WETLAND IDENTIFICATION
AND DELINEATION MANUAL

VOLUME I

RATIONALE, WETLAND PARAMETERS,
AND OVERVIEW OF JURISDICTIONAL APPROACH

by

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PREFACE

According to Corps of Engineers and Environmental Protection Agency (EPA) regulations (33 CFR Section 328.3 and 40 CFR Section 230.3, respectively), wetlands are ". . . areas that are inundated or saturated with surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas." Although this definition has been in effect since 1977, the development of formal guidance for implementing it has been slow, despite the fact that such guidance could help assure regional and national consistency in making wetland jurisdictional determinations. Moreover, a consistent, repeatable operational methodology for determining the presence and boundaries of wetlands as defined under the federal regulations cited above would alleviate some concerns of the regulated public and various private interest groups; it would also substantially reduce interagency disputes over wetland jurisdictional determinations. Therefore, this Wetland Identification and Delineation Manual was developed to address the need for operational jurisdictional guidance.

The basic rationale behind EPA's wetland jurisdictional approach was initially conceived in 1980 with the issuance of interim guidance for identifying wetlands under the 404 program (Environmental Protection Agency, 1980). In 1983 the rationale was expanded and a draft jurisdictional approach was developed consistent with the revised rationale. EPA distributed the 1983 draft rationale and approach to about forty potential peer reviewers. Because the responses were, for the most part, favorable, further revisions were made and a second draft was circulated to about sixty potential peer reviewers in 1984. Individuals receiving the drafts for review were associated with federal, state, and regional governmental agencies, academic institutions, consulting firms, and private environmental organizations; they represented a wide range of wetland technical expertise. The 1984 draft also went through EPA regional review, as well as formal interagency review by the U.S. Fish and Wildlife Service, Corps of Engineers, National Marine Fisheries Service, and Soil Conservation Service. Based upon the 1984 peer review comments, the comments from the federal agencies, and EPA field testing over the last few years in bottomland hardwoods, pocosins, and East Coast marshes and swamps, the document was further developed into this 2-volume Wetland Identification and Delineation Manual. Volume I presents EPA's rationale on wetland jurisdiction, elaborates on the three wetland parameters generally considered when making wetland jurisdictional determinations, and presents an overview of the jurisdictional approaches developed by EPA in Volume II, the Field Methodology. Thus, it lays the foundation for the "simple" and "detailed" jurisdictional approaches presented in Volume II.

This Wetland Identification and Delineation Manual has been approved by EPA as an interim final document to be field tested by EPA regional and headquarters' personnel for a one year period. During this same review period, the Corps of Engineers has agreed to conduct field review of its wetland delineation manual (Environmental Laboratory, 1987). After the respective reviews, both agencies have agreed to meet, consider the comments received, and attempt to merge the two documents into one 404 wetland jurisdictional methodology for use by both agencies.

The author truly appreciates the efforts of the many peer reviewers who commented on one or both of the drafts that preceded this interim final document, including Greg Auble, Barbara Bedford, Virginia Carter, Harold Cassell, Lew Cowardin, Bill Davis, Dave Davis, Doug Davis, Frank Dawson, Mike Gantt, Mike Gilbert, Frank Golet, Dave Hardin, Robin Hart, John Hefner, Wayne Klockner, Bill Kruczynski, Lyndon Lee, Dick Macomber, Ken Metsler, John Organ, Greg Peck, Don Reed, Charlie Rhodes, Charlie Roman, Dana Sanders, Bill Sanville, Hank Sather, Jim Schmid, Joe Shisler, Pat Stuber, Carl Thomas, Doug Thompson, Ralph Tiner, Fred Weinmann, and Bill Wilen. Their many constructive comments and recommendations have been very helpful in refining this document. The author also appreciates the help of EPA's Regional Bottomland Hardwood Wetland Delineation Review Team (Tom Glatzel, Lyndon Lee, Randy Pomponio, Susan Ray, Charlie Rhodes, Bill Sipple, Norm Thomas, and Tom Welborn) in field testing the basic rationale underlying the _Field Methodology_ at a number of bottomland hardwood sites in 1986. The vegetation sampling protocol in the _Field Methodology_ is to a large extent an outgrowth of that effort. Helpful review and administrative guidance was provided by Suzanne Schwartz, John Meagher, and Dave Davis of EPA's Office of Wetlands Protection. Comments and suggestions received during the federal interagency review were also instrumental in further refining the manual. In fact, in addressing the soil and hydrology parameters in this manual, the author relied heavily upon materials already developed by the Corps of Engineers in their wetland delineation manual cited above. Stan Franczak ably handled the huge typing load associated with the interim final, as well as the earlier drafts.

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SECTION I: INTRODUCTION

This volume of the Wetland Identification and Delineation Manual was developed as a companion document to Volume II, the Field Methodology. It presents EPA's rationale on wetland jurisdiction (Section II), elaborates on the three parameters generally considered in making wetland jurisdictional determinations (Section III), and presents an overview of the jurisdictional approaches developed by EPA in Volume II, the Field Methodology (Section IV).

Anyone using the Field Methodology, should first become familiar with Volume I, since it lays the foundation for the jurisdictional approaches presented in Volume II. Thus, Volume I should be thought of, in part, as a prerequisite training document on the use of the Field Methodology. It is particularly important to thoroughly review the glossary in Appendix A, since a good understanding of the terms used in the methodology is imperative.

In utilizing this Field Identification and Delineation Manual, keep in mind that wetland jurisdictional determinations frequently have both technical and administrative components. Sometimes the latter component will play an important role in jurisdictional determinations. For example, because of cyclic hydrologic changes, some isolated wetlands (e.g., prairie potholes) do not have "fixed" boundaries. What vegetation boundary to choose (e.g., that established under high water conditions, low water conditions or average water conditions) is an agency administrative decision beyond the scope of this document. A second administrative decision beyond the scope of this document is a determination as to whether or not an isolated wetland meets the commerce test and is thus a "water of the United States." Therefore, to the extent practicable, this Wetland Identification and Delineation Manual emphasizes the technical aspects of jurisdiction.

SECTION II: RATIONALE

Although the three parameters mentioned in the Corps-EPA regulatory definition of wetlands (vegetation, soils and hydrology) are determinative factors in terms of whether or not a site is a wetland, it does not follow that all three parameters have to be evaluated or measured in every instance in order to determine the presence and boundaries of a wetland. Frequently, vegetation alone, which is a reflection of hydrologic and soil conditions, will suffice. Specifically, in the presence of one or more dominant obligate wetland species and in the absence of significant hydrologic modifications, it can be assumed that soils would, with some exceptions (e.g., where obligate wetland plants have recently become established, but hydric soils have not yet developed), be hydric. In other words, there is generally no need to collect data on soils and hydrology in a vegetation unit dominated by one or more obligate wetland plant species. Likewise, there is generally no need to collect soils and hydrology data for a vegetation unit dominated by one or more obligate upland species. However, if vegetation alone is not diagnostic, such as when only facultative species occur, soils and hydrology must be considered in determining the extent of wetlands and/or uplands at a site.

