ERDC/CRREL TN-11-1

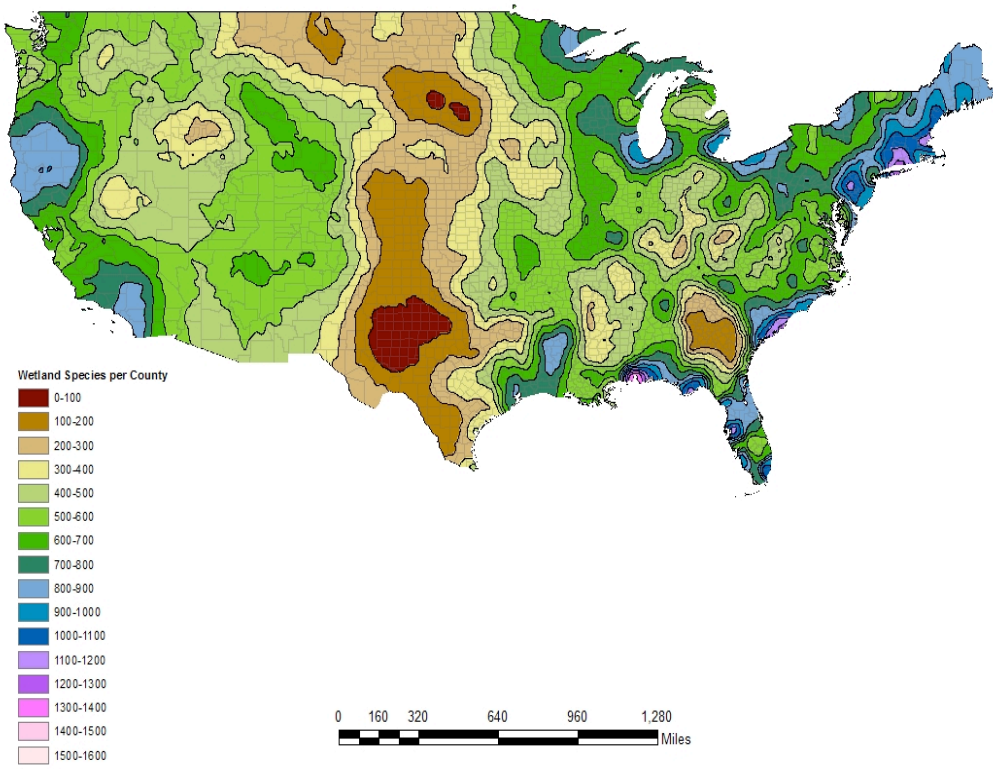
US Army Corps
of Engineers®
Engineer Research and
Development Center

Wetlands Regulatory Assistance Program

Final Protocol for Assigning Wetland Indicator Status Ratings during National Wetland Plant List Update

Robert W. Lichvar and Jennifer J. Gillrich

September 2011



Cold Regions Research and Engineering Laboratory

Cover: Density map of wetland species by county (Kartesz 2009).

Wetlands Regulatory
Assistance Program

ERDC/CRREL TN-11-1
September 2011

Final Protocol for Assigning Wetland Indicator Status Ratings during National Wetland Plant List Update

Robert W. Lichvar and Jennifer J. Gillrich

Cold Regions Research and Engineering Laboratory
US Army Engineer Research and Development Center
72 Lyme Road
Hanover, NH 03755

Final report

Prepared for US Army Corps of Engineers
Washington, DC 20314-1000

Abstract: This report is the third in a series of reports (see also ERDC/CRREL TN-08-3 and ERDC/CRREL TN-09-1) documenting procedures used in updating the National Wetland Plant List, formerly called the National List of Plant Species that Occur in Wetlands (Reed 1988). This national effort was led by four Federal agencies: the US Army Corps of Engineers, the US Environmental Protection Agency, the US Fish and Wildlife Service, and the Natural Resources Conservation Service. The update of plant species' wetland indicator status ratings involved five rounds of voting by national and regional botanists, with evaluation by wetland ecologists and input from professional scientists from the public and academic institutions. This report describes the voting process and the wetland indicator status definitions that will be used to make final decisions for species with ratings that remain unresolved after the final round of voting from the public.

Table of Contents

Preface

This research was funded by the Wetlands Regulatory Assistance Program of the US Army Corps Regulatory Program. Permission to publish was granted by Director, Cold Regions Research and Engineering Laboratory (CRREL), US Army Engineer Research and Development Center (ERDC), Hanover, NH.

This report was prepared by Robert W. Lichvar and Jennifer J. Gillrich, both of the Remote Sensing/Geographic Information Systems (RS/GIS) and Water Resources Branch, ERDC-CRREL. This study was conducted under the general supervision of Timothy Pangburn, Chief, RS/GIS and Water Resources Branch; Dr. Justin B. Berman, Chief, Research and Engineering Division; Dr. Lance Hansen, Deputy Director; and Dr. Robert E. Davis, Director. Permission to publish was granted by Director, Cold Regions Research and Engineering Laboratory.

