HISTORY AND CONCEPTS OF A HYDRIC SOIL
(Student Notes)

1976

SCS and FWS agreement to develop a list of hydric soils as an attachment to FWS wetland classification (Cowardin, et al.).

Objective was to develop a class of soils that correlated with the presence of hydrophytic vegetation.

1977

Blake Parker, SCS Soil Scientist assigned.

First Definition - Soils with water at or near the surface for most of growing season or the soil is saturated long enough to support plants that grow well in a wet environment.

Questions at the time were:

-how long does it take hydric soils to form?

-how long does a soil have to be saturated to support hydrophytes?

First field studies to start development of criteria by looking at wetlands and identifying Taxonomic classes of soils that occur there.

1978

Further field studies revealed not all aquic suborder soils supported hydrophytic vegetation. People involved realizing complexity of defining hydric soils. Soil Taxonomy alone could not do it.

1979

SCS National leadership did not believe cultivated soils should be wetlands / hydric.

Definition: ...reducing regime...saturated... capillary fringe **saturates to the surface**... duration of saturation such that cultivated crops not generally grown. Central concept is undrained soils that classify as typic subgroups of aquic suborders.

1980

Distributed first draft of the hydric soils of the U.S. for review to the states.

Group re-emphasized the intent of the hydric soils definition to identify soils that: 1. favor the production and regeneration of hydrophytic vegetation, and 2. that have a high degree of correlation between hydrophytic plant communities and hydric soils.

Most hydric soils have properties that reflect dominant colors in the matrix as follows:

1. if there is mottling, the chroma is 2 or less.
2. if there is no mottling, the chroma is 1 or less.

1981

Deputy Chief of SCS appoints a Technical Committee to finalize definition and to prepare an approved list by October 1982.

Procedure for identifying hydric soils: Aquic moisture regime immediately below or within a depth of 25 cm. *effectively at 25 cm*

Soils drained or protected from flooding are not hydric.

1982

National Bulletin 430-2-7 distributed final draft of hydric soils and definition for comment.

Lot of criticism for using aquic moisture regime to identify hydric soils - "aquic moisture regime in Soil Taxonomy is not that wet."

1983

Bulletin 430-3-10 distributed list of soils with actual or high potential for hydric conditions. List relied on the presence of an aquic moisture regime and presence of morphological indicators within 25 cm of the soil surface.

1984

Letter to NTCHS requesting them to write a set of rules to enable consistent judgements of hydric soils in the field.

1985

NTCHS given responsibility for list because of inconsistencies between states and no rules for deleting soils from the list. State SCS staffs being arbitrary.

NTCHS expanded to include reps from COE, EPA, Universities.

Definition: 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.

Criteria: used Taxonomy, drainage class, water table depths, permeability, and growing season defined by soil temperature regimes.

Controversy: Can a drained soil be hydric? What is drained?
The intent (although not clearly stated) was that "once a hydric soil always a hydric soil." Drained soils are hydric.

1986

NTCHS removes "in its undrained condition" from definition.

Movement towards removal of reference to hydrophytic vegetation.

1987

Second edition of Hydric Soils of the U.S. was published.

Duration of saturation was added to criteria because of use of 7 day hydric soil hydrology criteria in development on 89 Wetland Manual. 1989 manual also (incorrectly) used 1.5 ft. depth to water table as wetland hydrology criteria.

1989

Revised criteria to address sandy soils issues on the southern coastal plain. Sands do not support hydrophytic vegetation unless water table at the surface. Lack of capillary tension for saturation above the water table.

Discussion by NTCHS on "fidelity" groupings of hydric soils. Histosols and VPD = obligate hydric etc. Issue tabled, user groups (EPA and COE) did not see the utility of such an approach.

1990

Effort to develop hydric soil indicators accelerated.

Dr. Wildings research (TX) indicates it takes 14-21 days for soil to become anaerobic.

1991

Further development of hydric indicators.

Discussion on clarification of criteria to show that <1.5 ft. actually means < or = to 1.0 ft. because water tables are entered in the database in .5 ft. increments. NTCHS "chickens out" and tables changing the criteria; afraid the user community would perceive this as making hydric soils "wetter."

1992

NTCHS adds the following statement to introductory material: "The criteria are designed to generate a list of hydric soils based upon soil attributes that are on the SIR. They are not meant for on-site identification or verification of hydric soils. Regional indicators of hydric soils are designed for on-site identification of soils that meet the definition and criteria for hydric soils."

1994

Definition changed to once and for all indicate that drained soils are hydric by saying "hydric soils are soils that formed under conditions of saturation..."

Field testing of Field Indicators of Hydric Soils in the U.S.

First discussions regarding a scientific technical standard for hydric soils for researchers. How wet? How long? How deep? Reduced how much? Statistical reliability?

1995

NAS Wetlands report. States "hydric soils lists are a good first step but field indicators should be used for on-site verification."

Field Indicators of Hydric Soils in the U.S. released by NRCS for use in the field. Policy is they will be used on all delineations performed by NRCS. Technical buy in from other agencies has been achieved; however, because of politics administrators of 404 program are "dragging their feet."

Hydric soils go "on-line", information available on the INTERNET on NRCS, NSSC, Hydric Soils Home Page on WWW.

NRCS Wetland Science Page NRCSUSDA

1996

Supplemental guidance from COE HQ allows use of Field Indicators of Hydric Soils in the U.S. if tied to 87 Manual or Problem soils.

CONCLUSION

Hydric soils have always been meant to correlate with hydrophytic plant communities and; therefore, wetlands.

In 1986 change was made to include areas that are potentially wetlands (removed "in its undrained condition")

The upper part has always meant the upper 25 - 30 cm. of the soil.(loamy soils) In addition, (per 1979) capillary fringe saturates to the surface. (0-12")

The saturation criteria was never meant to be applied in the field without data. i.e. one time observation of a water table / saturated soil doesnt "prove" the criteria is met.

