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Field Testing the Proposed Federal Wetlands Delineation Manual

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Commonwealth's Declared Policy:

"to preserve the wetlands and to prevent their despoliation and destruction. . ."

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In fulfilling their charge to protect our remaining wetland resources, federal agencies must be able to delineate those wetlands (i.e., determine the boundary line that separates the wetland from the upland). Prior to 1989, each federal regulatory agency had its own method for delineating wetlands; the boundary lines drawn by different agencies were often inconsistent with each other. Since 1989, federal regulators have relied on a manual jointly produced by scientists from four federal agencies (Army Corps of Engineers, Environmental Protection Agency, Soil Conservation Service, and the Dept. of Interior Fish and Wildlife Service) to draw this boundary. Recently, the 1989 version of the manual has come under criticism from developers and agricultural interest groups as being too restrictive. In response to these groups, the current administration has proposed changes to the 1989 manual. On August 14, 1991, a draft copy of the proposed manual was printed in the Federal Register. In conjunction with its publication, state and federal agencies were asked to field test the proposed manual.

In August 1991, the staff of VIMS Wetlands Program, as part of an interdisciplinary/interagency field team comprised of both federal and state agency representatives, spent two weeks testing the scientific validity and technical consistency of the proposed revisions to the 1989 *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (hereinafter referred to as "proposed Manual"). Field tests were conducted on eight sites, each representing a distinct geographic and geomorphic area within the Commonwealth of Virginia. Jurisdictional wetland determinations were made on representative wetlands of each site according to the criteria presented in the proposed Manual. Methods used to collect the necessary data were taken directly from the proposed Manual. For comparison, delineations/determinations with the 1989 Manual were made using the methods taken from that Manual. Both manuals use a definition of wetlands which is based on three parameters: hydrology (wetness), soils, and vegetation. For each of these parameters, the manuals set out specific, but different,

(continued)

criteria which an area must meet in order to be considered a jurisdictional wetland. Clarity, consistency, and accuracy of the proposed Manual were discussed throughout the fieldwork.

Site Descriptions

Eight sites representing distinct geographical and geomorphic areas of the Commonwealth of Virginia were tested. A summary of each of the sites is given in Table 1.

Table 1

Description of field sites used for testing the proposed Manual.

SITE: HABITAT TYPE

Back Bay National Wildlife Refuge: Freshwater emergent, scrub/shrub, maritime forest, and interdunal swale, barrier island spit system.

Caledon Natural Area: Emergent and forested upper coastal plain headwater system.

Catlett Islands: Evergreen maritime forest, emergent and shrub/scrub tidal estuarine bay island system.

Chickahominy River: Emergent and forested, upper coastal plain palustrine/ riverine bottomland system.

Grafton Ponds: Vernal pools interspersed throughout a pine-oak seasonal wetland forest.

Great Dismal Swamp National Wildlife Refuge: Perched coastal plain forested ecosystems.

Huntley Meadows Park: Forested, upper coastal plain creek headwaters system.

York River State Park: Forested seasonally tidal, emergent and shrub/scrub tidal, estuarine embayment system.

Results And Discussion

Although unique problems with application of the proposed Manual were encountered at each site, several major problems recurred on nearly every site. Major problems were encountered with 1) interpretation of the hydrology criterion and 2) limiting vegetation methods to the use of a prevalence index only.

The first and perhaps the most important problem encountered was differing interpretations of the hydrology criterion of the proposed Manual by the field scientists. The term hydrology refers to the unique physiochemical conditions that distinguish wetlands from both well-drained uplands and deepwater habitats (Mitsch and Gosselink, 1986). We found that two very different interpretations were possible. These can be referred to as a "conservative" and a "liberal" interpretation, in reference to the weight that could be applied to the indicators listed for the hydrology criterion.