The work described in this report could not have been accomplished without the critical input from John Kartesz; National Plant Panel members (Mary Butterwick, William Kirchner, and Norman Melvin); Regional Panel members (Jae Chung, Gary Craig, Richard Darden, Tammy Fudge, David Knepper, Mary Lee Plumb-Mentjes, and Jim Spencer); and members of the National Technical Committee on Wetland Vegetation (David Cooper, Mike Gilbert, William Kruczynski, Donald Leopold, Paul Minkin, Lytton Musselman, Gerald Tande, Tina Teed, Ralph Tiner, Michelle Schuman, Hans Williams, and James Wiseman).

COL Kevin J. Wilson was the Commander and Executive Director of ERDC, and Dr. Jeffery P. Holland was the Director.

1 Introduction: Problems Associated with Cardinal Indicator Status Categories

For over two decades, the National List of Plant Species that Occur in Wetlands (Reed 1988), hereafter called List 88, has served as the standard reference for plant species' wetland indicator status ratings in the United States. These ratings are used for many purposes, including wetland delineations, assessment, mitigation, and habitat restoration. List 88 was developed by the US Fish and Wildlife Service (FWS) in cooperation with three other Federal agencies: the US Army Corps of Engineers (USACE), the US Environmental Protection Agency (EPA), and the US Department of Agriculture Natural Resources Conservation Service (NRCS), at that time, the Soil Conservation Service (Lichvar and Minkin 2008). Wetland indicator status ratings were assigned to plant species that occur in wetlands in 13 FWS regions. The five rating categories initially assigned to List 88 (Table 1) were developed based on a thorough review of the botanical literature and the best professional judgment of national and regional experts. Each plant species was assigned a rating that represented the estimated probability, or frequency, with which it was thought to occur in wetlands, as opposed to nonwetlands, across its entire range. Plus (+) or minus (–) indicators were used to describe species with frequencies that were intermediate between two categories.

The use of cardinal indicator status categories assigned to List 88 based on estimated frequency had one serious drawback. The numerical categories implied that these ratings were created from data collected using a sampling design and analyzed using an accepted mathematical formula. Unfortunately, there were no data, sampling designs, or mathematical

Table 1. Wetland indicator status ratings and their cardinal rating categories, as described in National List of Plant Species that Occur in Wetlands (Reed 1988).

Indicator Status (abbreviation)	% Occurrence in Wetlands
Obligate (OBL)	99
Facultative Wetland (FACW)	67–99
Facultative (FAC)	34–66
Facultative Upland (FACU)	1–33
Upland (UPL)	1

formulas to support the List 88 rating system. This type of data does not exist, because it is impractical to sample thousands of plant species at such a large scale. Randomly sampling wetlands and nonwetlands across even one species' range and determining its frequency of occurrence in wetlands would be a monumental undertaking.

In 2006, USACE assumed administrative responsibility for List 88, renaming it the National Wetland Plant List (NWPL) (https://wetland_plants.usace.army.mil). USACE initiated a national effort to update the NWPL indicator status categories, nomenclature, and geographic regions (Lichvar and Minkin 2008). To clarify the meaning and increase understanding of each wetland indicator status category, the wetland indicator ratings were transformed from cardinal categories, based on numerical frequencies, to ordinal categories, based on ecological descriptions (Table 2). The plus (+) and minus (–) indicators were eliminated. A web-based voting procedure was developed to assign these new, descriptive wetland indicator categories to a draft list of wetland plant species.

The use of wetland plant indicator statuses in applications such as hydrophytic vegetation determinations during wetland delineations is well documented (Wakeley et al. 1996; Wakeley and Lichvar 1997; Lichvar et al. 2011). Because they are used in delineation protocols for establishing jurisdictional boundaries under Sec. 404 of the Clean Water Act and for wetland compliance under the Food Security Act, indicator status ratings of certain species receive extra scrutiny and can be controversial. As straightforward as it may seem to categorize wetland plants, for certain species there is continual disagreement about their frequency of occurrence in wetlands. These differences become contentious when the wetland plant ratings fall into the FAC or FACU groups because of the possible impact on the jurisdictional determination.

Table 2. Wetland indicator status ratings and their ordinal rating categories, based on ecological descriptions.

Indicator Status (abbreviation)	Ecological Description*
Obligate (OBL)	Almost always is a hydrophyte, rarely in uplands
Facultative Wetland (FACW)	Usually is a hydrophyte but occasionally found in uplands
Facultative (FAC)	Commonly occurs as either a hydrophyte or nonhydrophyte
Facultative Upland (FACU)	Occasionally is a hydrophyte, but usually occurs in uplands
Upland (UPL)	Rarely is a hydrophyte, almost always in uplands.
*Source: Lichvar and Minkin (2008)	

During the NWPL update, we observed that participants contributing input on wetland ratings seem to have different concepts of a species' frequency of occurrence that are loosely associated with the style of studies and observations they perform. For example, wetland delineators and ecologists tend to categorize contentious FAC and FACU wetland plants into "wetter" indicator status groups than do botanists performing studies involving the entire landscape. In contrast, general botanists collecting data or plant specimens across the entire landscape from a variety of habitats have a "drier" perception of species frequency for the same species based on their experience at the landscape scale.