Soil morphology has always been the preferred way to identify hydric soils.

Classification of Wetland Soils for Wetland Identification[1]

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Abstract

The objective of this paper is to discuss the background in the development of the hydric soil definition and criteria. The hydric soil classification was developed at the request of the Fish and Wildlife Service as a tool for use in the National Wet-

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lands Inventory (NWI) of the USA. The objective of creating a hydric class of soils was to develop a class of soils that correlated with the presence of hydrophytic vegetation. This list of hydric soils in conjunction with soil surveys is used to help identify wetlands in the NWI. Development of the hydric soils classification was a result of extensive field studies and testing of proposed definitions. The resulting definition and criteria for hydric soils uses water table depths, flooding and ponding, drainage class, and permeability properties and qualities from the national soil survey database, and the aquic and Histosol classes in Soil Taxonomy. The definition and criteria were developed to generate a national list of hydric soils that support hydrophytic vegetation. The criteria were not meant for field use in identifying hydric soils. The use of morphologic indicators are suggested for field identification of hydric soils.

The effort to develop a hydric class of soils began in the mid- to late 1970s at the request of the Fish and Wildlife Service (FWS) to aid in their NWI. The NWI is completed largely using remote sensing techniques and other available resource inventory data. The hydric or wet class of soils was defined to make the soil resource inventory of the National Cooperative Soil Survey most useful to the NWI effort. The FWS uses the list of hydric soils along with soil maps to the National Cooperative Soil Survey as an aid in their wetlands mapping activities.

The objective of this paper is to discuss the background in the development of the hydric soil classification, the definition and criteria for hydric soils, and issues with respect to the hydric soil definition and criteria.

Background

Cowardin et al. (1979) coined the term hydric soil in their publication *Classification of Wetlands and Deepwater Habitats of the United States*. They defined wetland as having one or more of the following three attributes: the land periodically supports predominantly hydrophytes, the substrate is predominantly undrained hydric soil, and the substrate is nonsoil and is saturated with water or is covered by water some time during the growing season of each year. In cooperation with the initiation of the NWI effort of the FEW, the Soil Conservation Service (SCS) agreed to develop the hydric soil definition (classification) and to provide a list of hydric soils for use in the NWI.

The work began on developing a class of hydric soils concurrent with the development of the Cowardin et al. (1979) publication. The main objective of the hydric soil definition or classification was to define a class of soils that correlated closely with hydrophytic vegetation.

Hydric Soil Classification Process

Phase 1, 1977–1980

The strategy for developing a list of hydric soils was to first define the concept and criteria for identifying hydric soils and then to conduct field

studies to determine which soils best fit the initial definition of hydric soil. Some initial questions were: (i) how long does it take hydric soils to form?, and (ii) how long does a soil have to be saturated to support growth of hydrophytes?

The initial working definition was: "Hydric soils are soils with water at or near the surface for most of the growing season or the soil is saturated long enough to support plants that grow well in a wet environment."

Initially it was thought that all soils with aquic and peraquic moisture regimes would meet this definition. The definition of aquic moisture regime, "...implies a reducing regime that is free of dissolved oxygen because the soil is saturated by ground water or by water of the capillary fringe,' (Soil Survey Staff, 1975).

Implications of this definition are that at the highest categories in Soil Taxonomy such as typic subgroups of Aquic Suborders, the whole soil is saturated. Conversely, in aquic and aeric subgroups only part of the profile is saturated and most likely only the lower parts. Soil Taxonomy does not specify a duration of saturation but suggests that saturation occurs for at least a few days.

A study group was formed to field test the definition and initial criteria of hydric soils. The field tests were mainly concerned with correlating "hydric soils" to hydrophytic vegetation. As a result of field studies and correlations between soils and hydrophytic vegetation the team observed that most hydric soils: (i) have dominant colors in the matrix as follows—if there is mottling, the chroma is two or less, and if there is no mottling chroma is one or less; have three wetness conditions—typic or similar subgroups that meet the wetness requirements of typic, aeric or similar subgroups that do not meet the wetness requirements of typic, and other subgroups with or without wetness requirements of typic; and Histosols except Folists also were considered hydric.

These observations are very close to the criteria used to distinguish Aquic Suborders and subgroups in Soil Taxonomy. In an effort to tie the hydric soil classification to the presence of an aquic moisture regime, the team modified the initial definition of hydric soils to more closely align with the definition of aquic moisture regimes. In 1980 a list of wet soils was distributed to the State SCS staffs for testing and review. Each state was to ensure that the soils on the list supported a predominance of wetland vegetation in their undrained condition and did not generally support cultivated crops unless drained or protected from flooding.

Phase 2, 1980–1983

The group developing the hydric soils classification was formalized into the National Technical Committee for Hydric Soils (NTCHS). The NTCH was formed to finalize the hydric soil definition and to prepare an approved list of hydric soils. The original team included soil scientists from SCS, the SCS National Biologist, and two university experts in wet soils. The committee re-emphasized that the intent of the hydric soil definition is to identify soils that: (i) favor the production and regeneration of hydrophytic vegetation, (ii) that have a high degree of correlation between hydrophyti

plant communities and hydric soils, (iii) are protected from flooding or that are drained are not hydric, (iv) are wet from human influences are not hydric, and (v) are wet from natural factors such as beaver ponds but that may not have wetness characteristics are considered hydric.

Comments received on the hydric soil criteria of 1980 suggested that: soil water does not have to be virtually free of O_2 because soil microorganisms will quickly deplete available O_2, promoted the idea of obligate and facultative hydric soils, aeric subgroups may not be hydric in the south, Soil Taxonomy should not be used in the hydric soil criteria because not all aquic moisture regimes are presently reducing or saturated but are related to the presence of morphology associated with wetness, designation of hydric status must be at the series level, and drained soils should not be listed on the hydric soil list.