A conservative interpretation of the proposed Manual would hold that if the hydrology criterion states that 15 consecutive days of inundation or 21 consecutive days of saturation are necessary to meet the criterion, then the evidence ("indicators") presented to substantiate the hydrology criterion should be scientifically defendable. Evidence such as wet areas on aerial photographs (representing only one day), oxidized rhizospheres, hydrogen sulfide odor (both take only 7 to 14 consecutive days of saturation to become apparent), buttressed tree trunks and shallow rootstocks (these may be artifacts of former conditions, i.e. wetland hydrology may no longer be present) cannot be used to show that the hydrology of the site meets the 15 consecutive days of inundation or 21 consecutive days of saturation to the surface. Therefore, if a conservative interpretation is adopted, only the presence of long-term hydrology data, such as monitoring wells or gauges, would be sufficient to determine the presence of wetland hydrology on a site.

A liberal interpretation holds that the proposed Manual allows delineators to accept the evidence provided by indicators presented in the proposed Manual as sufficient to meet the

hydrology criterion, even though it would not be scientifically defendable.

To avoid prolonged discussions concerning the two interpretations, the team decided that whenever valid questions of interpretation arose, an "uncertain" call would be made on the hydrology criterion. As can be seen in the summary of the sites (Table 2), questions arose on the hydrology interpretation in a majority of the sites tested (15 out of the 27). This points out a major problem in the proposed Manual: since two interpretations of the hydrology criterion are possible, field wetland determinations would not be consistent. Before consistent delineations/ determinations can be conducted with the proposed Manual, the hydrology criterion must be clarified.

Table 2

Site summary sheet for field testing of the proposed Manual.

	Vegetation		Soils		Hydrology			
Virginia Field Testing Data Summary Draft-9/10/91	P.I.	Ratio of FACW/FAC/ FACU	FAC Neut. Test	Field Verif. Hydric Soil?	Depth to Water in Hole	Indicators	1989 Manual Wetland	1991 Manual Wetland
Dismal Swamp 1	2.76	1/6/0	Y	Y	-8"	B,L,P,T	Y	U
Dismal Swamp 2	2.38	2/5/0	Y	Y	+6"	B,P,T	Y	U
Dismal Swamp 3	2.78	1/4/2	N	Y	0"	B,L,P,T	Y	U
Back Bay 1		2/0/0	Y	Y	+6"		Y	Y
Back Bay 2	1.74	4/0/0	Y	Y	+(4"-6")	O	Y	Y
Back Bay 3	1.77	2/1/0	Y	Y	+(0"-6")		Y	U
Back Bay 4	2.81	1/3/0	Y	Y	+(4"-8")	B,H	Y	U
Chickahominy 1	1.22	1/0/0	Y	Y	+4"	A,B,P,S	Y	U
Chickahominy 2	3.12	0/6/1	N	N	Dry at 43"		N	N
Chickahominy 3	2.88	0/6/0	N	Y	-(4"-8")	B,D,P,R	Y	U
Chickahominy 4	1.96	3/3/0	Y	Y	-14"	B,O,P	Y	U
Chickahominy 5	1.71	4/0/0	Y	Y	Dry at 48"	O,P,S	Y	U
Caledon 1	2.62	2/2/0	Y	Y	Dry at 50"	B,O,P,R	Y	U
Caledon 2	3.55	0/1/2	N	N	Dry at 35"	B	N	N
Caledon 3	2.59	3/5/1	Y	Y	Dry at 48"	B,L,O,P,W	Y	U
Caledon 4	3.56	0/3/1	N	Y	Dry at 36"	B,P,R	Y	N
Caledon 5	3.33	2/2/0	Y	Y	Dry at 46"	O	Y	N
Grafton 1	1.76	2/0/0	Y	Y	0"	B,H,P,T,V,W	Y	Y
Grafton 2	2.18	5/1/0	Y	Y	-14"	B,O,T,V,W	Y	Y
Grafton 3	3.04	1/6/0	Y	Y	Dry at 36"	O	Y	N
York River 1	1.0	1/0/0	Y	Y	0	A,H,S,P	Y	Y
York River 2	2.0	2/0/0	Y	Y	0	A,D,H	Y	Y
York River 3	2.0	2/0/0	Y	Y	-2"	H,L,P	Y	Y
Catlett 1	3.43	0/4/3	N	N	-52"		N	N
Catlett 2a	3.42	0/1/1	N	N	Dry at 60"		N	N
Catlett 2b	3.02	2/2/1	Y	N	-45"		N	N

