date NYSDEC has formally amended more than 200 of the 7.5-minute (1:24,000-scale) official freshwater wetland maps outside the Adirondack Park.

Eleven years after the Act, the NYSDEC issued its April 1986 *Technical Methods Statement* laying out the procedures it used for preparing official wetland maps (as directed by §24-0301.1; NYSDEC 1986). This guidance recommends careful attention to all available technical information on soils and hydrology as well as plants when determining the limits of wetlands. It also recommends using species information from the National Wetland Inventory, which at that time listed nearly 1,000 species for USFWS Region I, to supplement the plants listed by the 1975 statute itself. Only a small part (Section 3) of the 45-page document addresses how to set a precise boundary in the field.

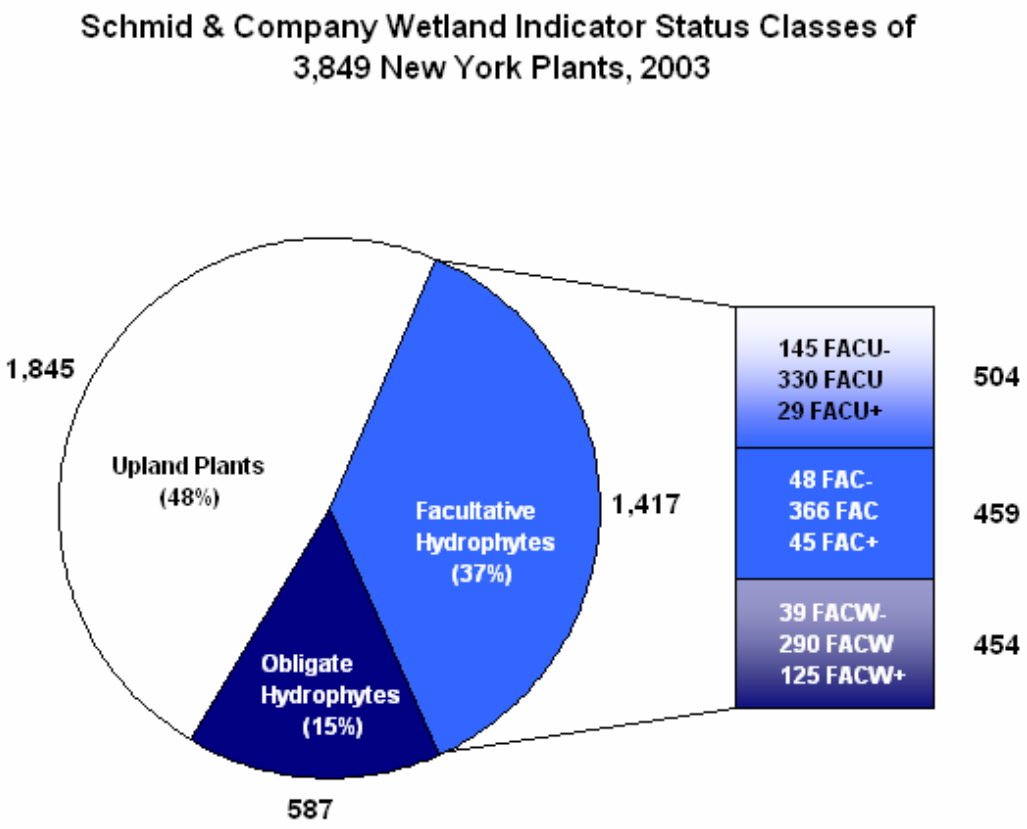


Figure 2. Distribution of New York Plant Species among NWI Wetland Indicator Classes.

The 1986 *Technical Methods Statement* (Section 2.8, page 11) slightly misrepresents the NWI categorization of wetland indicator status. It is correct that "T[he NWI] list categorizes plants by their frequency of occurrence in wetlands. Those plants that are always found in wetlands (99% of the time) are referred to as 'obligate' plants." It is not correct, however, that "They [*all* the obligate hydrophytes] require saturated soil or standing water to exist." Instead, some individuals of many species classed as obligate hydrophytes can survive in uplands, and some species of obligate hydrophytes typically inhabit seasonally dry, never-ponded wetlands along wetland margins.

Plant species are populations of individual organisms. Some species have much less specialized physiological tolerances for wet or dry habitats than other species do. This becomes important when one encounters a group of plants in the field. Problems seldom arise in the middle of wetlands, where saturation is constant or of very long duration, soils are organic or gleyed, and the plant community is strongly hydrophytic. The problems arise at the upland margin, where a boundary must be set. The location of that boundary may have profound consequences for private landowners seeking to change land uses.