The main concern with use of the aquic moisture regime and subsequent classification in Soil Taxonomy is the following statement in the keys to Suborders, "...have an aquic moisture regime or are artificially drained and have characteristics associated with wetness," (Soil Survey Staff, 1975). The phrase "or artificially drained" includes soils in the aquic moisture regime that may not presently have the saturation required for hydric soils. Also the use of soil characteristics associated with wetness such as mottles, Mn concretions, and soil colors, may be related to relic conditions of the soil and not always indicate present hydrology of the soil.

As a result of these comments, the committee revised the definition and criteria slightly and also muddied the waters by adding a definition for hydric soil condition. A list of hydric soils and soils with hydric conditions was distributed in June 1983 for comment by SCS State staff. This list still relied on the use of aquic moisture regime and presence of morphological indicators of wetness within 25 cm (9.84 inches) of the soil surface.

Phase 3, 1983-1985

The NTCHS was expanded to include members from an expanded user group of the Corps of Engineers (CE) and Environmental Protection Agency (EPA). The CE and EPA use hydric soils in determining wetland as part of the Clean Water Act (U.S. Army Engineer Corps, Environmental Laboratory, 1987). The NTCHS was formalized in a letter from SCS top staff with a list of functions which included: development of definition and criteria for hydric soils, development of procedures for reassessing the criteria and the list of hydric soils, development of an operational list of hydric soils and distribute to SCS state offices and cooperators, coordination of activities with the National Wetland Plant List Review Panel, and provision of continuing technical leadership in the formulation, evaluation, and application of criteria for hydric soils.

The present committee membership consists of: M.J. Mausbach, Chair, Soil Scientist, SCS; H.C. Smith, Soil Scientist, SCS; D. Williams, Soil Scientist, SCS; C.L. Girdner, Soil Scientist, SCS: A.J. Tugel, Soil Scientist, SCS; D.S. Fanning, Soil Scientist, Univ. of Maryland; R.W. Skaggs, Agricultural Engineer, North Carolina State Univ.; W.H. Patrick, Soil Chemist, Louisiana State Univ.; J.L. Richardson, Soil Scientist, North Dakota State Univ.;

B.M. Teels, National Biologist, SCS; W. Sipple, Ecologist, EPA; P.B. Reed, Biologist, FWS; R. Theriot, Biologist, Army Corps of Engineers; W.B. Parker, Soil Scientist, HYDRICSOIL; P. Avers, Soil Scientist, Forest Service; and C. Voigt, Soil Scientist, Bureau of Land Management.

Feedback from the 1983 list and criteria for hydric soils suggested that only poorly and very poorly drained soils be included on the list; and that there was an alarming inconsistency among state lists, and thus indicated the need for a standardized procedure to generate the list of hydric soils.

As a result of the need for a standardized procedure for generating the national list of hydric soils, the NTCHS concentrated on developing criteria that would use soil properties in the Soil Interpretations Record (SIR) for soil series to create a national list of hydric soils. The SIR is a national database that contains soil property records for all soil series recognized in the National Cooperative Soil Survey in the USA (Mausbach et al., 1989).

The NTCHS used the aquic moisture regime of soil taxonomy as a general cut for saturated soils supplemented with water table, flooding and ponding data, and Land Capability Class and subclass. They arbitrarily created growing season periods based on soil temperature regimes (NTCHS, 1985).

This list generated many comments: capability classification could not be used because it was based on a hierarchy and the wetness factors may not be correctly reflected in the subclass rotation, taxonomic criteria do not identify all hydric soils, a number of SIRs are missing drainage class information, there are a number of aquic soils that do not have water tables close to the surface, the definition and criteria do not match, and the flooding and ponding criterion includes well- and excessively well-drained soils.

The NTCHS considered these comments and replaced the use of Land Capability Subclass with drainage class and water tables. The final definition and criteria for a hydric soil were (NTCHS, 1985), "A hydric soil is 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."

The use of the phrase "in its undrained condition" has been interpreted by many to imply that a drained soil would not meet the definition of hydric soils. However, the phrase was included to tie the hydric soil definition to the keys of Aquic Suborders in Soil Taxonomy that state "unless artificially drained." The phrase means that once a hydric soil always a hydric soil and that draiange of the soil would not change the classification.

The criteria are:

1. All Histosols except Folists, or
2. Soils in Aquic Suborders, Aquic Subgroups, Albolls Suborder, Salorthids Great Group, or Pell Great Groups of Vertisols that are
   a. somewhat poorly drained and have water table less than 0.5 ft from the surface at some time during the growing season; or
   b. poorly drained or very poorly drained and have either;
      (i) water table at less than 1.0 feet from the surface at some time during the growing season if permeability is equal to

or greater than 6.0 inches/hour in all layers within 20 inches, or

(ii) water table at less than 1.5 feet from the surface at some time during the growing season if permeability is less than 6.0 in./h in any layer within 20 inches, or

3. Soils that are ponded during any part of the growing season, or
4. Soils that are frequently flooded for long duration or very long duration during the growing season.

The use of drainage classes and water table depths appears inconsistent with the definition of drainage classes in that the highest water tables are associated with the somewhat poorly drained soils. Because the SIR database does not include duration of water tables, drainage class is used as a substitute for duration of the water table at a certain depth. Somewhat poorly drained soils are interpreted as having relatively short duration of water tables, thus the water table is placed at a depth of less than 0.5 feet. The use of permeability class relates to ease of drainage of excess water from the soil and, rightly or wrongly, relates to the capillary fringe above the free water table. One could argue that texture is better correlated to capillary fringe.

The first National List of Hydric Soils in the USA was published in 1985 (NTCHS, 1985).