SECTION III: THE THREE WETLAND PARAMETERS: HYDROPHYTIC VEGETATION, HYDRIC SOILS, AND WETLAND HYDROLOGY

A. Hydrophytic Vegetation

1. Characteristics of Hydrophytic Vegetation

As used in this manual, hydrophyte is a broad term that includes both aquatic plants and wetland plants. Therefore, hydrophytic vegetation includes any macroscopic plant life growing in water or on a substrate that is a least periodically deficient of oxygen as a result of excessive water content. Aquatic habitats are areas, other than wetlands, that generally have shallow or deep water; the shallow water areas sometimes support non-emergent macroscopic hydrophytes (e.g., submerged aquatic, unattached-floating, and attached-floating plant species). "Swamps, marshes, bogs and similar areas" were mentioned in the Corps-EPA wetland regulatory definition (33 CFR Section 328.3 and 40 CFR Section 230.3) as examples of areas commonly considered wetlands and to distinguish them from other waters of the United States, such as aquatic habitats, and uplands. The hydrophytes that usually dominate wetlands as defined in this document are emergent plant species (erect, rooted non-woody species such as the common cattail, *Typha latifolia*) or woody species, such as the bald cypress (*Taxodium distichum*). As opposed to submerged species such as water milfoil (*Myriophyllum spicatum*), unattached-floating species such as duckweed (*Lemna minor*), and attached-floating species such as water lily (*Nymphaea odorata*), emergent species may be permanently or temporarily flooded at their bases, but do not tolerate prolonged inundation of the entire plants (or if tolerant, do not flower when submerged). Wetland hydrophytes are usually also vascular plants. Thus, most wetlands are dominated by emergent vascular plant species, which may or may not occur in association with vascular or non-vascular submergent, unattached-floating, and/or attached-floating plant species. When these non-emergent macroscopic hydrophytes do occur interspersed with emergent plants in a vegetation unit, the unit should be considered wetlands if 50% or more of the total percent areal cover is comprised of emergent species. Small areas of bare ground or open water may occur interspersed with wetland vegetation. Under such circumstances, the bare ground (unless it is an upland inclusion) and open water should be considered part of the wetland system.

2. Prevalent Vegetation

The Corps-EPA regulatory definition of wetlands includes the phrase "a prevalence of vegetation." As used in this manual, the term prevalence is considered equivalent to dominance. Thus, the prevalent vegetation is the dominant vegetation. In an ecological sense, a dominant plant species is one that by virtue of its size, number, production, or other activities, exerts a controlling influence on its environment and therefore determines to a large extent what other kinds of organisms are present in the ecosystem (Odum, 1971). In this document, however, dominance strictly refers to the spatial extent of a species because the extent is directly discernible or measurable in the field. Spatially dominant plant species are characteristically the most common species (i.e., those having numerous individuals or a large biomass in comparison to uncommon or rare species). In this sense, a dominant species is either the predominant species (the only species dominating a unit) or a codominant species (when two or more species dominate a unit). In the jurisdictional approaches presented in this Manual, percent areal cover is the standard measure of spatial extent, except for trees in which case basal area is used. Note: Because this Manual relies heavily on vegetation, in its absence (e.g., during the non-growing season, particularly when dealing with annual species, or after clearing or filling) historical data (e.g., aerial photographs) will have to be utilized.

3. Typically Adapted Plants

The words "typically adapted" are also present in the Corps-EPA wetland definition. Something that is typical is normal, usual or common in occurrence (Environmental Laboratory, 1987). An adaptation is a condition of showing fitness for a particular environment, as applied to characteristics of a structure, function, or entire organism (Mayr, 1970). These characteristics make the organism more fit (adapted) for reproduction and/or existence under conditions of its environment. For example, plant species that gain a competitive advantage in saturated soil conditions are typically adapted for such conditions. Various morphological, physiological, and reproductive adaptations for inundation or saturated soil conditions are given in A4b (page 11).

4. Indicators of Hydrophytic Vegetation

There are a number of indicators of the presence of hydrophytic vegetation. Some indicators are diagnostic under natural conditions (i.e., obligate wetland species); others are, for the most part, diagnostic (i.e., morphological, physiological, and reproductive adaptations); still others (i.e., facultative species) are indicative of hydrophytic vegetation in the presence of hydric soils and hydrologic indicators. These indicators of hydrophytic vegetation are elaborated below.

a. Obligate wetland species. The U.S. Fish and Wildlife Service (1986) has prepared a national list and a series of regional lists of plants that occur in wetlands. Some of the species on these lists are obligate wetland species which, under natural conditions, always occur in wetlands. The presence of obligate wetland species, particularly as dominants, in a vegetation unit should be considered diagnostic of wetlands as long as the unit has not been significantly modified hydrologically. Facultative species may be present as well, but obligate upland species can not be present.

The U.S. Fish and Wildlife Service plant lists were developed in cooperation with a national panel and regional panels comprised of personnel from the U.S. Fish and Wildlife Service, Environmental Protection Agency, Corps of Engineers, and Soil Conservation Service. There are three points that should be kept in mind when utilizing the lists.

(1) Because the plant lists were developed for use with the Classification of Wetlands and Deepwater Habitats of the United States (Cowardin, et al, 1979), they include plant species that occur in a number of habitat types that are not considered wetlands under the Corps-EPA regulatory program. However, most of these areas are at least potentially other waters of the United States (e.g., shallow open water, mud flats, and submerged

aquatic beds), which are frequently dominated by macroscopic, non-emergent species (e.g., the various submerged, unattached-floating, and rooted-floating plants) and/or microscopic algae.

(2) Because the plant lists include only vascular plants, alternate taxonomic or ecological reference sources will have to be utilized for determining the indicator status of non-vascular plants (e.g., bryophytes). This will be particularly applicable to bogs and swamps in the Northeast, Pacific Northwest, Alaska, and Hawaii.