With the lack of frequency data for properly assigning wetland plants to the best group, the numerical frequency categories can become illusive when coupled with a lack of clear definitions describing the habitat and lifestyle of each indicator status group. This lack of refined descriptions for each indicator status group allows a distortion of one's observations of frequency in the field. An individual's observations, experiences, and purpose create a lens through which one perceives plant species' frequency. This contrast may explain differences of opinions between, for example, a general botanist who is collecting data or specimens across the entire landscape from a variety of habitats versus a wetlands botanist whose field experience has mostly involved visiting wetlands. Without real frequency data and well-defined descriptions of the habitats and species lifestyles, some species will never have a wetland rating to which all will agree. Acknowledging the reality that species frequency concepts are not based on real frequency data but rather on perceptions of frequency may lead to resolving some disagreements.

We have undertaken the effort to describe the limits of the ecological and biological boundaries for each indicator status in a rigorous fashion that is intended to provide a common description or target for each wetland indicator status category. Using these tighter definitions as a common lens through which we all can view our field observations will lead to more consistent wetland ratings for contentious species.

2 Methods for Updating Wetland Indicator Status Ratings

The NWPL's web-based update to assign wetland indicator status ratings to 9,751 plant species, including nearly 1,200 infraspecific taxa, began in 2009. This national effort includes eight rounds of voting, with participation from the National Plant Panel (NP), ten Regional Panels (RP), expert botanists, and professional/technical members of the public. Composed of botanists from the four cooperating agencies, the NP provided leadership and direction throughout the update. A list of panel members is available on the NWPL home page. They developed the ecological descriptions of each indicator status category (Table 2) and the voting methodology. The NP also produced the initial draft list of wetland plant species, after nearly 2,400 nomenclatural updates and geographic updates reflecting the switch from FWS to USACE regional boundaries had taken place (for details, see Lichvar and Minkin 2008; Lichvar and Kartesz 2009a). An independent, external scientific panel reviewed this initial draft list using a peer review process (Battelle Memorial Institute 2010).

In the first two rounds, RPs composed of wetland ecologists from the four cooperating federal agencies cast 80,000 on-line votes, assigning the descriptive wetland indicator categories to more than 3,742 plant species in 11 USACE regions. The RPs relied on the botanical literature and their best professional judgment of plant frequency, abundance, and percentage of wetlands in the landscape to assign each species to a descriptive wetland indicator category (for detailed voting instructions, see Lichvar and Minkin 2008). RPs were also able to consider votes cast in previous revisions in 1988 and in 1996 for the numerical rating categories, since these votes are available through links on the NWPL home page (https://rsgis.crrel.usace.army.mil/NWPL_CRREL/docs/fws_lists/l96_intro.html). In addition, Robert Mohlenbrock, national botanist emeritus, rated 2,009 species that lacked votes. He cast 3,502 votes in 8 USACE regions. On the NWPL website, these votes are shown as round 2.5.

Prior to round 3, the NP decided that the NWPL would only have wetland ratings at the species level and that all infraspecific species would be treated equally within the concept of the species level for each wetland species ratings.

In round 3, a group of 24 external academic/professional botanists not associated with the four agencies broke ties that occurred in the first two rounds and reviewed specifically identified species, such as former FAC– species from nine USACE regions. The new ratings of the 431 former FAC– species were almost equally split between the FAC and FACU categories. Overall, the external botanists reviewed a total of 2,447 species and made 4,575 indicator status determinations in 10 USACE regions. In round 4, the NP reviewed the list and removed 41 crop plants (e.g., *Solanum lycopersicum* [tomato] and *Zea mays* [corn]), reducing the total number of species in the NWPL update to 8,200. Mary Butterwick (EPA), John Kartesz (Biota of North America Program), and Robert Lichvar (USACE) made 618 indicator status determinations in 9 USACE regions for 353 species that were still unrated. Each species on the national list had now received at least one baseline determination vote in round 1, 2, 2.5, or 4.

In round 5, the RPs reviewed the external botanists' votes from round 3. Six RPs amended their baseline determination for 14 species after considering the external botanists' input. Two RPs challenged 78 votes and provided supporting evidence for their baseline determinations for certain species. Mohlenbrock rescinded three of his votes that were challenged by the Alaska RP. The Atlantic and Gulf Coastal Plain Region (SE) challenged 75 votes cast by the external botanists, with a focus on 14 common plants. The NP decided that the votes of both the SE RP and the external botanists would be posted on the NWPL for the public to consider when voting. In addition, the voting links for all 75 species were highlighted in green on the NWPL "results" page, and the *Federal Register* (FR) noted that "more input is needed" for these species. NP members reviewed the list again and obtained approval from their agencies' headquarters to move forward to an FR public notice. By this point, 90,000 votes had been cast. The list was made available for public comment via a January 2011 FR notice.