The NWI provides a best-available consensus estimate of the proportion of individuals in any species that are expected to live in wetlands, by region, across the United States. As the 1987 Corps Manual makes clear, any individual plant of any species living in a wetland is a hydrophyte. Individual plants of some species classed as obligate hydrophytes (for example, skunk cabbage, *Symplocarpus foetidus* or broadleaf cattail, *Typha latifolia*) are much less likely to dwell in uplands than species not listed by NWI, but they occasionally do so. Some species, indeed, some entire genera, are true aquatic plants and are virtually never found outside ponds, streams, or very wet wetlands (Table 4). Such plants are good indicators of wetland conditions, and they

Table 4. Representative multi-species genera consisting entirely of species ranked as obligate hydrophytes (OBL) by NWI and reasonably cited collectively by NYSDEC.

Genus	English Common Name	# Spp. in NY	Listed in 1975 Act	In 1995 NYSDEC Manual Listing
Alisma	Water-Plantains	3		X
Drosera	Sundews	3		X
Elodea	Waterweeds	4	X	
Eriophorum	Cotton-Grasses	6		X
Gratiola	Hedge-Hyssops	2		X
Lycopus	Water-Horehounds	7		X
Lemna	Duckweeds	6		X
Mimulus	Monkey-Flowers	4		X
Myriophyllum	Water-Milfoils	8	X	X
Najas	Waternymphs	5	X	X
Potamogeton	Pondweeds	32	X	X
Sagittaria	Arrowheads	9	X	X
Sparganium	Burr-Reeds	7	X	X
Utricularia	Bladderworts	14	X	X
Wolffia	Watermeals	3	X	X
Xyris	Yellow-Eyed-Grasses	4		X

seldom grow together with upland plants. By themselves, they often provide a sufficient basis for identifying and documenting a wetland. Even stands of such plants, however, are not wetlands if unaccompanied by hydric soils and prolonged wetness. These species seldom dominate the typical vegetation near the wetland boundary where there is no abrupt change of slope.

Individual plants of the species in the NWI classes of *facultative* hydrophytes, by definition, are less frequently encountered in wetlands than are *obligate* hydrophytes, and some of them (the FACU hydrophytes) are commonly encountered in uplands at least twice as frequently as in wetlands (Figure 1). Hence the 1987 Corps Manual requires that more than 50% of the dominant species be classed FAC or “wetter” as the threshold of hydrophytic vegetation at any location. The Federal wetland methodology then relies on field evidence of the other two parameters, not merely the wetter kinds of

facultative hydrophytic plants alone, but also hydric soils and hydrology above defined thresholds, to confirm the existence of a wetland.

The 1986 *Technical Methods Statement* describes sources for relevant information on soils and hydrology, and it quotes the New York State statute as defining "the wetland boundary as the outer limit of aquatic or semi-aquatic vegetation." It directs that a boundary be set in the field

> where wetland indicator species no longer have a competitive advantage over upland species. Wetland and upland plants will mix together at this transition zone. … When the intermixing of vegetation is an even gradient … it is in the area of the 50 percent mix where the competitive advantage of upland species is demonstrated. The boundary line, therefore, is drawn at the mid-point of that zone. (p. 22)

The 1986 *Statement* continues:

> In situtations [*sic*] where predominately facultative species (as defined [using the NWI categories]) are found, the ecological association of that community must be examined to determine if the area is a wetland. Facultative species, such as red maple (*Acer rubrum*), have a wide tolerance of soil saturation conditions and can survive in wet or dry environments. They, therefore, should not be used as the sole indicator of wetland presence or boundary delineation. Other plant species in the community need to be examined. When a facultative species is found in conjunction with obligate plants, such as swamp white oak (*Quercus bicolor*) [not ranked by NWI as OBL in Region 1 after 1982; rather, FACW+] or buttonbush (*Cephalanthus occidentalis*), the area is a wetland. However, if red maple is found with upland plants such as wild cherry (*Prunus avium*) or common burdock (*Arctium minus* [an FACU- facultative hydrophyte in Region 1 per NWI]), the area is an upland.