(3) It has been suggested by some users of the plant lists that they are too awkward (i.e., they contain too many species, too many uncommon species, too many unfamiliar species). This apparently reflects a misunderstanding of how the lists will likely be used in a jurisdictional sense. The fact that a field investigator may not know all the species on a regional list is irrelevant, since not all the species on a list will occur in a generic wetland type (e.g., a bog) let alone at a given site. Thus, at any one time, the field investigator will be dealing with a small subset of the plants on the list -- <u>a subset determined by the investigator at the site, not the list.</u> The field investigator will then check the dominants found against their indicator status on the list and make the jurisdictional decision. If field investigators find that their level of unfamiliarity with the plants at a given site precludes a scientifically sound and defensible determination, additional expertise should be sought. Furthermore, because there are many wetland types in each region and a determination of all of the dominants for each type has not been made, potential dominants should not be eliminated by rule (i.e., a complete list of species that occur in wetlands will allow for all possibilities).

b. <u>Plants with adaptations for soil saturation and/or inundation.</u>

(1) <u>Plants with morphological adaptations.</u> Plants manifest a number of morphological adaptations to inundation and/or saturated soil conditions such as pneumatophores, buttressed tree trunks, adventitious roots, shallow root systems, floating stems, floating leaves, polymorphic leaves, multiple trunks, hypertrophied lenticels, and inflated leaves, stems or roots. <u>Note</u>: <u>Although a given wetland plant species may have one or more morphological adaptations, in other wetland species they may not be as evident or may even be non-existent.</u>

(2) Plants with physiological adaptations. Although they are not as useful because they cannot be observed in the field, known physiological adaptations, such as the accumulation of malate in the swamp tupelo (*Nyssa sylvatica* var. *biflora*) and increased levels of nitrate reductase in the eastern larch (*Larix laricina*), are associated with inundation and/or soil saturation.

(3) Plants with reproductive adaptations. Many wetland plants have reproductive strategies that allow them to exist and reproduce under inundated or saturated soil conditions. Some can germinate under low oxygen concentrations; other have flood-tolerant seedlings. Many species also manifest prolonged seed viability, remaining dormant until soil moisture conditions are right for germination.

c. Facultative species. Any combination of the three categories of facultative species (i.e., facultative wetland, straight facultative, and/or facultative upland) should be considered indicative of hydrophytic vegetation if the vegetation unit in which they occur has hydric soils and one or more hydrologic indicators are at least periodically present during the growing season. In addition, obligate upland species must either be absent or present only on microsites and/or larger similar inclusions. In other words, facultative species, even as dominants, are not in themselves diagnostic of wetlands or uplands. However, an examination of the soils and hydrology should give an indication as to whether the facultative species are, in fact, occurring under conditions that would require them to be adapted for life in saturated soils. Note: This latter statement may not be applicable to existing wetlands that have been hydrologically disturbed (e.g., ditched). Because of the inherent difficulty in establishing how much the water table in the disturbed wetland would have to drop to no longer be a wetland hydrologically, it may be more appropriate to judge the significance of the hydrologic impact on the vegetation by evaluating the nature and direction of secondary plant succession to determine whether the site still functions, or has the potential to function, as a wetland.

B. Hydric Soils

1. Definition

A hydric soil is a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part (Soil Conservation Service, 1987). Such soils usually support hydrophytic plants.

2. Criteria for Hydric Soils

Consistent with the above definition, the Soil Conservation Service (1987) in cooperation with the National Technical Committee for Hydric Soils developed the following hydric soil criteria.

a. All Histosols except Folists, or
b. Soils in Aquic suborders, Aquic subgroups, Albolls suborder, Salorthids great group, or Pell great groups of Vertisols that are:*

    (1) Somewhat poorly drained and have water table less than 15 centimeters (0.5 foot) from the surface for a significant period (usually a week or more) during the growing season, or

    (2) poorly drained or very poorly drained and have either:

        (a) water table at less than 30 centimeters (1.0 foot) from the surface for a significant period (usually a week or more) during the growing season if permeability is equal to or greater than 15 centimeters/hour (6.0 inches/hour) in all layers within 50 centimeters (20 inches), or

        (b) water table at less than 45 centimeters (1.5 feet) from the surface for a significant period (usually a week or more) during the growing season if permeability is less than 15 centimeters/hour (6.0 inches/hour) in any layer within 50 centimeters (20 inches), or

c. Soils that are ponded for long duration or very long duration during the growing season, or

d. Soils that are frequently flooded for long duration or very long duration during the growing season.

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* For an elaboration of these terms, see <u>Soil Taxonomy</u> (Soil Survey Staff, 1975) or <u>Keys to Soil Taxonomy</u> (Department of Agriculture, 1985).

3. Classification of Hydric Soils

Under the current soil classification system published in Soil Taxonomy (Soil Survey Staff, 1975), there are two broad categories of hydric soils: Organic soils (Histosols) and mineral soils. All organic soils are hydric except for the Folists, which occur mostly in very humid climates from the Tropics to high latitudes. In the United States, Folists are found mainly in Hawaii and Alaska (Soil Survey Staff, 1975). Folists are more or less freely drained Histosols that consist primarily of plant litter that has accumulated over bedrock. Those Histosols that are hydric are commonly known as peats and mucks. Mineral soils, on the other hand, consist predominantly of mineral matter, and contain less than 20% organic matter by weight (Buckman and Brady, 1969). Mineral soils that are hydric are saturated long enough to significantly affect various physical and chemical soil properties. They are usually either gray, mottled immediately below the surface horizon, or have thick, dark-colored surface layers overlying gray or mottled subsurface horizons (Environmental Laboratory, 1987).

4. Indicators of Hydric Soils

Indicators of hydric soils can be placed into two categories: Soil series and phases on the national and state hydric soils lists and field indicators of hydric soils. These indicators are elaborated below.

a. Soil series and phases considered hydric. The Soil Conservation Service (1987) has developed national and state lists of hydric soils in conjunction with the National Technical Committee for Hydric Soils. In practice, it is always best to verify in the field that the soil series or phase listed as hydric has been correctly mapped and that the area in question is not an inclusion of another series or phase that is not hydric. Note: Some mapping units (e.g., tidal marsh) may be hydric but will not be on the list of hydric soils because they do not yet have series names for the area in question. In addition, a hydric soil that has been drained to the extent that it no longer meets the hydric soil criteria in B2 (page 13) is no longer considered hydric.

b. Field evidence of hydric soils.

(1) Organic soils (Histosols). Histosols are organic soils (mostly peats and mucks) that have organic materials in more than half (by volume) the upper 80 centimeters (32 inches), unless the depth to rock or to fragmental materials in less than 80 centimeters, or the bulk density is very low (Soil Survey Staff, 1975). A more detailed definition can be found in Soil Taxonomy (Soil Survey Staff, 1975). Except for Folists, all organic soils are hydric.

(2) Histic epipedons. A histic epipedon is an 8-16 inch (20-40 centimeter) soil layer at or near the surface that is saturated for 30 consecutive days or more during the growing season in most years and contains a minimum of 20% organic matter when no clay is present or a minimum of 30% organic matter when 60% or greater clay is present (Environmental Laboratory, 1987). In general, a histic epipedon is a thin horizon of peat or muck if the sod has not been plowed (Soil Survey Staff, 1975).

(3) Mineral soils with mottling and/or gleying. Soil colors can be very useful indicators of hydric mineral soils. Because of the anaerobic conditions associated with waterlogging, soils generally become chemically reduced and gleyed. With chemical reduction, elements such as iron and manganese change from the oxidized (ferric and manganic) state to the reduced (ferrous and manganous) state. Such changes are manifested in bluish, greenish or grayish colors characteristic of gleying. Gleyed soil conditions can be determined by comparing a soil sample with the gley chart in Munsel Soil Color Charts (Kollmorgen Corporation, 1975). Gleying can occur in both mottled and unmottled soils.