During round 6, the public provided input on 45% of the NWPL, voting on 3,665 of the 8,200 species on the list. Most of the votes (78.0%) were placed in the FACW, FAC, and FACU categories. A total of 16,397 votes were cast in 10 USACE regions. Approximately half (49.0%) of the voters were affiliated with a federal or state government agency. An additional 45.5% were affiliated with environmental consulting firms. A small percentage of voters were affiliated with Universities (2.1%) or a native plant society (0.4%). The affiliation of 3.0% of the voters could not be determined.

After the FR comment period closed on 21 March 2011, we calculated the percentage of votes each species received in each indicator status category (OBL-UPL). To obtain a percentage, we tallied the number of votes for each indicator category, divided by the total number of votes for that species, and multiplied by 100. These results were posted as R6(FR) on each species' web page.

A species' indicator status was considered resolved if the category that received the largest percentage of public votes matched the species' baseline determination. Species that received no public input were also considered resolved if the panels and the external botanists agreed on a status rating.

In round 7, the RPs will consider ratings for 125 newly proposed species. The panels will also review 2,791 species from nine regions with conflicting ratings. Species will be considered resolved if an RP agrees to change its baseline determination to match the status proposed by external botanists and/or the public. The final step in updating the NWPL will be for the NP to assign a wetland indicator status to each species that has not been resolved by consensus and agreed upon by the RPs. To resolve this list, the NP will meet in person, along with one or more professional botanists hired by contract. At the meeting, each species will be reviewed based on all input received throughout the entire update process. The NP will question the professional botanists to obtain information on habitat, existing herbarium specimens, literature, etc. (The professional botanist will not be able to cast a vote on the status of the species.) Then the NP, using all input and information, will assign each unresolved species an indicator status using the revised wetland category definitions designed specifically for this purpose, which we present here.

Kartesz and Lichvar developed the initial concepts and skeletal descriptions of the indicator status groups. These draft definitions were then refined by the NP through a series of revisions. Once the NP completed its draft, the definitions were reviewed and evaluated for technical soundness by the RPs and the National Technical Committee on Wetland Vegetation (NTCWV), a panel of expert botanists tasked with advising the National Advisory Team and Regional Working Groups during the update of the Corps of Engineers Wetland Delineation Manual and the development of Regional Supplements. Their comments and suggestions are summarized in Table 3 and Table 4.

Table 3. Summary of points that most RP and NTCWV members either agreed or disagreed on when critiquing the first draft of "Key to be used by the National Plant Panel to assign wetland ratings to unresolved plant species."

Critics Agreed	Critics Disagreed
Couplets lack parallel structure. Must have this.	Omit "mesic" and "xeric." Define all categories in terms of "hydric."
Omit word "Aquatic" in OBL species description.	Omit "upland/wetland." Use "hydric," "mesic," and "xeric" instead.
Omit "always" (maybe replace with 95-99% of the time).	Omit "hydric," "mesic," and "xeric." Use only "upland/wetland."
Plant examples must have the same indicator status rating across the U.S.	Don't use "upland." Use "nonwetland" instead.
We should include UPL species in this key.	Include "upland" in key, but don't use "lowland."
Don't use *Taxodium distichum* as an OBL emergent example; it often does not grow in standing water. Some *Nelumbo* spp. are emergent.	Some felt the definition of "mesic" was too dry; mesic habitats have hydric soils and FACW species grow there. Others felt mesic habitats were drier and FAC and FACU species grow there.
Distinguish between OBL floating and OBL floating-leaved rooted plants.	Use NRCS soil drainage classes to define "hydric," "mesic," and "xeric."
Hydrology language (describing how much water is present and for how long) needs to be reworked (several different suggestions).	Use literature citations in the 1988 list to determine whether a species occurs in "hydric," "mesic," and "xeric" habitats.
"Under these conditions" is unclear. What does it modify? Maybe move to the beginning of sentence.	Use Curtis (1959) to define "hydric," "mesic," and "xeric" habitats.

Table 4. Detailed suggestions offered by RP and NTCWV members when critiquing the first draft of "Key to be used by the National Plant Panel to assign wetland ratings to unresolved plant species."