Nine years later, NYSDEC issued a *Freshwater Wetlands Delineation Manual* intended to incorporate advances in wetland science made since 1986 and the Department's growing experience in freshwater wetland regulation (Browne *et al.* 1995). This *Manual* is to be used for in-field boundary delineations more precise than possible at the scale of 1:24,000 published maps. The State's 1995 Manual makes repeated reference to the Corps 1987 Manual, and refers users to the Corps Manual whenever more comprehensive or rigorous methods are needed on complex or controversial sites. Nowhere does the 1995 New York Manual express any intent to identify or delineate a wetland boundary different from that produced by the 1987 Corps Manual.

The 1995 Manual directs delineators to the list of hydrophytic plants in the 1975 Statute and to the 1988 version of the NWI wetland plant list, with the further recommendation that future delineators use the most current version of NWI listings. The 1995 Manual recognized that only about 27% of the 7,000 species listed by NWI nationwide as of 1988 were considered to be obligate hydrophytes. That means 73% of the1988 NWI-listed plants were facultative hydrophytes or upland plants. In New York State 63% of the 1997 NWI Region 1-listed plants are insufficient by themselves for reliably identifying wetlands. According to the 1995 Manual, the "drier" facultative hydrophytes (FAC-, FACU+, FACU, FACU-; 556 species) and upland species do not "count" when identifying hydrophytic vegetation in New York State. "For freshwater wetlands that frequently lack standing water (shrub swamps, deciduous swamps, coniferous swamps,

wet meadows), [even relatively strongly hydrophytic] vegetation alone may not be adequately diagnostic for identification of a wetland boundary. In these wetland types, field verification of wetland hydrology and/or hydric soils might be required…." (p.3). These types of wetlands, of course, are precisely the most common types of wetlands wherein boundaries must be established for regulatory purposes.

The 1995 New York Manual sought to simplify the information that needs to be recorded when documenting obvious wetlands. Its Appendix A provides a field data form for site-specific observations (which the 1986 *Technical Methods Statement* previously had recommended be recorded, but without suggesting any particular format). Appendix A also set forth a new "freshwater wetland plant list" that contains 154 species plus 29 genera not broken down to species (Table 5), while omitting 7 genera listed in the Act (Table 7). It included some of the indicator status designations from the 1988 NWI list, with various modifications, some of which appear to have been inadvertent. FACW+ and FACW- wet facultative hydrophytes intentionally were lumped as FACW. Both FAC+ and FAC- in fact were lumped into FAC (even though the text at page 4 implies that NYSDEC, like the Corps 1987 Manual, intends to treat species labeled FAC- quite differently from FAC when adding up dominants to determine whether vegetation is hydrophytic). Some plants listed by statute inexplicably were dropped (duckmeat, *Spirodela polyrrhiza,* and the shrub dogwoods, *Cornus* spp.); many others, not listed by statute, were added. Many genera were listed, some understandably in a compact field data form list (for example, the genera in Table 4). Other generic listings were more problematic, with a broad, vague range of indicator statuses that undermine the use of these genera as wetland indicators (Table 6). Some status classifications were simply erroneously transcribed from then-current NWI Region I listings. Nomenclature was not consistently updated. All this was done with no explanation for users as to how the State's 1995 plant list was constructed.

Table 5. Numbers of species and genera of higher plants classified by wetland indicator status on the 1995 NYSDEC Manual Appendix A Field Form.

Ecosystem Category	Named Species	Undifferentiated Genera
Trees	26	0
Shrubs (no vines included)	28	1 (24 spp.)
Emergent/Wet Meadow	60	19 (436 spp.)
Floating/Submergent	9	7 (73 spp.)
Bog Mat	15	3 (23 spp.)
Ferns	16	0
Total*	154	29* (542* spp.)

*Totals do not double *Utricularia* (14 spp.) or *Myrica gale*, which were entered twice on NYSDEC list. Lower plants (*Chara* spp., *Nitella* spp., *Sphagnum* spp.) also are omitted from this table.

Table 6. Sample problematic "wetland" genera listed in the 1995 NYSDEC Manual with 1997 NWI indicator status rankings of species. NYSDEC composite "indicators" applied to all species in these genera are not helpful for field delineation. "U" includes the NWI listings UPL, NA, and NI, as well as non-listed (upland) species. "NA" is the NWI symbol for No (unanimous) Agreement among the regional panel; "NI" (No Indicator) is the label for species not considered by the panel, usually because of a lack of information. "UPL" means the species is a wetland plant somewhere outside Region 1, but is not associated with wetlands in this region.