Mineral soils that are periodically saturated for long periods during the growing season also are usually hydric. Under such alternating saturated and unsaturated conditions, mottles commonly develop. Mottles are spots or blotches of different color or shades of color interspersed with the dominant color (Buckman and Brady, 1969). The dominant color is called the soil matrix. Although the soil matrix is usually greater than 50% of a given soil layer, the term soil matrix can refer to a soil layer that has no mottles at all. When the soil matrix in a mottled soil is gleyed, it is considered a hydric soil. When the matrix is not gleyed, it is still considered hydric if it has a chroma of ≤ 2. Likewise, an unmottled gleyed soil is considered hydric, as are unmottled soils that are not gleyed, but have a chroma of ≤ 1. Soil chroma should be determined using the Munsel Soil Color Charts (Kollmorgen Corporation, 1975). Note: Because soil color is generally not a good indicator in sandy soils (e.g., barrier islands), other indicators of hydric soils may have to be used.

(4) Aquic or peraquic moisture regime. The aquic moisture regime is a reducing regime that is virtually free of dissolved oxygen because the soil is saturated by ground water or by water of the capillary fringe (Soil Survey Staff, 1975). The soil is considered saturated if water stands in an unlined borehole at shallow enough depths that the capillary fringe reaches the soil surface except in non-capillary pores. Because dissolved oxygen is removed from ground water by microorganism, root, and soil faunal respiration, it is implicit in the concept of aquic moisture regime that the soil temperature is above biologic zero (5 degrees centigrade) at some time while the soil or soil horizon is saturated (Soil Survey Staff, 1975).

There are also soils (e.g., saltmarsh soils) in which the ground water is always at or very close to the surface. The moisture regimes for these soils is termed peraquic (Soil Survey Staff, 1975). Although soils with peraquic moisture regimes would always be hydric under natural conditions, those with aquic moisture regimes would be hydric only if they meet the hydric soil criteria specified B2 (page 13).

(5) Sulfidic materials. Sulfidic materials accumulate in soils that are permanently saturated, generally with brackish water. Under saturated conditions, the sulfates in water are biologically reduced to sulfides as the soil materials accumulate (Soil Survey Staff, 1975). The presence of sulfidic materials is generally evidenced by the smell of hydrogen sulfide, which has a rotten egg odor.

(6) Iron and manganese concretions. Concretions are local concentrations of chemical compounds (e.g., iron oxide) in the form of a grain or nodule of varying size, shape, hardness, and color (Buckman and Brady, 1969). Iron and manganese concretions are usually black or dark brown and occur as small aggregates near the soil surface. Iron and manganese concretions greater than 2 millimeters (0.08 inches) in diameter that occur within 7.5 centimeters (3.0 inches) of the soil surface are evidence that the soil is saturated for long periods near the surface (Environmental Laboratory, 1987).

(7) Anaerobic soil conditions. Most wetlands manifest at least periodic soil saturation (waterlogging). When saturation is long enough, an anaerobic environment develops, which can result in a highly reduced soil. Under these conditions, ferric iron, the oxidized form of oxygen, is converted to the reduced form, ferrous iron. The presence of reduced iron in the soil can be detected by the use of a colorimetric field test kit.

(8) Other organic materials. In sandy soils (e.g., on barrier islands), organic materials in the soil profile under the conditions described below are considered evidence of hydric soils (Environmental Laboratory, 1987).

(a) High organic matter in the surface horizon. Because prolonged inundation and soil saturation result in anaerobic conditions, organic matter tends to accumulate above or in the surface horizon of sandy soils. The mineral surface layer generally appears darker than the mineral material immediately below it due to organic matter interspersed among or adhearing to sand particles particles. Note: Because organic matter also accumulates on upland soils, in some instances it may be difficult to distinguish a surface organic layer associated with a wetland site from litter and duff associated with an upland site unless the species composition of the organic materials is determined.

(b) Organic pans. As organic matter moves downward through sandy soils, it tends to accumulate and become slightly cemented with aluminum at a point in the soil profile representing the most commonly occurring depth to the water table. This thin layer of hardened organic matter is called an organic pan or spodic horizon.

(c) Dark vertical streaking in subsurface horizons. This is the result of the downward movement of organic materials from the soil surface. When the soil from a vertical streak is rubbed between the fingers, a dark stain will result.

C. Wetland Hydrology

1. Characteristics of Wetland Hydrology

Wetland hydrology is the sum total of wetness characteristics in areas that are inundated or have saturated soils for a sufficient duration to support hydrophytic vegetation (Environmental Laboratory, 1987). This inundation or saturation can come from many sources, such as direct precipitation, surface runoff, ground water, tidal influence, and overland flooding. Thus, if there is anything that all wetlands have in common, they are at least periodically wet (Cowardin, *et al*, 1979).

2. Hydrologic Indicators

Although the hydrology parameter may at times be quite evident and dramatic in the field (e.g., overbank flooding), more often than not this parameter and its various indicators are usually very difficult to observe. Furthermore, as opposed to the vegetation and soil parameters, which are relatively stable, the hydrology parameter exhibits substantial spatial and temporal variation, making it generally impracticable for delineating wetland boundaries. Rather, hydrologic indicators are most useful in confirming that a site with hydrophytic vegetation and hydric soils still exhibits hydrologic conditions typically associated with such vegetation and soils (i.e., that the vegetation unit has not been significantly hydrologically modified to the extent that it supports only remnant, generally stressed and/or dying, hydrophytic vegetation and drained hydric soils). In other words, whereas hydrologic indicators can sometimes be diagnostic of the presence of wetlands, they are generally either operationally impracticable (in the case of recorded data) or technically inaccurate (in the case of field indicators) for delineating wetland boundaries. In the former case, surveying the wetland boundary is generally too time consuming (even if a given elevation corresponds with the "wetland hydrologic boundary," which is unlikely); in the latter case, it should be obvious that indicators of flooding frequently extend well beyond the wetland boundary. Consequently, in the jurisdictional approaches presented in this Manual, hydrophytic plants and hydric soils are used to spatially bound wetlands. Note: In some instances, however, the successional responses of the vegetation at a known wetland site that has been hydrologically modified (e.g., ditched) may be more useful than a documented hydrologic change, such as an arbitrarily established drop in water table, in determining whether the site is still a wetland.

Hydrologic indicators associated with wetlands fall under two categories: Recorded data and field data. These indicators are elaborated below.

a. Recorded data. Recorded data can be obtained from tide gauges, stream gauges, flood predictions, historical data (e.g., aerial photographs and soil surveys), etc. The U.S. Geological Survey and the Corps of Engineers are two good sources of recorded hydrologic data.

b. Field data.