Name	General Comments	OBL	FACW	FACU	FAC
Knepper (RP, USACE)		Examples of emergents that are always found in seasonally saturated soil only (i.e., not ponded areas)?		Habitats where they dominate should be described first; the majority of occurrences are in upland habitats with non-hydric soils or hydric soils where hydrology has been removed.	Any examples of plants that the NP feels are clearly FAC?
Schuman (RP and NTCWV NRCS)	All categories should be defined in terms of hydric soils	OBL – Sustain optimum growth, production, and in water but can also survive in seasonally saturated hydric soils.	FACW – Plants that sustain optimum growth and production in seasonally saturated hydric soils but can survive in dry conditions (delete the rest).	FACU – Plants that can survive in moist or seasonally saturated hydric soil conditions but reproduction and growth is poor.	FAC – Plants that can survive and reproduce in seasonally saturated hydric soils and have adapted to a wide range of moisture, temp, and other environmental variables.
Wiseman (RP and NTCWV, USACE)				The opposite of wetland is not upland!	Replace habitat with "environments" or "communities."
Williams (NTCWV, academia)		OBL – Replace "optimal" with "adequate" or "viable" and omit "maintain healthy"; replace with "sustain viable" for all categories.	FACWs occur in both uplands and hydric soils??? Doesn't make sense.		
Tiner (NTCWV, USFWS)	All categories in terms of "wetland dependency"? All examples too heavy on AK plants and indicator status ratings.	OBL and FACW are solely and mostly wetland dependent.	Change "hydric soils" to "wetter hydric soils"_where water saturates or floods the soil for extended periods seasonally.	FAC and FACU are not wetland dependent but have adapted. *Cornus sericea* and *Pilea pumila* are not FACU. Use *C. florida* as a FACU example.	Add "and prolonged saturation" tolerance of water. Add "drier" to modify "upland habitats."

Name	General Comments	OBL	FACW	FACU	FAC
Minkin (RP and NTCWV, USACE)	What about genetic variability?	Both standing water and soil saturation can be seasonal. Use "saturated soils, at least seasonally." Use 14 consecutive days.	FACW – Too heavy on AK plants and indicator status ratings.	List is based on frequency of occurrence in wetland, not how wet the wetland is.	
Musselman (NTCWV, academia)		OBL – Also consider Lemnaceae, or *Pistia, Azolla, Salvinia, Eichornia*	FACW – Too heavy on bog plants.	FACU – *Solidago*-complex genus. Use less complex example?	
Spencer (RP, NRCS)			Occupy mesic sites	Occupy mesic to xeric sites	Occupy xeric, mesic, and hydric sites
Chung (RP, USACE)				Is FACU found in hydric or xeric/mesic? Can't tell.	
Gilbert (RP and NTCWV, USACE)	Use some standard reference to define xeric, mesic, and hydric habitats, e.g., use the FWS 1988 species reference citations to assign hydric, mesic, xeric habitats; then translate habitats into new indicator status. Or use Curtis (1959).				
Fudge (RP, USACE)	Mentioned correlations between these three ecological categories and the seven NRCS natural drainage classes. Xeric = dry, Mesic = well drained (moist), Hydric = wet, Applicable to the Piedmont.				
Plumb-Mentjes (RP, USACE)	Verbal descriptions take us farther from our goals; numbers are more helpful to quantify categories.				

3 Results: Key for National Plant Panel to Use When Assigning Wetland Ratings to Unresolved Plant Species

We considered all comments (Table 3 and Table 4) and incorporated many of them in the final version of the purposes and definitions of each of the wetland plant indicator status categories provided below.

3.1 Definitions for assigning wetland ratings to unresolved species

The following definitions will be used as part of the protocol to assist in making final decisions for wetland ratings of unresolved species after the closure of the FR notice. These definitions are not intended to replace any existing definitions for the wetland plant indicator categories (Reed 1988; Lichvar and Minkin 2008); rather, they are intended to refine boundaries for the nonwetland and four wetland categories by including certain physical and biological characteristics associated with them. These refined definitions will assist the NP in its final efforts to assign wetland ratings for those species that are still unresolved after the FR comments and input are assessed.

Using defined categories for each of the indicator groups helps address two problems:

1. They more discretely define the physical and biological characteristics of the habitat to be evaluated for a species occurrence.
2. They help to more discretely assign species into one of the wetland plant indicator categories in the absence of frequency occurrence data.

First, the habitat description “mesic” is problematic in assigning wetland ratings because different authors and plant collectors use the term differently. The habitat descriptions used here are based heavily, but not entirely, on Curtis (1959). We define mesic as occurring in a variety of habitats, typically with dense vegetation that shades “damp or moist” soils that are not hydric. In these settings, organic matter, which accumulates as plants decay, moderates soil temperatures and increases the soil’s water-holding capacity. The large percentage of pore space in mesic soils pro-

motes infiltration throughout the upper part of the profile. Soils therefore are generally well drained yet almost always moist.

Nationally, the habitat description "xeric" is based in two different concepts. The xeric habitats of the Arid West typically occur in areas of low rainfall and in what are referred to as desert conditions. The other concept of xeric occurs throughout the remainder of the country in habitats often, but not always, located on hilltops and ridges, on south- or west-facing slopes, or on flatlands with sandy, porous soils. Vegetative cover in xeric habitats is sparser than the vegetation associated with mesic soils. As such, more sunlight reaches the soil surface, creating warmer, drier conditions in the rooting zone. Surface runoff and wind often erode topsoil, maintaining a shallow, excessively well drained to dry soil profile with a low water-holding capacity.