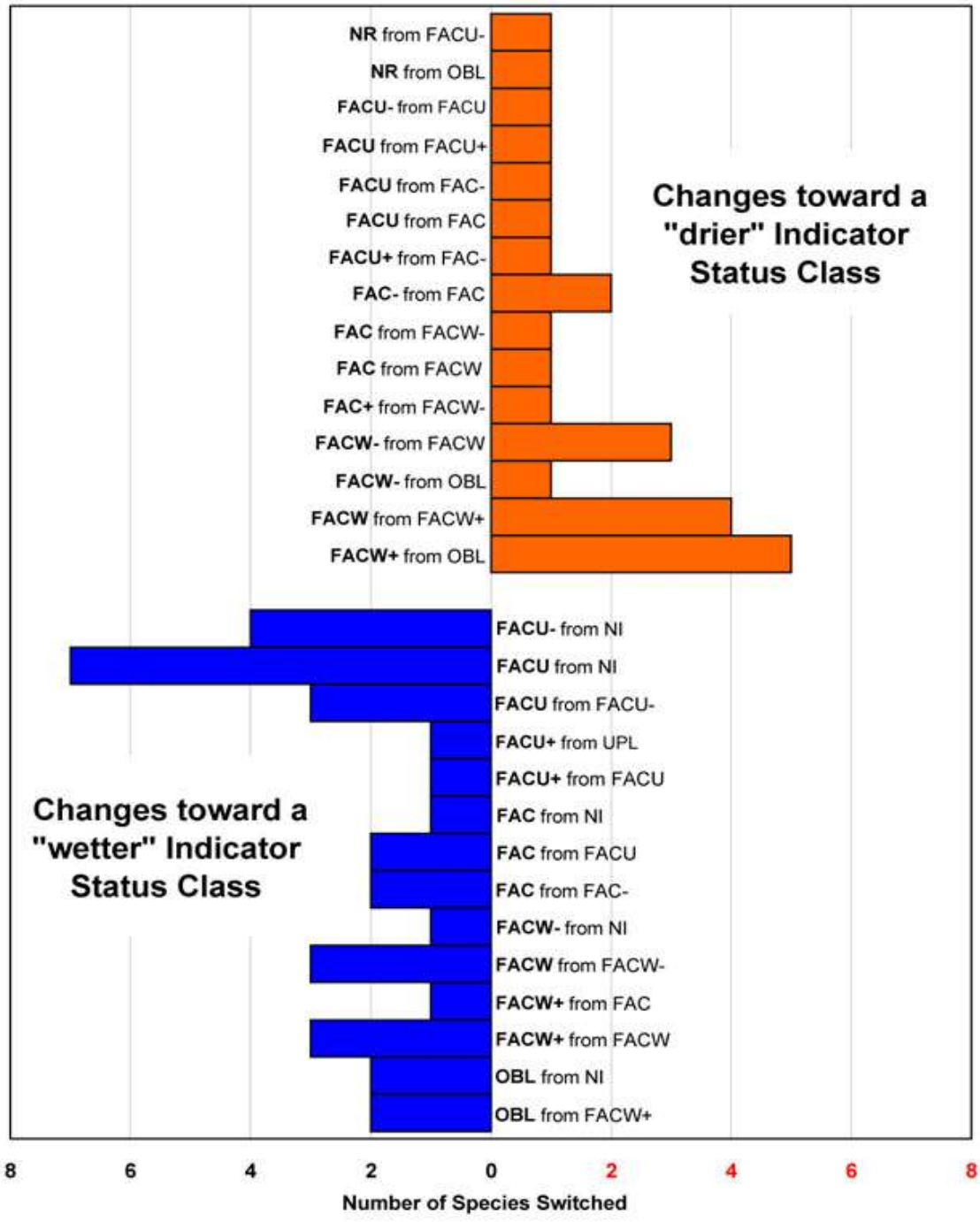
Genus	Common Name	# Spp. in NY	1995 NYSDEC "Indicator"	# Species in each class of 1997 NWI Indicator (including + and -)
Bidens	Beggarticks	15	OBL/FAC/FACW	OBL 5, FACW 6, U 4
Carex	Sedges	208	"Mostly FACW & OBL"	OBL 71, FACW 39, FAC 26, FACU 22, U 50
Cornus	Dogwoods (shrub)	10	(None - only in Act)	FACW 2, FAC 3, FACU 1, U 4
Galium	Bedstraws	24	"Mostly FACW & OBL"	OBL 5, FACW 3, FACU 3, U 13
Polygonum	Knotweeds	37	OBL/FACW	OBL 9, FACW 4, FAC 4, FACU 8, U 12
Salix	Willows (shrub)	24	FAC/FACW/OBL	OBL 5, FACW 9, FACU 1, U 9
*Solidago**	Goldenrods	40	"Various"	OBL 6, FACW 3, FAC 6, FACU 8, U 17
Verbena	Vervains	11	FACW	FACW 1, FACU 2, U 8

- Includes *Euthamia*, *Oligoneuron*, and *Gutierrezia*, which now contain 8 New York species split from *Solidago*.