Phase 4, 1985–Present

The passage of the Food Security Act of 1985 played a significant role in the use of hydric soil definition, criteria, and lists. It passed into law the definition of wetland as meeting three criteria: hydrophytic vegetation, hydric soils, and hydrology. Rules and regulations developed by the USDA allowed the use of only two criteria: hydric soils and vegetation, in areas where hydrology had not been modified. These changes in the use of the hydric soil list, definition, and criteria placed increased pressure on the hydric soil definition and criteria in respect to length of time for a soil to become anaerobic. Increasingly groups were citing the hydric soils criteria as indicating 7 days of saturation, flooding, and ponding as the length of time for a soil to become anaerobic. The 1989 Federal Wetlands Manual (Federal Interagency Committee for Wetland Delineation, 1989) used verbatim the hydric soil hydrology criteria as the hydrology criteria for the manual. These same groups were misquoting the hydric soil criteria and stating that a water table could be as low as 1.5 feet and still meet the wetland hydrology (by convention water tables in the SIR are recorded by 0.5-feet increments, thus the NTCHS could have easily used less than or equal to 1.0 feet in place of less than 1.5 ft in the criterion). There also were some lingering issues of the criteria such as requiring ponded and flooded soils to have aquic moisture regimes, and sandy soils in the southeastern coastal plain.

Because of these developments, the NTCHS received comments criticizing the implied 7 days duration of saturation for anoxic condition to develop. They then reviewed recent literature and research on wet soils with respect to anaerobic conditions in the upper part of the soil as related to sandy soils, duration of wetness, and depth of wetness. Duration for saturation was added to the criteria in a 1987 revision (National Technical Committee for

Hydric Soils, 1987). In 1990 they made a significant change to the criteria by increasing the period for saturation from 1 week to 2 weeks or more during the growing season based on recent research. This change did not affect the list of hydric soils since the Soil Interpretation Record distinguishes high water table on a basis of a few weeks.

The SCS and NTCHS also conducted field tests in the southeastern coastal plain and added a special criterion for sandy soils based in part on the potential capillary rise in these very sandy soils. This criterion requires the water table to be at the surface for these soils.

The present definition of hydric soils is (NTCHS, 1991), "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. The following criteria reflect those soils that meet this definition."

Changes to the definition from 1985 include removing the phrase "in its undrained condition" and the reference to hydrophytic vegetation. The reference to hydrophytic vegetation was replaced with the phrase indicating presence of anaerobic conditions in the upper part. This change was made to make the definition independent of hydrophytic vegetation although hydric soils are still closely related to the presence of hydrophytes.

The criteria use the basic soil properties of water table depth, flooding, and ponding; the soil quality and permeability; and classes of soil taxonomy and drainage. The criteria are:

1. All Histosols except Folists, or
2. Soils in Aquic Suborder, Aquic Subgroups, Albolls Suborder, Salorthids Great Group, Pell Great Groups of Vertisols, Pachic Subgroups, or Cumulic Subgroups that are:
   a. somewhat poorly drained and have a frequently occurring water table at less than 0.5 ft from the surface for a significant period (usually more than 2 wk) during the growing season, or
   b. poorly drained or very poorly drained and have either:
      (i) a frequently occurring water table at less than 0.5 feet from the surface for a significant period (usually more than 2 weeks) during the growing season if textures are coarse sand, sand, or fine sand in all layers within 2] inches, or for other soils;
      (ii) a frequently occurring water table at less than 1.0 feet from the surface for a significant period (usually more than 2 weeks) during the growing season if permeability is equal to or greater than 6.0 inches/hour in all layers within 20 inches; or
      (iii) a frequently occurring water table at less than 1.5 feet from the surface for a significant period (usually more than 2 weeks) during the growing season if permeability is less than 6.0 inches/hour in any layer within 20 in., or
3. Soils that are frequently ponded for long duration or very long duration during the growing season, or

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

The criteria were not designed to be used in the field identification of hydric soils, but in the absence of field procedures for identifying hydric soils in the wetland delineation process, delineators were trying to apply the hydric soil criteria along with morphological descriptions of the soil in soil survey reports. In many cases these descriptions were not complete enough for the delineators to make consist wetland delineation calls. The NTCHS recently added a statement of clarification of how the criteria are meant to be used. The statement reads, "The criteria are designed to generate a list of hydric soils based on soil attributes in the Soil Interpretations Record. They are not meant for on-site identification or verification of hydric soils. Regional indicators of hydric soils are designed for on-site identification of soils that meet the hydric soil definition and criteria."

The regional indicators of hydric soils are currently under development and testing by the SCS. An excellent example of these criteria are those developed by the SCS soils staff in Florida (Hurt & Puckett, 1992, and Watts & Hurt, 1991).

The NTCHS continues to study hydric soil issues that include review of the flooding and ponding criterion with respect to: the presence of anaerobic conditions in soils that do not have an aquic moisture regime, similar to saturated soils; water table depth with respect to capillary fringe and anoxic conditions in the upper part of the soil; and duration of saturation with respect to anoxic conditions in the upper part.

Conclusions

The development of the hydric soil classification of soils has evolved over 15 years of study and testing of the definition and criteria. The objective was and still is to develop a list of soils that correlates with the presence of hydrophytic vegetation. The classification criteria use the aquic moisture regime of Soil Taxonomy as a first cut in identifying soils with anaerobic conditions. The soil properties and qualities of water table depth, flooding and ponding, soil texture, soil permeability, and drainage class are used to generate a list of hydric soils from the national Soil Interpretational Record database. The criteria are strictly utilitarian in that they are useful for generating a standardized list of soils. Field morphological properties that related to water table levels and zones of anaerobicity in soils should be used when identifying hydric soils in the field.