The definitions are specifically designed to separate out the UPL and OBL plants and then clarify the distinction between FACW and FACU plants, for which the associated habitats and the tolerance for wetland conditions are easier to describe than for the FAC category. Distinguishing the FACW and FACU groups brings clarity to the more variable FAC group by the simple logic that FAC species "sit" somewhere between these other two more predictable categories. The nomenclature is according to Kartesz (2009). The example species for each wetland indicator group are according to Lichvar and Kartesz (2009b).

3.2 Key to wetland rating groups

For the purpose of placing a plant species into a defined group to assign a wetland rating, we present here a simple key:

1. Plants that almost never occur in water[1] or saturated soils.[1] In these xeric and nonwetland habitats, the plants exhibit optimum growth and healthy[2] populations.. ..... UPL

1. Plants that infrequently to nearly always occur in standing water[1] or saturated soils.[1] Preferred habitats various.

    2. Plants that always occur in standing water[1] or in saturated soils.[1] In this preferred habitat, the plants exhibit optimum growth and healthy populations.[2] This group typically includes all growth forms but is dominated by submergent, floating, floating-leaved, or emergent forms. ..... OBL

    2. Plants that occur in standing water[1] or in saturated soils[1] less frequently than "always." Typical growth forms for this group include herbaceous, shrubs, woody vines, and trees.

        3. Plants that nearly always occur in areas of prolonged flooding or require standing water[1] or saturated soils[1] to exhibit optimum growth and healthy[2] populations. This group may, on rare occasions, occur in nonwetlands. ..... FACW

        3. Plants that occur in a variety of habitats, including wetland and nonwetlands and do not necessarily require, but may sometimes occur in, standing water[1] or saturated soils.[1]

            4. Plants that typically occur in xeric or mesic nonwetland habitats but may frequently occur in standing water[1] or saturated soils.[1] ..... FACU

            4. Plants that occur in a variety of habitats, including wetland and mesic to xeric nonwetland habitats but often occur in standing water[1] or saturated soils.[1] ..... FAC

[1] Present at least seasonally, meaning 14 or more consecutive days in the growing season in most years.

[2] Healthy, as used here, includes population size, vigor, and reproductive capabilities.

3.3 Wetland category definitions and examples

3.3.1 Upland (UPL)

These plants occupy mesic to xeric nonwetland habitats. They almost never occur in standing water or saturated soils. Typical growth forms include herbaceous, shrubs, woody vines, and trees. Examples of upland plants include *Artemisia vulgaris* (common wormwood), *Epilobium brachycarpum* (tall annual willow herb), *Prenanthes aspera* (rough rattlesnake root), and *Quercus prinus* (chestnut oak).

3.3.2. Obligate (OBL)

These wetland-dependent plants (herbaceous or woody) require standing water or seasonally saturated soils (14 or more consecutive days) near the surface to assure adequate growth, development, and reproduction and to maintain healthy populations. These plants are of four types:

- Submerged (plants that conduct virtually all of their growth and reproductive activity under water);
- Floating (plants that grow with the leaves and most often their vegetative and reproductive organs floating on the water surface);
- Floating-leaved (plants that are rooted in sediment but also have leaves that float on the water surface); and
- Emergent (herbaceous and woody plants that grow with their bases submerged and rooted in inundated sediment or seasonally saturated soil and their upper portions, including most of the vegetative and reproductive organs, growing above the water level).

Examples of submerged plants include *Myriophyllum* spp. (water milfoil), *Najas* spp. (water-nymph), and *Potamogeton* spp. (pondweed).

Examples of floating plants include *Lemna minor* (common duckweed), *Brasenia schreberi* (watershield), and *Wolffia borealis* (northern watermeal).

Examples of floating-leaved plants include *Marsilea vestita* (hairy water clover), *Nuphar lutea* (yellow pond lily), and *Nymphaea odorata* (American water lily).

Examples of emergent plants include *Sagittaria* spp. (arrowhead), *Typha* spp. (cattail), *Zizania aquatica* (Indian wild rice), *Downingia bicornuta* (double-horned calico flower), *Cephalanthus occidentalis* (common buttonbush), *Nelumbo lutea* (Amercian lotus), *Carya aquatica* (water hickory), *Leersia oryzoides* (rice cut grass), *Acorus americanus* (sweetflag), *Carex aquatilis* (leafy tussock sedge), and *Toxicodendron vernix* (poison sumac).

3.3.3. Facultative Wetland (FACW)

These plants depend on and predominately occur with hydric soils, standing water, or seasonally high water tables in wet habitats for assuring optimal growth, development, and reproduction and for maintaining healthy populations. These plants often grow in geomorphic locations where water saturates soils or floods the soil surface at least seasonally.