The 1997 NWI list of hydrophytes is more extensive than the 1988 NWI list (adding 265 New York species) and reflects many changes in scientific nomenclature, but the indicator status classification of plants changed relatively little. About 3% of New York plants changed status. NWI changed the wetland indicator status class of 67 species of New York plants from 1988 to 1997, shifting 26 (39%) from wetter to drier and 32 (48%) from drier to wetter categories; 9 (13%) were moved from NI to UPL, no effective change (Figure 3). A few of the changes were substantial (for example, FAC from FACW, FACW+ from FAC, FAC from FAC-, FAC- from FAC).

The NYSDEC 1995 plant list poses a challenge to users if it is regarded as the primary basis for wetland identification. It departs considerably from the most current NWI listings. Its 154 directly identifiable species are assigned by the 1997 NWI Region I list of wetland indicator statuses as follows: 49% obligate hydrophytes (OBL), 38% wet facultative hydrophytes (FACW), 10% middle facultative hydrophytes (FAC), and 3% dry facultative hydrophytes (FACU). Yet the inclusion of merely the eight genera listed in Table 6 stretches the 1995 "wetland" plant list to encompass 45 FACU hydrophytes and nearly 120 species of upland plants as well! In the genus *Verbena* (vervains), for

Figure 3. Distribution of 57 New York Plant Species Switched Among NWI Region 1 Wetland Indicator Classes, from 1988 to **1997**



example, only 1 species (9%) falls into the intended NYSDEC 1995 FACW category; 2 species (18%) are FACU, and 8 species (73%) are upland plants. The 1995 NYSDEC list also inexplicably omits some plants that might be expected, such as switchgrass (*Panicum virgatum*, FAC), a common grass of freshwater wetlands also listed by the State's tidal wetland mapping contractor.

By focusing attention only on plants it considers "wet," the 1995 NYSDEC list gives a false impression of the relative abundance of species in each of the wetland indicator status classes for wild plants that grow in New York. The best available data from the New York State Museum, New York Natural Heritage Program, and other sources, list 1,990 species growing in New York State that have been assigned by NWI to some class of hydrophyte: 29% OBL, 23% FACW, 23% FAC, and 25% FACU (lumping pluses and minuses of the 1997 NWI listings; Figure 4). (Unlisted plants are not deemed hydrophytes in any region.)

My 2003 field checklist for New York wild plants seeks to encompass all species in all genera, including species of hydrophytic plants that are found downstate, many of which were omitted from the NYSDEC 1995 list. The 1997 NWI list also added subregional classifications for three species found in New York State (mentioned but not reported by NYSDEC in its 1995 Manual), and those are identified in my 2003 compilation. When all 3,849 species in the 2003 New York State flora are considered, 48% are upland plants not known to grow in wetlands in Region I (including UPL, NA, NI, and the plants