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Federal Register
February 24, 1995

Supplementary Information

The list of hydric soils was created by computer using criteria that were developed by the National Technical Committee for Hydric Soils. The criteria are selected soil properties that are documented in Soil Taxonomy and were designed primarily to generate a list of hydric soils from the national database of Soil Interpretation Records (SIR). Criteria 1, 3, and 4 serve as both database criteria and as indicators for identification of hydric soils. **Criteria 2 serves only to retrieve soils from the database.**

The wording of criterion 2 has been changed to incorporate recent changes in Soil Taxonomy and delete references to water table frequency and duration. Until all soils have been reclassified, the computer program will continue to select soils under their former classification. The water table frequency and duration data are not contained on the Soil Interpretations Record and, therefore, were not selection criteria.

The wording of criterion 2 has also been changed to clarify the way in which water-table data were used to select soils from the Soils Interpretation Records database. Because the water table depths on the SIRs are entered in 0.5 ft. increments, **previous versions of criterion 2 used water tables** at less than 0.5, 1.0, and 1.5 ft. in order to extract hydric soils from the database **with actual recorded water tables of 0.0, 0.5, and 1.0 ft.**

It is important to note that these changes do not cause any soils to be added or deleted from the list.

Definition of a Hydric Soil

A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part.

Present criteria

Criteria for Hydric Soils

1. All Histosols except Folists, or

2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Aquisalids, Pachic subgroups, or Cumulic subgroups that are:

a. somewhat poorly drained with a water table equal to 0.0 ft. from the surface during the growing season, or

b. poorly drained or very poorly drained and have either:

(1) water table equal to 0.0 ft. during the growing season if textures are coarse sand, sand, or fine sand in all layers within 20 inches (in), or for other soils,

(2) water table at less than or equal to 0.5 ft. from the surface during the growing season if permeability is equal to or greater than 6.0 in/hour (h) in all layers within 20 in, or

(3) water table at less than or equal to 1.0 ft. from the surface during the growing season, if permeability is less than 6.0 in/h in any layer within 20 in or,

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

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

RATIONALE FOR HYDRIC SOILS

By
W. BLAKE PARKER

INTRODUCTION

The Soil Conservation Service and Fish and Wildlife Service entered into an agreement to provide an SCS Soil Scientist to work on an assignment with the National Wetlands Inventory, in 1976. The purpose of this assignment was to develop the definition and criteria for hydric soils and publish a list of hydric soils of the U.S. as an attachment to the Fish and Wildlife Service's wetland classification system. I accepted this assignment and began working on this project in May, 1977. The strategy for developing the list of hydric soils was first to refine the concept, then to summarize it as a definition, to field-test the definition, and finally to identify those soil characteristics that are indicative of hydric conditions.

With the assistance from a number of people, especially Keith K. Young and Dr's. Richard Guthrie and William H. Patrick, the definition of hydric soils was developed and field tested. After numerous revisions and updates the current definition emerged. Then by means of using Soil Taxonomy and the National Soil Survey in identifying and classifying soils one could develop criteria that would identify that part of the landscape considered hydric.

In the beginning all soils with aquic and peraquic moisture regimes were considered hydric. During the field studies, soils with aeric subgroups in aquic suborders were considered too dry to be included as hydric. Because these soils are dry during the early part of the growing season, neither the plant community nor the soils reflect a wetland condition. An interagency study team (consisting of the Soil Conservation Service, U.S. Fish & Wildlife Service, U.S. Army Corps of Engineers and, when possible, the Environmental Protection Agency and other federal and state agencies) designated key states in which to do field studies on the correlation of plant communities and hydric soils. These field studies stressed the need for more definite research on soil saturation and plant adaptation to certain kinds of wet soils.

During these field studies in the Eastern Gulf and Atlantic coastal flatwoods major land resource areas, Aquults and Aqualfs with light-colored surface layers seemed to have more yellow and red mottles and were not usually considered hydric by the study group. The Aquults and Aqualfs with dark-colored surface layers were more gray in the subsoil and were usually considered hydric by the group. The Ochraquults and Albaqualfs that were highly mottled, particularly with red mottles, seemed to support a more mesophytic-type of plant community and were not considered hydric.

The water regime of wetlands can usually be correlated with the soil moisture regimes of Soil taxonomy.

There are five such soil moisture regime classes, viz., aquic, aridic, torric, udic, and ustic. The aquic implies a reducing regime that is virtually free of dissolved O_2 because the soil is saturated by groundwater or by water of the capillary fringe. The aquic moisture regime in the highest categories of soils seems to correlate best with the hydric soils.

The soils most likely to fit the definition of hydric soils are those in the Typic subgroups of aquic suborders and other subgroups of aquic suborders with an equivalent degree of wetness.

The length of time and the depth to which a soil is saturated are important for soil interpretations, use potential, management, classification, and genesis. A water table strongly influences biological and chemical processes. In most soils, depth and length of saturation can be correlated to the quantity, nature and pattern of mottles relative to soil horizons, and to structure. The relationship between the quantity, distribution, and color of mottles is related to oxidation-reduction conditions in the soil. Periodic saturation of a soil may result in processes of reduction followed by oxidation when the soil becomes unsaturated. Reduction and removal of reduced compounds results in gleying characterized by low chroma colors.

Most soils that have repeated or extended periods of saturation are mottled in the wet part of the profile. The abundance, size, and color of the mottles usually indicate the periodicity of saturation. Soils that are predominantly gray with brown or yellow mottles are usually saturated for a much longer time than those that are predominantly yellow or brown with gray mottles. Soils that are never saturated are usually bright colored and are not mottled. Soils that are always saturated during the seasons of biological activity in the soil usually lack mottles and are uniformly gray throughout the zone that is saturated. Mottles may not be visible in some soils because they are masked by the organic matter.

One of the early definitions of hydric soils. Note the reference to reducing conditions and depth to within 25 cm. approximately 1980-81.

Hydric Soils

The intent of the definition of hydric soils is to identify soils that favor the production and regeneration of hydrophytic vegetation. There is a high degree of correlation between present hydrophytic plant communities and hydric soils. Presence of hydric soils alone does not necessitate that an area be classified as wetlands since other factors including hydrophytic plants and hydrology must also be considered.