Key to Hydrology Indicators

Y Yes	A Aerenchyma	L Hypertrophied Lenticels	S Sediment Deposits
N No	B Blackened Leaves	O Oxidized Rhizospheres	T Buttressed Trunks
U Uncertain	D Drift Lines	P Drainage Patterns	V Vernal Pool
	H Hydrogen Sulfide Odor	R Shallow Roots	W Water Marks

The second major problem that arose in the field was the time needed to complete the prevalence index (PI) for the vegetation criterion. The PI is the only method of measuring vegetation allowed in the proposed Manual. The PI involves establishing three, 200 ft. long sampling lines on the site. At two foot intervals along each line, the species of vegetation intersected by an imaginary line perpendicular to the sample line is recorded. The total number of times an individual species is encountered, the indicator status of the species (discussed later in this report), and the total number of species encountered are used to calculate a "weighted average" (WA) for the site. If the calculated WA is less than three, then, according to the proposed Manual, the vegetation is dominated by a prevalence of wetland (hydrophytic) vegetation and meets the hyhdrophytic wetland criteria. Using experienced botanists (four on each sample line), up to an hour was needed to complete each line. According to the method presented in the proposed Manual, a standard error for the three lines must be calculated. If size of the standard error exceded 0.20, three more lines must be sampled.

A wetland ***determination*** is simply determining whether or not the site sampled is a wetland. A ***delineation*** is the drawing of the wetlands/upland boundary line. In order to complete a *delineation*, three lines must be run *at each point* where a determination is made along a gradient. To accomplish one delineation point on a site, it would have taken our team of experienced botanists a minimum of nine hours, assuming that the standard error of the prevalence index for the individual point fell within the defined limits ($\leq$0.20). Since we had many sites to test, we decided that a delineation based on the prevalence index would be too time consumptive. Therefore, two modifications were made in our design: 1) if the prevalence index for a transect was under 2.75 or over 3.25, second and third lines were not run, and 2) no delineations were attempted.

The prevalence index was created for measuring grass and/or herbaceous systems. In order to use the method in a forested system, special tools are required (Mueller-Dombois and Ellenberg, 1974). Other methods have been developed for forested systems that are as quantitative (and much more accurate) and take much less time. Many of these were developed as professional forestry tools for determining the economic value of timberland. These include the Bitterlich gauges and prism angles, all still in use by many ecologists and foresters today. Other descriptive methods such as stem density counts, cover estimates, and distance measures have been validated by extensive studies (see Mueller-Dombois and Ellenberg, 1974).

Another problem which we encountered in the proposed Manual was the use of the Facultative (FAC) Neutral Test: Although the proposed Manual requires the use of the prevalence index for determining presence of hydrophytic vegetation, the Federal Register also sought comments on the use of a "FAC neutral" test. When testing for the presence of hydrophytic vegetation in past manuals (1987 and 1989 versions), the dominant plant species of a site would be determined by the use of several different ecological techniques (see discussion on techniques above). The indicator status of each dominant species is then determined. Indicator status is defined as the probability of finding a certain plant species in a wetland (Table 3). There are five indicator status categories: obligate wetland species (OBL), facultative wetland species (FACW), facultative species (FAC), facultative upland species (FACU), and upland species. The status of nearly all plants that occur in the United States has been established by a board of ex-

Table 3

Indicator status categories used in determining the presence of hydrophytic vegetation. % is the probability of a plant species being found in a wetland.