(1) Visual observation of inundation. An obvious hydrologic indicator is inundation (flooding or ponding). Although visual evidence of inundation is most commonly obtained for wetlands along estuaries, rivers, streams, and lakes, inundation can sometimes be observed in wetlands occurring at other geomorphological settings as well, including isolated depressional wetlands.

(2) Visual observation of soil saturation. Evidence of soil saturation can be obtained from examining a soil pit after sufficient time has passed to allow water to drain into the hole. The amount of time required will depend upon the texture of the soil. For example, water will drain more slowly into a soil pit dug in a clayey soil as opposed to a sandy one. In some heavy clay soils, however, water may not rapidly move into the hole even when the soil is saturated. Under these circumstances, it may be necessary to examine the sides of the soil pit for seepage. Note: The depth to saturated soil will always be somewhat higher in the soil profile than the standing water due to the upward movement of water in the capillary zone.

For soil saturation to have a significant impact on the plants in a vegetation unit, it must occur within the major portion of the root zone (Environmental Laboratory, 1987). For most species occurring in wetlands, particularly herbaceous plants, the majority of the roots and rhizomes generally occur within the upper 30 centimeters (12 inches) of soil. Note: When examining for this indicator in the field, both antecedent weather conditions (e.g., the significance recent storms and long-term droughts) and the time of the year should be taken into consideration.

(3) Sediment deposits. Tidal flooding in estuaries and flooding along non-tidal rivers, streams, and lakes frequently results in the deposition of inorganic or organic sediments on live vegetation, debris, and stationary man-made structures. This is frequently manifested as a fine layer of silt. Silt is also sometimes evident at the soil surface on small debris.

(4) Drift lines. Like watermarks and sediment deposits, drift lines are commonly found along rivers, streams and lakes. Debris (e.g., plant parts, sediment, and assorted litter) is frequently left stranded in plants, on man-made structures, and at other obstructions as the flood-waters recede.

(5) Surface scouring. Surface scouring occurs along floodplains where overbank flooding erodes sediments (e.g., at the bases of trees). The absence of leaf litter from the soil surface is also sometimes an indication of surface scouring.

(6) Wetland drainage patterns. Many wetlands (e.g., tidal marshes and floodplain wetlands) have characteristic meandering or braided drainage patterns that are readily recognized in the field or on aerial photographs and occasionally on togographic maps.

(7) Morphological plant adaptations. Many plants have developed morphological adaptations in response to inundation and/or soil saturation (see A4b, page 11). As long as there is no evidence of significant hydrological modifications, these adaptations can be used as hydrologic indicators.

SECTION IV: OVERVIEW OF JURISDICTIONAL APPROACHES

A. General

Prior to making a jurisdictional determination, it is generally necessary to gather preliminary data and scope out the delineation effort. This will allow the field investigator to decide whether the simple or detailed jurisdictional approach presented in Volume II is applicable to the project or site in question. The simple jurisdictional approach is for routine situations wherein a field investigator needs only to traverse the majority of the site and record data from ocular inspection. The detailed jurisdictional approach is generally for large and/or controversial sites or projects; it entails establishing transects and sample plots. In addition to traversing the majority of the site (simple approach) and establishing transects and sample plots (detailed approach), both of these jurisdictional approaches involve a number of specific steps. Four of these steps, which are basic to both approaches, are elaborated below. The entire sequence of steps, including the sampling protocols, are presented in Volume II.

There are a number of ways to effectively sample vegetation. Many procedures will produce essentially the same results and some procedures may be appropriate for certain vegetation types but not for others. The procedure presented in Volume II has been effective in the field, but may have to be adjusted in some instances because of site conditions and the nature of the vegetation. Other information on vegetation sampling is included in books by Barbour, Burk and Pitts (1987), Cain and Castro (1959), Curtis (1971), Daubenmire (1968), Greig-Smith (1983), Mueller-Dombois and Ellenberg (1974), Oosting (1956), and Smith (1974).

B. Basic Steps for Jurisdictional Approaches

1. Horizontal stratification of the site into vegetation units.

Vegetation units (i.e., patches, groupings, or zones of plants that are evident in overall plant cover and which appear distinct from other such units) should be distinguished in the field based upon an examination of vegetation structure and floristic composition. Vegetation units can also be determined through analysis of "vegetation signatures" on aerial photographs as long as a representative number of units are verified by field checking. Once this step is complete, a field investigator should have, either in his/her mind or on a vegetation map, topographic map, or annotated aerial photograph, a good indication of the various vegetation units at the site.

2. Determination of the dominant plant species.

This Manual relies heavily on the presence of dominant plant species. The spatially dominant species in a vegetation unit are characteristically the most common species (i.e., those having numerous individuals or a large biomass in comparison to uncommon or rare species). Percent areal cover is the standard measure of spatial extent and dominance used in this Manual, except for trees in which basal area is assessed. Percent areal cover is an estimate of the area covered by the foliage of a plant species projected onto the ground. Because of species overlap, each species should be treated separately in sampling, and the total areal cover of all species will frequently exceed 100%. Basal area is a measure of dominance in forests expressed as the area of a trunk of a tree at diameter breast height or as the total of such areas for all trees in a given space (Curtis, 1971).

Whether a species is dominant or not in a vegetation unit will depend upon the nature of the vegetation. In a monotypic vegetation type, the species present is clearly predominant and thus the dominant species in this instance. More frequently, however, two or more species will codominate a vegetation unit in which case all of the codominants should be considered dominant species. It is not uncommon to have a number of species dominating a vegetation unit, especially at forested sites where a few species may dominate each vertical stratum. Thus, the percent areal cover or the basal area necessary for a species to be a dominant should be flexible because of the naturally occurring spatial heterogeneity of some vegetation.

The approach taken in this Manual for determining the dominant species in a vegetation unit is an inductive one in which the dominant plants are determined after the data are collected, as opposed to collecting data on only what are considered the dominant plants based upon some a priori threshold. Although vegetation sampling protocols for the simple and detailed approaches vary somewhat, the basic procedure for determining the dominant plants in a vertical stratum can best be explained using the herbaceous stratum of a forested site as an example. Under the detailed approach, this first entails quantifying the average percent areal cover of each herbaceous species. Next, the herbaceous species are ranked according to their average percent areal cover; then the average percent areal cover values for all the herbaceous species are summed. Lastly, the average percent areal cover values of the ranked herbaceous species are cumulatively summed until 50% of the total average percent areal cover values for all herbaceous species is reached or initially exceeded. Any herbaceous species contributing to this 50% threshold are considered dominants. An essentially similar procedure is applied to any shrubs, woody vines, saplings and trees at the forested site. A more detailed explanation of this procedure is given in Volume II. Note: The 50% rule used in this Manual is for determining the dominant species in a vegetation unit. It should not be confused with two other 50% rules that have been suggested for determining what constitutes a "prevalence of vegetation typically adapted for life in saturated soil conditions" and "hydrophytic vegetation." Under the 50% rule for determining a "prevalence of vegetation typically adapted for life in saturated soil conditions," wetland plants must comprise at least 50% of the dominant species within the "plant community" at the site in question. Under the 50% rule for determining "hydrophytic vegetation," greater than 50% of the dominant plant species in a vegetation unit must be obligate wetland species, facultative wetland species, or straight facultative species.