Definition

Hydric soils are soils that for a significant period of the growing season have reducing conditions in the major part of the root zone and are saturated within 25 cm of the surface. Most hydric soils have properties that reflect dominant wetness characteristics, namely, they have immediately below 25 cm dominant colors in the matrix as follows:

1. If there is mottling, the chroma is 2 or less.

2. If there is no mottling, the chroma is 1 or less.

The definition in 1982 deleted the depth within 25 cm and reducing conditions.

Definition

Hydric soils have:

Either

a. The soil is saturated at or near the soil surface with water that is virtually lacking free oxygen (O_2) for significant periods during the growing season, or

b. The soil is flooded frequently for long periods during the growing season.

Early on criteria for hydric soils were developed.

The original criteria consisted of:

1. All Histosols (except Folists)
2. All soils with Aquic Suborders (Aquic moisture regimes)

3. All soils poorly or very poorly drained.
4. All soils with capability subclass IVw - VIIIw

A list of soils was printed using this criteria for field review. We immediately realized that other soils existed as hydric that did not fit these criteria. We then developed a computer program to print out all the soils of the U.S. that were saturated long enough to fit the definition of hydric soils. This included drainage, depth to water table and permeability. These were not originally part of the criteria, but during the process of evolution they became part of the hydric soils criteria.

After the list of hydric soils was printed and sent out for review and comments. This list received varied comments and suggestions, in fact some states deleted all the soils except Histosols or those inundated daily by the tides. Due to extreme action by some states it was realized that some consistent control was needed. At this time by my suggestion and encouragement, a National Technical Committee for Hydric Soil was formulated. This committee consisted of representatives from SCS, COE, EPA, USFWS, and three (3) Land Grant Universities that were doing considerable wet soils research. The decision was made to include one (1) member representing the TSC's, one (1) member representing the states, and three (3) members from the soils division and the National Biologist. The SCS Washington office agreed the committee would have the authority and responsibility for reviewing and revising the definition and criteria of hydric soils.

After field testing we realized that the sandy Entisols adjacent to streams that were frequently flooded long enough to be considered wetlands but with no hydric soils characteristics observable were a unique problem. We then started trying to figure out how we could develop hydric soil criteria to include these areas but not include areas that were not hydric. Work continued on this problem for several years. Finally, the only criterion we could come up with that consistently fit this problem was using flooding frequency and duration. A list of soils was printed that were frequently flooded for long or very long duration and began looking at these areas throughout the country to determine if they were wetlands according to the study group's opinion. We were criticized by a number of people saying we had deviated from soil criteria and were in fact using hydrology. We finally rationalized that flooding frequency and duration are soil criteria because they are properties of soil map units, are a part of the name of map units, are observed and recorded by soil scientists making soil surveys, and are used as a basis for making interpretations of soil surveys; hence, flooding frequency and duration are soil properties.

The list of hydric soils was created by computer using criteria that were developed by the National Technical Committee for Hydric Soils. The criteria are selected soil properties that are documented in Soil Taxonomy (Soil Survey Staff, 1975, 1994) and were designed primarily to generate a list of hydric soils from the national database of soil interpretations records. Criteria 1, 3, and 4 serve as both database criteria and as indicators for identification of hydric soils. Criterion 2 was developed to retrieve soils from the database.

The definition of hydric soil has changed considerably since 1977. The definition has gone from three (3) pages to one sentence. The early definition was revised to read "A hydric soil is 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." Later the undrained condition was changed to natural condition. Subsequent revision has deleted the reference to undrained and natural conditions as well as reference to vegetation. In the "upper part" received considerable discussion and the decision was made not to refer to a specific depth.

Comments on Criteria.

1. All Histosols except Folists seems to have consistent agreement.

2. The task force realized after field studies that all soils with aquic suborders were not always wet enough to be considered wetland and on the other hand some soils classified as aquic subgroups, wet Vertisols etc. were saturated at a depth and time to be considered wetlands. So other criteria were then considered; that is drainage, depth to water table, etc.

2. a. Somewhat poorly drained and have water table less than 0.5 feet from the surface at some time during the growing season. This item was suggested by Dick Johnson of the Midwestern NTC at Lincoln, Nebraska. His rationale as best as I can describe it was the soils in the prairie section or corn belt were developed under a wet moisture regime and due to tile drainage most of the acreage had the water table lowered and SCS had changed the drainage class from poorly to somewhat poorly on all those soils. In any event some of these soils were left in their natural conditions, the water table would be listed at less than 0.5 feet but the drainage class would remain as somewhat poorly. If these soils were not tile drained they would meet the criteria for hydric so he suggests we list somewhat poorly drained soils with water table less than 0.5 feet be listed as hydric and the computer would print these out.

2. b. (1) and 2 b (2) were separated out to help states with sandy soils with high water tables to distinguish between those soils with appreciable amounts of fines (silt + clay) versus those with appreciably no fines (silt + clay).

The criteria was revised to print out the list of soils based on Taxonomic classification, drainage class, depth to water table, ponding and flooding. Following is a list of the criteria:

Criteria for Hydric Soils

1. All Histosols except Folists, or

2. Soils in Aquic suborder, Aquic subgroups, Albolls suborder, Salorthids great group, Pell great groups of Vertisols, Pachic subgroups, or Cumulic subgroups that are:

a. Somewhat poorly drained and have a frequently occurring water table at less than 0.5 foot (ft) from the surface for a significant period (usually more than 2 weeks) during the growing season, or

b. poorly drained or very poorly drained and have either:

(1) a frequently occurring water table at less than 0.5 ft from the surface for a significant period (usually more than 2 weeks) during the growing season if textures are coarse sand, sand, or fine sand in all layers within 20 inches (in), or for other soils

(2) a frequently occurring water table at less than 1.0 ft from the surface for a significant period (usually more than 2 weeks) during the growing season if permeability is equal to or greater than 6.0 in/hr in all layers within 20 in, or

(3) a frequently occurring water table at less than 1.5 ft from the surface for a significant period (usually more than 2 weeks) during the growing season if permeability is less than 6.0 in/hr in any layer within 20 in, or

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

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

The definition and criteria are currently undergoing revisions and updates based on research on the transition zone.