STATUS	CODE	%
obligate	OBL	99
facultative wetland	FACW	67-99
facultative	FAC	34-66
facultative upland	FACU	1-33
upland	UPL	<1

perts and are listed in regional publications provided by the federal government (Reed, 1988a, 1988b).

A wetland species was defined by previous manuals as one that has an indicator status of either OBL, FACW, or FAC. Some examples are listed in Table 4. Hydrophytic vegetation was

Table 4

Some examples of obligate (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU), and upland (UPL) plants in Virginia.

INDICATOR STATUS	SPECIES
OBL	bald cypress
	water gum
FACW	green ash
	black willow
FAC	red maple
	sweetgum
FACU	white oak
	black cherry
UPL	shagbark hickory
	live oak

defined as being present at a site if more than 50% of the most abundant species at that site were OBL, FACW, and/or FAC plants (plants adapted to living in wet conditions). For example, if five (5) dominant species are present at a site, and three are either OBL, FACW, and/or FAC, then 60% (3/5) of the dominant vegetation on the site is hydrophytic (Note: the presence of hydrophytic vegetation does *not* necessarily mean that the site is a wetland. Hydrophytic vegetation is only one of three criteria. The other two — wetland hydrology and hydric soils — must still be confirmed).

The FAC neutral test, on the other hand, would eliminate dominant plant species that have FAC indicator status from consideration when determining the presence of hydrophytic vegetation. Therefore, if, in our example, two of the three wetland species were FAC species, only one wetland species would be considered present.

In our field test, three sites failed the FAC neutral test: Dismal Swamp #3, Chickahominy #3, and Caledon #4. The first two sites were FAC dominated areas. Dismal Swamp #3 is presented as an example below. The third site, Caledon #3, was FACU (white oak) dominated and would qualify as a Problem Wetland under the 1989 Manual but not under the proposed Manual. Of significant interest on this site was the abundance of blackened (water stained) leaves, a good indicator of wetland hydrology, but one that is not sanctioned under the proposed Manual.

Dismal Swamp site #3 was a maple/gum dominated swamp with several inches of water covering the site on the day of the testing. The site was dominated by red maples and sweet gums, both FAC species. Minor components of the system included green ash (FACW), white oaks (FACU), and American holly (FACU). The site did not pass the FAC neutral test since the true dominants (maple and gum) were thrown out and the number of upland and FACU species (two: white oak and American holly) outnumbered the FACW and obligate species (one: green ash). It is important to note that the FACU species did not dominate the site, and, therefore, would not qualify as exceptional (Problem Wetland) areas in the proposed Manual. This site made the shortcomings of the FAC neutral test obvious: in spite of the presence of wetland hydrology, this site would not meet the vegetation criterion and, therefore, would not qualify as a jurisdictional wetland. Hydrology is the independent variable which drives or determines the wetland system. Wetland vegetation and hydric soils are dependent variables: their existence depends on the presence of hydrology. By using a FAC neutral test, we would allow a dependent variable to override an independent variable, a situation that has no foundation in science.

Recommendations

1. Hydrology Criterion:

a. Any delineation manual adopted should be a workable, consistent, and scientifically defensible document. The literature consistently shows that interactions of chemical and biological processes in the soil provide significant signs of wetland hydrology (e.g. oxidized rhizospheres, H2S odors, blackened leaves). The literature further shows that these interactions take only 7 to 14 consecutive days of saturation and/or inundation to become visible. Therefore, if a period of saturation or inundation is included in the hydrology criterion, a period of 7 to 14 consecutive days of inundation/saturation should be used rather than the proposed 15 consecutive days of inundation and 21 consecutive days of saturation. Also note that there is no rationale for separation of inundation and saturation, and we have recommended that the time period required for these be the same.