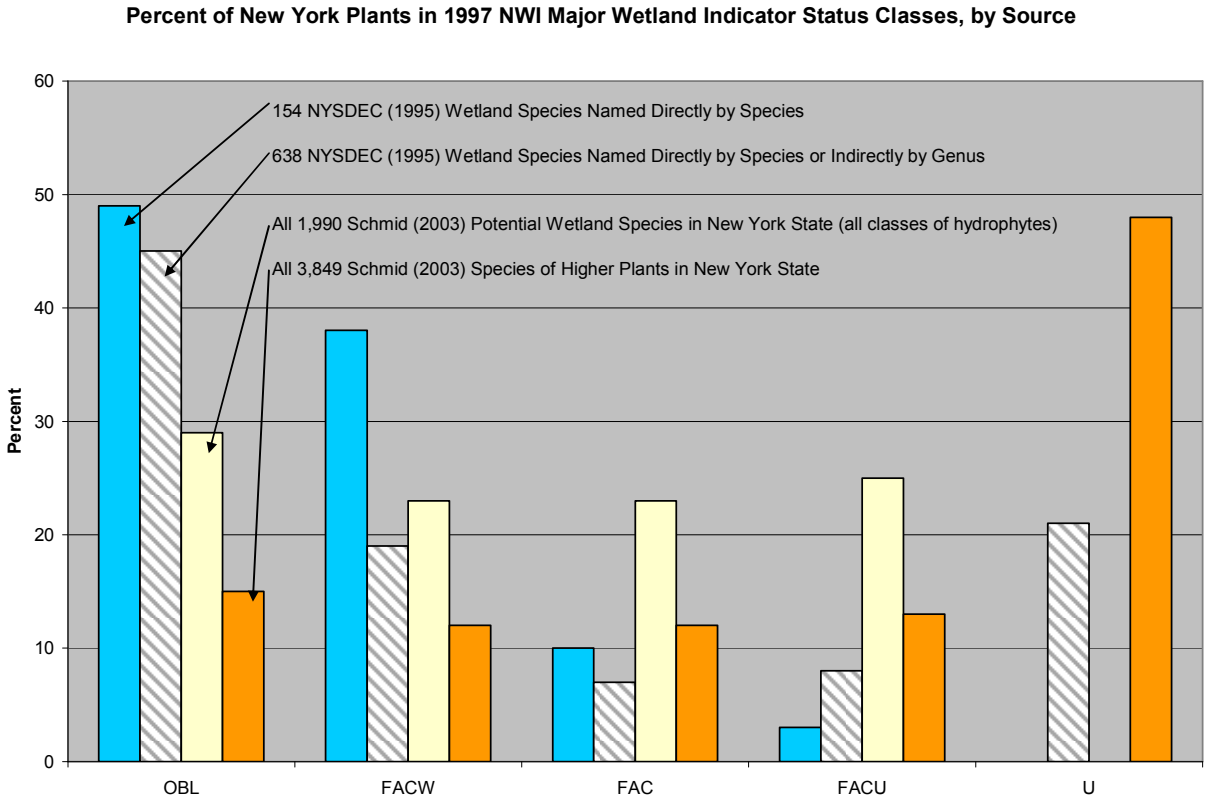


Figure 4. Distribution of New York Higher Plants across Major 1997 NWI Wetland Indicator Status Classes, by source.

unlisted by NWI for which strong evidence of association with wetlands is lacking); 13% are FACU, 12% FAC, 12% FACW, and 15% OBL (Figure 4).

Precisely because many genera include both wetland and upland species, NWI prudently avoided classifying plants at the generic level. Delineators must be aware of all the possible species in a genus that might be mistaken when field identifications are made, especially during the winter. Given this situation, wetland delineators in New York State would be wise to use the most current listing of hydrophytic plants for in-field decisionmaking.

The attached Table 7 relates the 811 kinds of plants found on the NYSDEC 1995 Freshwater Wetland plant list and/or in the 1975 Freshwater Wetlands Act to the most current nomenclature and NWI wetland indicator status. Nearly 300 contradictions, species for which the State wetland "indicator" is misleading and should not be used, or freshwater wetland indicator plants listed in the Statute but omitted from the 1995 NYSDEC list, are highlighted.

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Table 7. State-Identified New York Freshwater Wetland Plants and Wetland Indicator Status Designations.

Conflicts of greatest potential significance are highlighted, where New York State statutory and NYSDEC 1995 Manual plant lists are significantly incompatible with the 1997 NWI indicator statuses and the use of the obsolete data is likely to produce errors in wetland identification and delineation.

Notes on Sources:

Latin nomenclature is that of Schmid (2003) based on Kartesz & Meacham (1999), updated with the assistance of John T. Kartesz.

1975 NY Freshwater Wetlands Act, 1995 NYSDEC Freshwater Wetlands Manual Appendix A Plant List, G = Entire Genus listed; S =Species (as well as Genus) Listed.

National Wetland Inventory Indicator Status Symbols are from NWI 1988, NYSDEC 1995 Appendix A, and NWI 1997 (via Schmid 2003). Parentheses indicate indicator was applied by the source to entire genus rather than particular species (except where an indeterminate NWI category has been supplemented by Schmid using a one-letter interim code).

Nativity, Growth Habit, and New York Rarity codes are from Schmid (2003) according to Kartesz and Meacham (1999) and the NY Natural Heritage Program (2002), respectively. See Schmid (2003) for full explanation of codes.

Data for Table 7 are in a separate Acrobat file available through our web site: http://www.schmidco.com

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James A. Schmid
1201 Cedar Grove Road
Media PA 19063-1044

(60) 356-1416
Fax (610) 356-3629

jaschmid@aol.com