Regional field indicators of hydric soils are currently being developed.

Field Indicators are soil characteristics which are documented to be strictly associated only with hydric soils. field Indicators are an efficient on-site means to confirm the presence of hydric soil. The Field Indicators are designed to identify soils which meet the hydric soil definition without further data collection. Some hydric soils exist for which no Field Indicators have yet been recorded and documented, and to identify these soils as hydric, evidence must be gathered to demonstrate that the definition is met. Additional Field Indicators are being developed and tested.

Attached is a chronological list of "Hydric Soil Definitions".

Hydric Soil Condition

Introduction

The following list contains soil series that have hydric soil conditions in their natural undrained state. The list is to be used with the list of hydrophytic vegetation to aid in the identification of wetlands. Soil series in this list are likely to have the hydrology to support hydrophytic vegetation in their natural undrained state. It is recommended that this list be used in combination with hydrophytic vegetation and hydrology to determine if areas containing these soil series are wetlands.

Hydric conditions are associated with many soils most of the time, whereas these conditions are associated with other soils only occasionally, in certain landscapes or under certain management conditions. Most of the soils having hydric conditions are classified in Aquic suborders of Soil Taxonomy, but some subgroups normally do not have hydric conditions.

Definition

A hydric soil condition exists when the soil in its natural undrained state is saturated at or near the surface during much of the growing season. Features frequently associated with hydric soil conditions include:

1. Aquic moisture regime - the wetness state of soils that are saturated by groundwater or water of the capillary fringe and that have properties associated with wetness, immediately below a depth of 25 cm from the soil surface.

2. A deficiency of oxygen at or near the surface during much of the growing season.

3. Iron and manganese concretions near the surface.

4. Flooding or ponding of long duration during the growing season.

January 4, 1982

Hydric Soils

The intent of the definition of hydric soils is to identify soils that favor the production and regeneration of hydrophytic vegetation. Hydric soils are saturated or flooded long enough to produce anaerobic conditions (lacking oxygen) that affect the growth of plants. There is a high degree of correlation between present hydrophytic plant communities and hydric soils. The presence of free water in or on the soil for extended periods, accompanied by a virtual absence of oxygen, are key attributes of hydric soils. In identifying hydric soils, hydrology, land management, and observable soil properties as well as elements of the definition are evaluated. soils that were wet at one time but that have been drained or protected through natural or man-made means are not considered hydric soils. Neither are soils that are naturally not wet but that are periodically flooded or saturated for specific management purposes. For example, some soils with morphological properties of wet soils are no longer wet because the natural groundwater level had dropped since they formed. Other soils such as those covered by recent impoundments like beaver ponds do not have the morphology of wet soils but are considered to be hydric soils. A national list of hydric soils, consisting of phases of soil series identified as hydric soils by National Cooperative Soil Survey cooperators in each State, will be used in connection with a list of hydrophytes prepared by the Fish and Wildlife Service to identify wetlands. "Soil" in this context refers to a technical grouping, which consists of phases of soils and not to the names of map units on a soil survey map; consequently the operational use of soil maps to assist in designating areas of hydric soils may need additional guidelines.

Definition

Hydric soils have:

Either

a. The soil is saturated at or near the soil surface with water that is virtually lacking free oxygen (O_2) for significant periods during the growing season, or

b. The soil is flooded frequently for long periods during the growing season.

Procedure for identifying hydric soils

Accessory properties of soils that are related to attributes of the definition can be used to infer a hydric condition. Morphological properties that are routinely observed in describing and classifying soils that are most directly related to conditions which are characteristic of wetlands are gray colors, the presence of iron and manganese concretions near the surface, and wetness state. In addition, position in the landscape, known flooding or ponding history, and evidences of natural or man-made alterations.

October, 1985

Introduction

The list of hydric soils contains soils that are sufficiently wet under undrained conditions to support the growth and regeneration of hydrophytic vegetation. The list includes hydric soils that are either drained or undrained; therefore, not all areas of hydric soils support predominantly hydrophytic vegetation and thus are not wetland. In some soil series only those phases that are ponded or are frequently flooded for long or very long duration meet the criteria for hydric soils.

This list of hydric soils was created by computer using criteria that was developed by the National Technical Committee for Hydric Soils and reviewed by the agencies making up the committee. The criteria are selected soil properties that are documented in Soil Taxonomy and Soil Interpretations Records (SOI-5).

This list will have a number of agricultural and non-agricultural applications. These include assistance in land-use planning, conservation planning, mapping, classifying and delineating wetlands, mitigation planning, and assessment of potential wildlife habitat. This list, used in conjunction with the list of hydrophytes, is part of the procedure for classifying wetland as described in "Classification of Wetlands and Deepwater Habitats of the United States," U.S. Fish and Wildlife Service, December, 1979.

Definition of Hydric Soil

A hydric soil is 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.

Criteria for Hydric Soils

1. All Histosols except Folists, or

2. Soils in Aquic suborders, Aquic subgroups, Albolls suborder, Salorthids great group, or Pell great groups of Vertisols that are:

   a. somewhat poorly drained and have water table less than 0.5 ft. from the surface at some time during the growing season, or

   b. poorly drained or very poorly drained and have either:

or greater than 6.0 in/hr in all layers within 20 inches, or

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

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

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

June, 1991

Introduction

Hydric soils are developed under conditions sufficiently wet to support the growth and regeneration of hydrophytic vegetation. This list includes phases of soil series that may or may not have been drained. Some series, designated as hydric, have phases that are not hydric depending on water table, flooding, and ponding characteristics.