3. Determination of the indicator status of the dominant species in the vegetation unit using the U.S. Fish and Wildlife Service's national or appropriate regional list of plants that occur in wetlands.

Species on the lists are classified either as obligate wetland species or one of the three categories of facultative species (facultative wetland, straight facultative, and facultative upland). Unless there is a good technical reason to believe otherwise for a given species, any vascular plant species not on the lists should be considered an obligate upland species. However, because the national and regional lists are based upon the National List of Scientific Plant Names (Soil Conservation Service, 1982), the scientific names of some species listed may not be readily recognized by a field investigator (i.e., the investigator may be more familiar with a more commonly used taxonomic synonym). It is particularly important for the field investigator to be aware of this since a species may appear to be not on the list and therefore be considered an obligate upland species by the investigator, whereas it may really be on the list under its currently accepted scientific name. A brief check of the synonyms listed in Volume II of the National List of Scientific Plant Names should prevent this problem.

4. Decision on which vegetation units at the site are wetlands and delineation of the wetland boundaries.

The geographical extent of wetlands at a site will coincide with the spatial distribution of the wetland vegetation units. Two tools (a Jurisdictional Decision Flow Chart and a Jurisdictional Decision Diagnostic Key) presented in Volume II will expedite and conceptually guide decisions about jurisdiction for sample plots and vegetation units once the field data have been collected. Two approaches were developed to allow user flexibility, since some field investigators may feel more comfortable using one over the the other; however, they closely track each other and will lead to the same jurisdictional decisions. For example, the flow chart and key both indicate that the presence of dominant obligate plant species, whether obligate wetland or obligate upland, is generally diagnostic in itself. Specifically, if one or more dominant plant species in a vegetation unit is an obligate wetland species, the vegetation unit (and the site if it is a monotypic site) is a wetland and there is no need to consider soils and hydrology, other than to verify that there have been no significant hydrologic modifications. Likewise, the presence of one or more dominant obligate upland plant species is conclusive evidence of the presence of uplands. On the other hand, by definition, the presence of one or more dominant facultative species in a vegetation unit, even the presence of all facultative wetland dominants, is not truly diagnostic despite the fact the latter situation in particular would strongly suggest that the unit is a wetland. Therefore, if only facultative species dominate a vegetation unit, the flow chart and key direct investigators to the soil and hydrologic parameters to help determine whether the vegetation unit is wetland.

In some instances a mix of dominant obligate wetland species and dominant obligate upland species will occur in the same vegetation unit. These exceptions are reflected in the flow chart and key. They are either a consequence of (1) relatively dry microsites and/or larger similar inclusions (which support the upland species), (2) relative wet microsites and/or larger similar inclusions (which support the wetland species), or (3) plant succession resulting from natural or man-induced disturbances (e.g., the landward edge of a tidal marsh that is encroaching on an adjacent upland forest due to sea level and a site that has been drained but at which wetland plant species still persist but upland species are invading, respectively). When a mix of dominant obligate wetland species and dominant obligate upland species occurs, it is necessary to check to see if the site has been appropriately horizonally stratified and to adjust accordingly. If the obligate upland plants occur on dry microsites or similar larger inclusions, it is necessary to either show these local areas as individual upland units or consider the site to be wetlands but acknowledge the presence of local upland areas in a written description of the site. (A comparable procedure should be used for local low areas in an otherwise upland site.) As long as there are definable vegetation units, however, they should be handled individually. The minimum size treatable (i.e., the minimal mapping unit) will depend upon site conditions (e.g., size and access), plant physiognomy, and the tools available (e.g., type and quality of aerial photographs). Nevertheless, every attempt should be made to separately treat small units (i.e., to finely horizontally stratify) in order to segregate any discrete upland units in a wetland matrix (or vice versa) that could otherwise bias a jurisdictional determination.

If there is a rather uniform intermixed distribution of dominant obligate wetland species and dominant obligate upland species (the various subcategories of facultative species may be present too), then the unit is probably a naturally or unnaturally disturbed one where successional changes are occurring. Under these circumstances, either a 50% rule will have to be applied to the obligate species, or as an alternative for forested sites, tree vigor and reproduction (e.g., seedlings and saplings) may give a good indication of the direction of vegetation change at the unit or site. In some instances, the vegetation may be so heterogeneous that nothing appears to dominate. A situation in which no species is dominant will seldom occur, however, if the site has been appropriately horizontally stratified. Nevertheless, this situation is addressed in both the flow chart and the key.

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APPENDIX A

GLOSSARY

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GLOSSARY

Adaptation--The condition of showing fitness for a particular environment, as applied to characteristics of a structure, function, or entire organism (Mayr, 1970). These characteristics make the organism more fit (adapted) for reproduction and/or existence under the conditions of its environment. Plant species that gain a competitive advantage in saturated soil conditions are typically adapted for such conditions.

Aerobic--A condition in which molecular oxygen is present in the environment.

Anaerobic--A condition in which molecular oxygen is absent from the environment (Soil Conservation Service, 1987). This commonly occurs in wetlands when soils are saturated by water.

Aquatic habitats--Habitats, other than wetlands, that generally have shallow or deep water. The water can be intermittently or permanently present. Shallow water areas sometimes support non-emergent hydrophytes.

Aquic moisture regime--A reducing regime in which the soil is virtually free of dissolved oxygen because it is saturated by ground water or by water of the capillary fringe. Some soils (e.g., salt marshes) are so wet that the ground water is always at or very close to the soil surface and they are considered to have a peraquic moisture regime (Soil Survey Staff, 1975).

Basal area--A measure of dominance in forests expressed as the area of a trunk of a tree at diameter breast height (dbh) or as the total of such areas for all trees in a given space (Curtis, 1971).

Baseline--A line, generally a highway, unimprove road, or some other evident feature, from which transects extend into a site for which a wetland jurisdictional determination is to be made.

Bryophytes--A major taxonomic group of non-vascular plants comprised of liverworts, horned liverworts, and true mosses.

Capillary zone--The zone of soil essentially saturated with water, in which pores become filled as a result of surface tension (American Society of Agricultural Engineering, 1967).

Chemical reduction--Any process by which one compound or ion acts as an electron donor. In such cases, the valence state of the electron donor is decreased (Environmental Laboratory, 1987).