b. The manual should allow the use of certain hydric soils as proof that wetland hydrology exists in an area. A hydric soil is defined as a soil that in its undrained condition is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation. It is important to note that not all hydric soils indicate the presence of wetland hydrology. Some hydric soils are relic soils that are no longer subject to wetland hydrology. Therefore, we do not recommend that all soils found on the published hydric soils list for the Commonwealth be considered indicators of wetland hydrology. A regional list could be prepared by soil experts.

c. We recommend that the definition of growing season be changed. The appropriate definition of growing season is the time during which the soil in the root zone is warm enough (i.e., above 0 degrees C) to allow soil microorganism activity. If the soil is saturated for long enough (i.e., at least 7 consecutive days) during this period, oxygen is depleted, anaerobic conditions result, and soil microorganisms begin reducing iron and other compounds from oxidized to reduced states. In some areas, this growing season would occur all year round. The only way to determine the extent of the soil temperature-based growing season is to monitor soil temperature. This is not something that could be accomplished during a single brief site visit. However, many indicators of hydrology occurring during this soil temperature-based growing season would be obvious: gleization or mottling of the soil, other indicators of anoxia and reducing conditions such as oxidized rhizospheres, the presence of hydrogen sulfide, and plant morphological adaptations such as pneumatophores and hypertrophied lenticels. Therefore, these indicators could be used to determine whether the saturation or inundation of a site occurred during a time of the year when soil temperatures were sufficiently warm (i.e., whether or not the site has *wetland* hydrology).

2. Vegetation Criterion:

a. The manual should allow the use of alternative vegetation sampling methods. The prevalence index relies on a point intercept method. Since the point intercept method was designed for use in herbaceous vegetation, it is inaccurate when applied to forest vegetation without the use of special tools. Alternative vegetation methods, such as those that use a Bitterlich gauge, timber cruise gauge, angle prism, and/or stem density counts to calculate dominant species are well supported by scientific literature and should be used where appropriate (i.e. forested systems).

b. The FAC-neutral test should be eliminated. By definition, FAC species are opportunistic species that will survive and reproduce readily in a broad range of environments. A majority of the nontidal wetlands in the Coastal Plain and Piedmont regions of Virginia are palustrine forested wetlands. Nearly all of these are secondary forests that have been timbered at least once within the last century. Because of their opportunistic nature, FAC species (for example: red maple, sweet gum, and loblolly pine trees) have become established in the cut over areas and now dominate these secondary growth forests. Therefore, if FAC species are not used when calculating dominant species, a true

measure of the vegetation parameter is not achieved.

3. Problem Areas:

White oak swamps, American holly dominated wetlands, and sphagnum bogs should be added to the problem area list for the Commonwealth of Virginia. Both white oak and american holly are FACU species. Therefore, they would not meet the hydrophytic vegetation criterion. Sphagnum bogs are dominated by sphagnum moss, an obligate species. However, during dry season(s) the top layers of moss often appear dry. There is much concern that these bogs would not meet the hydrology criterion as they would not appear saturated to the surface.

4. General:

a. Any method of delineating wetlands should allow the use of best professional judgement in making wetlands determinations/ delineations. The three parameters used to make wetland delineations/determinations are water, soils, and vegetation. Water (hydrology) is the driving force within a wetland system and determines the condition of the soils and types of vegetation that will grow. Therefore, water is an independent variable while soil and vegetation are dependent variables. Highly complex interactions link all three parameters (e.g. transpiration of plants can draw off water, poorly drained soils may pond water, etc.). As well, in some wetland areas (e.g. disturbed or difficult to identify wetlands) all three parameters may not appear to be present. Therefore, wetland delineation/determination may be a very complex task and should be done only by those with an appropriate level of training.

b. Any sanctioned manual should make sure all criteria are based in science. Arbitrary numbers, such as 21 consecutive days of saturation, have no scientific validity and will more than likely fail a legal challenge.

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