This list of hydric soils was created by computer using criteria that was developed by the National Technical Committee for Hydric Soils. The criteria are selected soil properties that are documented in Soil Taxonomy (Soils Survey Staff, 1975) and Soil Interpretations Records (Soil Survey Staff, 1983).

This list will have a number of agricultural and nonagricultural applications. These include assistance in land-use planning, conservation planning, and assessment of potential wildlife habitat. Combination of the hydric soil, hydrophytic vegetation, and hydrology criteria define wetlands as described in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (Federal Interagency Committee for Wetland Delineation, 1989). Therefore an area that meets the hydric soil criteria must also meet the hydrophytic vegetation and wetland hydrology criteria in order for it to be classified as a jurisdictional wetland.

The general list of hydric soils in this publication is maintained in a computer file and is updated annually each October. The most current list of hydric soils may be obtained for the cost of printing from the SCS Project Manager, Statistical Laboratory, Iowa State University, 217 Snedecor Hall, Ames, IA 50011. State lists of hydric soils are available from the SCS state conservationist in each state. The SCS also maintains lists for each conservation district in the United States of map units that contain or may in some delineations contain hydric soils. These detailed lists are available by contacting the respective SCS state conservationist and are recommended for use in making wetland determinations.

Definition of Hydric Soil

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. The following criteria reflect those soils that meet this definition.

Criteria for Hydric Soils

1. All Histosols except Folists, or

(1) water table at less than 1.0 ft. from the surface at some time during the growing season if permeability is equal to or greater than 6.0 in/hr in all layers within 20 inches, or

(2) water table at less than 1.5 ft. from the surface at some time during the growing season if permeability is less than 6.0 in/hr in any layer within 20 inches, or

3. Soils that are ponded during any part of the growing season, or

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

1986

Hydric Soils

The intent of the definition of hydric soils is to identify soils that favor the production and regeneration of hydrophytic vegetation. Hydric soils are saturated or flooded long enough to produce anaerobic conditions that affect the plant growth. There is a high degree of correlation between present hydrophytic plant communities and hydric soils. The presence of free water in or on the soil for extended periods and a virtual absence of O_2 are key attributes of hydric soils. In identifying hydric soils, hydrology, land management, and observable soil properties as well as elements of the definition are evaluated. Phases of soil series were identified by cooperators in the National Cooperative Soil Survey (NCSS) as those soils that consistently meet the definition of hydric soils. "Soil" in this context refers to a technical grouping that consists of phases of a soil series and not to the names of map units on a soil survey map; consequently, the operational use of soil maps to assist in designating areas of hydric soils may need additional guidelines.

Definition of Hydric Soil

A hydric soil is a soil that in its natural 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.

Criteria for Hydric Soils

1. All Histosols except Folists, or

2. Soils in Aquic suborders, Aquic subgroups, Albolls suborder, Salorthids great group, or Pell great groups of Vertisols that are:

   a. somewhat poorly drained and have water table less than 0.5 feet from the surface at some time during the growing season, or

   b. poorly drained or very poorly drained and have either:

      (1) water table at less than 1.0 feet from the surface at some time during the growing season if permeability is equal to or greater than 6.0 in/hr in all layers within 20 inches, or

2. Soils in Aquic suborders, Aquic subgroups, Albolls suborder, Salorthids great group, or Pell great groups of Vertisols Pachic subgroups, or Cumulic subgroups that are:

a. somewhat poorly drained and have a frequently occurring water table at less than 0.5 feet from the surface for a significant period (usually more than 2 weeks) during the growing season, or

b. poorly drained or very poorly drained and have either:

(1) a frequently occurring water table at less than 0.5 feet from the surface for a significant period (usually more than 2 weeks) during the growing season if textures are coarse sand, sand, or fine sand in all layers within 20 inches, or for other soils

(2) a frequently occurring water table at less than 1.0 feet from the surface for a significant period (usually more than 2 weeks) during the growing season if permeability is equal to or greater than 6.0 in/hr in any layer within 20 inches, or

(3) a frequently occurring water table at less than 1.5 feet from the surface for a significant period (usually more than 2 weeks) during the growing season if permeability is less than 6.0 in/hr in any layer within 20 in, or

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

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

(2) water table at less than 1.5 feet from the surface at some time during the growing season if permeability is less than 6.0 in/hr in any layer within 20 inches, or

3. Soils that are ponded during any part of the growing season, or

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

December, 1987

Introduction

Hydric soils are developed under conditions sufficiently wet to support the growth and regeneration of hydrophytic vegetation. This list includes phases of soil series that may or may not have been drained. Some series have phases that are not hydric depending on water table, flooding, and ponding characteristics.

This list of hydric soils was created by computer using criteria that was developed by the National Technical Committee for Hydric Soils and reviewed by the agencies making up the committee. The criteria are selected soil properties that are documented in Soil Taxonomy and Soil Interpretations Records (SOI-5).

This list will have a number of agricultural and nonagricultural applications. These include assistance in land-use planning, conservation planning, mapping, classifying and delineating wetlands, mitigation planning, and assessment of potential wildlife habitat. This list, used in conjunction with the list of hydrophytes, is part of the procedure for classifying wetland as described in "Classification of Wetlands and Deepwater Habitats of the United States," U.S. Fish and Wildlife Service, December, 1979.

Definition of Hydric Soil

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.

Criteria for Hydric Soils

1. All Histosols except Folists, or

2. Soils in Aquic suborders, Aquic subgroups, Albolls suborder, Salorthids great group, or Pell great groups of Vertisols that are:

   a. somewhat poorly drained and have water table less than 0.5 feet from the surface for a significant period (usually a week or more) during the growing season, or

   b. poorly drained or very poorly drained and have either:

      (1) water table at less than 1.0 feet from the surface for a significant period (usually a week or more) during the growing season if permeability is equal to