Cover class--As used in this Manual, a category into which plant species would fit based upon their percent areal cover. The cover classes used (midpoints in parenthesis) are T=<1%(none), 1=1-5%(3.0), 2=6-15%(10.5), 3=16-25%(20.5), 4-26-50%(38.0), 5=51-75%(63.0), 6=76-95%(85.5), and 7=96-100%(98.0).

Diameter breast height (dbh)--The diameter of a tree trunk at 1.37 meters (4.5 feet) above the ground.

Dominant--In a ecological sense, a dominant plant species is one that by virtue of its size, number, production, or other activities, exerts a controlling influence on its environment and therefore determines to a large extent what other kinds of organisms are present in the ecosystem (Odum, 1971). In this document, however, dominance strictly refers to the spatial extent of a species because spatial extent is directly discernible or measurable in the field. In this sense, a dominant species is either the predominant species (i.e., the only species dominating a unit) or a codominant species (i.e., when two or more species dominant a unit). The measures of spatial extent utilized in this Manual (percent areal cover and basal area) are defined elsewhere in the glossary.

Facultative species--Species that can occur both in wetlands and uplands. There are three subcategories of facultative species (facultative wetland, straight facultative, and facultative upland). Under natural conditions, a facultative wetland species is usually (estimated probability of 67-99%) found in wetlands, but is occasionally found in uplands; a straight facultative species has basically a similar likelihood (estimated probability of 34-66%) of occurring in both wetlands and uplands; a facultative upland species is usually (estimated probability of 67-99%) found in uplands, but is occasionally found in wetlands.

Fern allies--A group of non-flowering vascular plants comprised of clubmosses (Lycopodiaceae), small clubmosses (Selaginellaceae), horsetails (Equisetaceae), and quillworts (Isoetaceae).

Flooded--A condition in which the soil surface is temporarily covered with flowing water from any source, such as streams overflowing their banks, runoff from adjacent or surrounding slopes, inflow from high tides, or any combination of sources (Soil Conservation Service, 1987).

Flora--A list of plant taxa in a geographic area of any size. This could be a simple list or a more detailed one that includes taxonomic descriptions, diagnostic keys, distribution data, etc. Compare this term with the term "vegetation."

Folist--A more or less freely drained Histosol that consists primarily of plant litter that has accumulated over bedrock (Soil Survey Staff, 1975).

Forbs--Broadleaf herbaceous plants, in contrast to bryophytes, ferns, fern allies, and graminoids.

Frequently flooded--A class of flooding in which flooding is likely to occur often under usual weather conditions (more than 50% change of flooding in any year, or more than 50 times in 100 years) (Soil Conservation Service, 1987).

Graminoids--Grasses (Gramineae) and grasslike plants, such as sedges (Cyperaceae) and rushes (Juncaceae).

Growing season--The portion of the year when soil temperatures are above biologic zero (5 degrees C), as defined in Soil Taxonomy (Soil Survey Staff, 1975). The following growing season months are assumed by the Soil Conservation Service (1987) for each of the soil temperature regimes:

Isohyperthermic:	January-December
Hyperthermic:	February-December
Isothermic:	January-December
Thermic:	February-October
Isomesic:	January-December
Mesic:	March-October
Frigid:	May-September
Cryic:	June-August
Pergelic:	July-August

Habitat--An environment occupied by plants and animals.

Herbaceous plants--Plants without persistent woody stems above the ground. Herbaceous plants are commonly called herbs.

Histic epipedon--An 8-16 inch (20-40 centimeter) soil layer at or near the surface that is saturated for 30 consecutive days or more during the growing season in most years and contains a minimum of 20% organic matter when no clay is present or a minimum of 30% organic matter when 60% or greater clay is present (Environmental Laboratory, 1987). In general, a thin horizon of peat or muck if the soil has not been plowed (Soil Survey Staff, 1975).

Histosol--An order in Soil Taxonomy composed of organic soils (mostly peats and mucks) that have organic materials in well over half the upper 80 centimeters (32 inches) unless the depth to rock or to fragmental materials is less than 80 centimeters (a rare condition), or the bulk density is very low (Soil Survey Staff, 1975).

Horizontal stratification--The division of the vegetation at a site into vegetation units (i.e., various patches, groupings, or zones).

Hydric soil--A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part (Soil Conservation Service, 1987).

Hydrophytes--Large plants (macrophytes), such as aquatic mosses, liverworts, non-microscopic algae and vascular plants, that grow in permanent water or on a substrate that is at least periodically inundated and/or saturated with water.

Hydrophytic vegetation--Macrophytic plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.

Inundated--A condition in which a soil is periodically or permanently flooded or ponded by water.

Long duration--A duration class in which inundation for a single event ranges from 7 days to 1 month (Soil Conservation Service, 1987).

Mineral soil--A soil consisting predominantly of, and having its properties determined predominantly by, mineral matter. Mineral soils usually contain less than 20% organic matter by weight (Buckman and Brady, 1969).

Monotypic vegetation--Vegetation that is dominated by only one plant species.

Mottling--Spots or blotches of different color or shades of color interspersed with the dominant color (Buckman and Brady, 1969). The dominant color is called the soil matrix.

Muck--Highly decomposed organic material in which the original plant parts are not recognizable (Buckman and Brady, 1969).

Obligate upland species--Species that, under natural conditions, always occur in uplands (i.e., greater than 99% of the time). The less than 1% is to allow for anomalous wetland occurrences (i.e., occurrences that are the result of man-induced disturbances and transplants).

Obligate wetland species--Species that, under natural conditions, always occur in wetlands (i.e., greater than 99% of time). The less than 1% is to allow for anomalous upland occurrences (i.e., occurrences that are the result of man-induced disturbances and transplants).

Organic pan--A layer (i.e., spodic horizon), usually occurring at 30-75 centimeters (12-30 inches) below the soil surface in coarse-textured soils, in which organic matter and aluminum (with or without iron) accumulated at the point where the top of the water table most often occurs (Environmental Laboratory, 1987).

Peat--The sod layer at and near the surface of a wetland, as well as the deeper, partially decomposed, vegetation into which the sod eventually grades (Sipple, 1985).

Percent areal cover--An estimate of the area covered by the foliage of a plant species projected onto the ground. It is determined independent of other species, and because of species overlap, the total areal cover for all species will frequently exceed 100%, particularly for forested sites.

Periodic--Occurring or recurring at intervals which need not be regular or predictable. Used here in reference to inundation or saturation of a wetland soil.

Permeability--The quality of the soil that enables water to move downward through the profile, measured as the number of inches per hour that water moves downward through the saturated soil (Soil Conservation Service, 1987).

Physiognomy--A term referring to the overall appearance of the vegetation, as opposed to its floristic composition. This is the result of the various life forms (e.g., trees, shrubs, and herbs) and their distribution in each stratum (Kuchler, 1967).

Ponded--A condition in which water stands in a closed depression. The water is removed only by percolation, evaporation, or transpiration (Soil Conservation Service, 1987).