Examples include *Carex scoparia* (broom sedge), *Aconitum columbianum* (Columbian monk's hood), *Cornus amomum* (silky dogwood), *Eleocharis compressa* (flat-stem spike rush), *Equisetum variegatum* (variegated scouring rush), *Lysimachia ciliata* (fringed yellow loosestrife), *Platanthera dilatata* (scentbottle), *Salix amygdaloides* (peach-leaf willow), *Ranunculus flammula* (greater creeping spearwort), *Ranunculus inamoenus* (graceful buttercup), *Sanguisorba canadensis* (Canadian burnet), *Symphyotrichum novae-angliae* (New England aster), *Viola nephrophylla* (northern bog violet), *and Tamarix chinensis* (five stamen tamarisk).

3.3.4. Facultative Upland (FACU)

These plants are not wetland dependent. They can grow on hydric and seasonally saturated soils, but they develop optimal growth and healthy populations on predominately drier or more mesic sites. Unlike Facultative Wetland plants, these plants are nonwetland plants by habitat preference.

Examples include *Amaranthus albus* (tumbleweed), *Achillea millefolium* (common yarrow), *Arabis hirsuta* (hairy eared rockcress), *Ambrosia artemisifolia* (annual ragweed), *Betula papyrifera* (paper birch), *Carex eburnea* (bristle-leaf sedge), *Carya ovata* (shag-bark hickory), *Elymus glaucus* (blue rye grass), *Eragrostis pilosa* (Indian love grass), *Oenothera biennis* (king's-cureall), *Ostrya virginiana* (eastern hop-hornbeam),

Prunus serotina (black cherry), *Phleum pretense* (common timothy), *Sarcobatus vermiculatus* (greasewood), *Solidago canadensis* (Canadian goldenrod), *Schizachyrium scoparium* (little false bluestem), and *Tilia americana* (American basswood).

3.3.5. Facultative (FAC)

These plants can occur in wetlands or nonwetlands. They can grow in hydric, mesic, or xeric habitats. The occurrence of these plants in different habitats represents responses to a variety of environmental variables other than just hydrology, such as shade tolerance, soil pH, and elevation, and they have a wide tolerance of soil moisture conditions. The FAC category is the most challenging to determine. First, determine whether a plant is better placed in the FACW or FACU categories. If it does not fit well into either category, by simple deduction it fits the middle category of FAC.

Examples include *Agrostis scabra* (rough bent grass), *Cornus drummondii* (rough-leaf dogwood), *Carpinus caroliniana* (American hornbeam), *Pseudognaphalium stramineum* (cotton-batting-plant), *Staphylea trifolia* (American bladdernut), *Ulmus rubra* (slippery elm), and *Zizia aurea* (golden alexander).

4 Discussion

These definitions will improve clarity in assigning wetland indicator statuses in two ways. First, they more discretely define the physical characteristics of the habitat to be evaluated for a species' occurrence. The term "mesic" has been particularly problematic for assigning wetland ratings because botanists and ecologists tend to use the term differently (Table 3 and Table 4). We also noticed regional differences among experts and their usage of the terms "mesic" and "xeric." Selection of a standard benchmark definition for the term "mesic habitat" (heavily based on Curtis 1959) ensures that all final decisions on wetland indicator status ratings will be made using the same frame of reference.

Second, these definitions more discretely assign species into one of the new descriptive indicator categories by clearly separating the requirements to fit into a category and by forcing a process of elimination. The definitions are presented in the form of a dichotomous key to first separate out the extremes: Upland (UPL) and then Obligate (OBL) plants. Next, the distinction between Facultative Wetland (FACW) and Facultative Upland (FACU) plants is clarified based on their requirement for wetland conditions and their preferred habitats. Distinguishing the FACW and FACU groups helps bring clarity to the more variable Facultative (FAC) category, by the simple logic that FAC species "sit" somewhere between these other two more predictable categories.

5 Conclusion

Using these definitions, the National Plant Panel will complete the last step in this national effort to update the NWPL's wetland plant indicator categories. The initial list of 9,751 plant species underwent 2,400 nomenclatural changes, 41 crop species were removed, and most of the remaining 8,200 plant species were assigned an ordinal wetland rating. Those species that were not assigned ratings by consensus will be assigned ratings from ecologically based descriptions. The development of these refined category definitions is paramount in finalizing the NWPL using the best possible approaches based on scientific concepts. A forthcoming report will summarize each round of voting and regional changes to indicator status that may have occurred during the NWPL update.

Finally, in acknowledgment of the lack of landscape-level frequency and abundance data, the NWPL update includes a provision allowing challenges to a species' wetland indicator status (Lichvar and Minkin 2008). After the NWPL is finalized, individuals and/or institutions may petition for a change in the indicator status of any taxon using study design guidelines and a protocol for submitting challenge data developed by the NTCWV and the NP. Procedures for validating and evaluating challenge data are currently under consideration. This process will ensure that proposed additions or changes to the NWPL are evaluated using data collected at an appropriate scale and are analyzed using scientific methods.