Poorly drained--A condition in which water is removed from the soil so slowly that the soil is saturated periodically during the growing season or remains wet for long periods (Soil Conservation Service, 1987).

Prevalence--This term is equivalent to dominance. Thus, the prevalent vegetation is the dominant vegetation.

Quadrats--Sampling units or plots that may vary in size, shape, number, and arrangement, depending upon the nature of the vegetation and the objectives of the study (Smith, 1974).

Root zone--That part of the soil profile that is or can be occupied by plant roots and rhizomes. For most plant species occurring in wetlands, particularly herbaceous plants, the majority of the roots and rhizomes generally occur within the upper 30 centimeters (12 inches) of soil.

Sapling--A young tree between 1 and 10 centimeters (0.4 and 4 inches) in diameter 1.37 meters (4.5 feet) above the ground surface.

Saturated--A condition in which all voids (pores) between soil particles in the root zone are filled with water to a level at or near the soil surface (maximum water retention capacity). Saturation may be periodic or permanent.

Seedling--A young tree that is smaller than a sapling and generally less than 1 meter (3.28 feet) high.

Shrub--A woody plant that at maturity is usually less than 6.1 meters (20 feet) tall and generally exhibits several erect, spreading or prostrate stems and has a bushy appearance (e.g., smooth alder, *Alnus serrulata*) (Cowardin, *et al*, 1979).

Soil--A dynamic natural body on the surface of the earth in which plants grow, composed of mineral and organic materials and living forms. Also the collection of natural bodies occupying parts of the earth's surface that support plants and that have properties due to the integrated effect of climate and living matter acting upon parent material, as conditioned by relief, over periods of time (Buckman and Brady, 1969).

Soil color--A characteristic of soil that has three variables: chroma, hue, and value. The hue notation of a color indicates its relationship to red, yellow, green, blue, and purple; the value notation indicates its lightness; and the chroma notation indicates its strength or departure from a neutral of the same lightness (Kollmorgen Corporation, 1975).

Soil horizon--A layer of soil, approximately parallel to the soil surface, with distinct characteristics produced by soil-forming processes (Buckman and Brady, 1969). For example, the A horizon is the upper-most mineral horizon. It lies at or near the soil surface and is where maximum soil leaching occurs.

Soil matrix--The portion (usually greater than 50%) of a given soil layer that has the dominant color (Environmental Laboratory, 1987).

Soil phase--A subdivision of a soil series based on features such as slope, surface texture, stoniness, and thickness (Soil Conservation Service, 1987).

Soil profile--A verticle section of the soil through all the horizons and extending into the parent material (Buckman and Brady, 1969).

Soil series--A group of soils having horizons similar in differentiating characteristics and arrangements in the soil profile, except for texture of the surface layer (Soil Conservation Service, 1987).

Somewhat poorly drained--A condition in which water is removed slowly enough that the soil is wet for significant periods during the growing season (Soil Conservation Service, 1987).

Species area curve--As used in this Manual, the curve on a graph produced when plotting the cumulative number of plant species found in a series of quadrats against the cumulative number or area of those quadrats. It is used here in the detailed jurisdictional approach to determine the number of quadrats sufficient to adequately survey the herbaceous understory.

Topographic contour--An imaginery line of constant elevation along the ground (Environmental Laboratory, 1987). A contour line is the corresponding line on a topographic map.

Transect--As used in this Manual, a line along which sample plots are established for collecting vegetation, soil, and hydrology data.

Tree--A woody plant that at maturity is usually 6.1 meters (20 feet) or more in height and generally has a single trunk, unbranched to about three feet above the ground, and more or less definite crown (e.g., red maple, Acer rubrum) (Cowardin, et al, 1979). As distinguished from a sapling, a tree is greater than 10 centimeters (4 inches) diameter breast height.

Typical--That which normally, usually or commonly occurs (Environmental Laboratory, 1987).

Under natural conditions--This phrase refers to situations in which plant species occur in the native state at sites "undisturbed" by man as opposed to those species occurring as transplants or on sites significantly disturbed by man's activities (e.g., dredging, filling, draining, and impounding).

Under normal circumstances--This phrase was placed in the regulatory definition of wetlands to respond, for example, to those situations in which an individual has attempted to eliminate permit requirements by destroying the wetland vegetation (e.g., a de-vegetated wetland could normally support wetland vegetation) and those areas that are not wetlands but experience the abnormal presence of wetland vegetation (e.g., marsh spoil piles placed under upland conditions, but temporarily supporting marsh plants due to remnant plant propagules). Under the former situation, an area would still remain a part of the overall wetland system protected by the Section 404 program. Conversely, the abnormal presence of wetland vegetation in a non-wetland area would not be sufficient to include that area within the jurisdiction of the Section 404 program. Legal alterations to the hydrologic regime, as opposed to mere removal of vegetation, may alter "normal circumstances" if they in fact change the nature of a wetland area so that it no longer functions as part of waters of the United States.

Uplands--Areas that, under normal circumstances, support a prevalence of plants that are not typically adapted for life in saturated soil conditions. Uplands include all areas, other than aquatic habitats, that are not wetlands.

Upland-wetland boundary--The line established in jurisdictional determinations that separate wetland areas from adjacent upland areas.

Vegetation--The plant life as it exists on the ground (i.e., the mosaic of plant communities on a landscape) (Kuchler, 1967).

Vegetation signature--A unique spectral reflectance or emission response transmitted or received by a sensor (e.g., the photographic appearance of vegetation units on color film).

Vegetation structure--The division of a plant community into strata and the distribution of the various life forms in each of these strata (Kuchler, 1967).

Vegetation unit--A patch, grouping, or zone of plants evident in overall plant cover which appears distinct from other such units because of the vegetation's structure and floristic composition. A given unit is typically topographically distinct and typically has a rather uniform soil, except possibly for relatively dry microsites in an otherwise wet area (e.g., tree bases, old tree stumps, mosquito ditch spoil piles, and small earth hummocks) or relatively wet microsites in an otherwise dry area (e.g., small depressions).

Very long duration--A duration class in which inundation for a single event is greater than 1 month (Soil Conservation Service, 1987).

Very poorly drained--A condition in which water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season (Soil Conservation Service, 1987).

Water table--The zone of saturation at the highest average depth during the wettest season. It is at least 15 centimeters (6 inches) thick and persists in the soil for more than a few weeks (Soil Conservation Service, 1987).

Wetland hydrology--The sum total of wetness characteristics in areas that are inundated or have saturated soils for a sufficient duration to support hydrophytic vegetation (Environmental Laboratory, 1987).

Wetland indicator status--The exclusiveness or fidelity with which a plant species occurs in wetlands. The different indicator categories (i.e., facultative species, obligate wetland species, and obligate upland species) are defined elsewhere in this glossary.

Wetlands--Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR Section 328.3 and 40 CFR Section 230.3).