References

Curtis, J.T. 1959. *The Vegetation of Wisconsin: An Ordination of Plant Communities*. Second edition. Madison, WI: University of Wisconsin Press.

Battelle Memorial Institute. 2010. *Final Independent External Peer Review Report for National Wetland Plant List Update*. Contract No. W911NF-07-D-0001. Lexington, MA: Battelle Memorial Institute. https://wetland_plants.usace.army.mil.

Kartesz, J.T. 2009. *Floristic Synthesis of North America, Version 1.0*. Chapel Hill, NC: Biota of North America Program (BONAP).

Lichvar, R., and J.T. Kartesz. 2009a. *Nomenclature of the National Wetland Plant List*. ERDC/CRREL TN-09-01. Hanover, NH: U.S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory. http://libweb.erdc.usace.army.mil/Archimages/2810.PDF.

Lichvar, R.W., and J.T. Kartesz. 2009b. *North American Digital Flora: National Wetland Plant List, Version 2.1.0*. Hanover, NH: U.S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory, and Chapel Hill, NC: BONAP. https://wetland_plants.usace.army.mil.

Lichvar, R., and P. Minkin. 2008. *Concepts and Procedures for Updating the National Wetland Plant List*. ERDC/CRREL TN-08-03. Hanover, NH: U.S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory. http://libweb.erdc.usace.army.mil/Archimages/2295.PDF.

Lichvar, R.W., J.J. Gillrich, and W.R. Ochs. 2011. Discrepancies in hydrophytic determinations produced by three vegetation formulas used for wetland delineations. *Wetlands* 31:603-11.

Office of the Federal Register. 2011. Notice. National Wetland Plant List. *Federal Register* 76(4)/January 6, 2011:777–780.

Reed, P.B., Jr. 1988. *National List of Plant Species that occur in Wetlands*. Biology Report 88(26.1). Washington, DC: U.S. Fish and Wildlife Service.

Wakeley, J.S., and R.W. Lichvar. 1997. Disagreements between plot-based prevalence indices and dominance ratios in evaluations of wetland vegetation. *Wetlands* 17: 301–309.

Wakeley, J.S., S.W. Sprecher, and R.W. Lichvar. 1996. Relationships among wetland indicators in the Hawaiian rain forest. *Wetlands* 16: 173–184.

Acronyms and Abbreviations

CRREL	Cold Regions Research and Engineering Laboratory
EPA	United States Environmental Protection Agency
ERDC	Engineer Research and Development Center
FAC	Facultative (indicator status)
FACW	Facultative Wetland (indicator status)
FR	Federal Register
FWS	United States Fish and Wildlife Service
NP	National Plant Panel
NRCS	Natural Resources Conservation Service
NTCWV	National Technical Committee on Wetland Vegetation
NWPL	National Wetland Plant List
OBL	Obligate (indicator status)
RP	Regional Panel
RS/GIS	Remote Sensing/Geographic Information Systems
SE	Atlantic and Gulf Coastal Plain Region
UPL	Upland (indicator status)
USACE	United States Army Corps of Engineers

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
September 2011	Technical Note	

4. TITLE AND SUBTITLE

Final Protocol for Assigning Wetland Indicator Status Ratings to the 2011 National Wetland Plant List

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Robert W. Lichvar and Jennifer J. Gillrich

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

US Army Engineer Research and Development Center
Cold Regions Research and Engineering Laboratory
72 Lyme Road
Hanover, NH 03755-1290

8. PERFORMING ORGANIZATION REPORT NUMBER

ERDC/CRREL TN-11-1

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Wetland Regulatory Assistance Program
US Army Corps of Engineers
Washington, DC 20314-1000

10. SPONSOR/MONITOR'S ACRONYM(S)

WRAP, USACE

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

Available from NTIS, Springfield, Virginia 22161.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

This report is the third in a series of reports (see also ERDC/CRREL TN-08-3 and ERDC/CRREL TN-09-1) documenting procedures used in updating the National Wetland Plant List, formerly called the National List of Plant Species that Occur in Wetlands. This national effort was led by four Federal agencies: the US Army Corps of Engineers, the US Environmental Protection Agency, the US Fish and Wildlife Service, and the Natural Resources Conservation Service. The update of plant species indicator status ratings involved five rounds of voting by national and regional botanists, with evaluation by wetland ecologists and input from professional scientists from the public and academic institutions. This report describes the voting process and the set of wetland indicator status definitions that will be used to make final decisions for species with ratings that remain unresolved after the final round of voting from the public.

15. SUBJECT TERMS

National Wetland Plant List
Wetland delineation
Wetland plants

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER *(include area code)*
Unclassified	Unclassified	Unclassified	Unclassified	26	