U.S. Department of Agriculture
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Natural Resources Conservation Service
Soil and Plant Science Division
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Hydric Soil Technical Standard

Purpose

The National Technical Committee for Hydric Soils (NTCHS) developed the Hydric Soil Technical Standard (HSTS) to provide a scientifically based and standardized approach to document soils that are saturated long enough during the growing season to become anaerobic in the upper part of the soil profile, thus demonstrating that the definition of a hydric soil ("Changes in Hydric Soils of the United States," 1995) has been met. The HSTS identifies a hydric soil when a field indicator may not be present such as in problematic or undeveloped soils. Finally, the HSTS is a tool to identify and propose additions or changes to existing hydric soil indicators. The technical data requirements for applications associated with the HSTS are described in this technical note.

Acknowledgements

The HSTS is a product of the NTCHS work over several decades. This technical note is based on input from former NTCHS members in addition to the current committee members and many researchers in the field. It coincides with a journal article entitled "Development and application of the Hydric Soil Technical Standard" written by Jacob F. Berkowitz, Michael J. Vepraskas, Karen L. Vaughan, and Lenore M. Vasilas. For additional information regarding the NTCHS or to submit comments related to the field indicators of hydric soil, contact the current Chair of the National Technical Committee for Hydric Soils or visit the NTCHS website.

Background

The NTCHS developed the HSTS to address the need for an approach to pair the hydric soil definition with the functional status of a soil. The HSTS is a scientifically based and standardized approach for collecting, evaluating, and presenting hydric soils data. It uses quantitative measurements of soil saturation or inundation and anaerobic conditions in the upper part (NTCHS, 2015) of the soil profile. The required measurements are collectively referred to as the HSTS. The HSTS uses direct measures of soil saturation, flooding, or ponding in conjunction with the presence of anaerobic conditions in the upper part of the soil profile where a majority of the roots occur (National Research Council, 1995). Finally, the NTCHS created the HSTS to facilitate the development and maintenance of hydric soils field indicators by connecting observed soil morphological features with the hydric soil definition.

Definition of a Hydric Soil and Guidance for Applying the HSTS

Hydric soils are defined as soils that "formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part" of the soil profile

(Soil Conservation Service, 1994). The HSTS is a tool used to meet the hydric soil definition when field indicators are not present, evaluate the current functional hydric soil status, propose changes to exisiting field indicators and develop new field indicators. The hydric soil definition is based upon documenting that a soil remains saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper portion of the soil profile. Therefore, the HSTS requires that the following three technical conditions be met:

1. The soil exhibits anaerobic conditions that can be measured, and
2. Following a period of normal or drier than normal precipitation when soil microbes are active, the soil is saturated and anaerobic conditions are met, and
3. The soil is saturated in the upper 25 centimeters (cm) of the soil profile for a specific period that is—
    a. At least 7 consecutive days, occurring for a minimum of 28 days annually, for Vertisols in Louisiana and Texas, or
    b. At least 14 consecutive days for all other soils.

The HSTS pairs the hydric soil definition with the functional status of a soil. The functional status is determined by directly measuring soil saturation, flooding, or ponding and the presence of anaerobic conditions in the upper part of the soil profile. The HSTS documents whether a soil currently functions as a hydric soil, but it does not address the conditions under which the soil formed. Therefore, not all soils that meet the definition of a hydric soil will meet the HSTS. As a result, the HSTS is not designed to overrule or invalidate a determination of hydric soil that has met one or more field indicators of hydric soil. The hydric soil field indicators reflect natural processes that develop over time during soil formation and generally provide the best evidence that hydric soils are present on a site. The HSTS can be used as a tool for the following:

1. Initiating new field indicators of hydric soils,
2. Altering existing field indicators of hydric soils,
3. Identifying the presence of hydric soil conditions in areas lacking an approved field indicator of hydric soil, and
4. Evaluating the current functional status of a hydric soil.

Onsite Precipitation Data

Precipitation analysis places short-duration study results into a larger climatic context. As a result, HSTS application requires that the saturation and anaerobic conditions criteria be met following a period of normal or drier than normal precipitation. Data demonstrating that requirements for saturation and anaerobic conditions exist following a wetter than normal period cannot be used to meet the HSTS. Additional monitoring would be needed to document hydric soil conditions (Vepraskas et al., 2019).

Precipitation data is used to evaluate whether the period of observation was normal, wetter than normal, or drier than normal precipitation. The analysis should be based on data collected onsite or at a nearby location with similar elevation and climate. Three methods are recommended to measure precipitation data. These include the following:

1. The Direct Antecedent Rainfall Evaluation Method (DAREM),
2. The Moving Total Antecedent Rainfall Method, and
3. The Adjusted Moving Total Antecedent Rainfall Method.

Sprecher and Warne (2000) provide a description of each method (although referring to them as the Method for Estimating Antecedent Moisture Conditions, Method of Rolling Totals, and the Combined Method, respectively), offer guidance on application, and compare and contrast the three methods. The DAREM has been used in several studies examining hydric soils and has proven to be the most useful method to measuring normal rainfall. However, it does show some limitations where conditions may not reflect normal hydrology or hydraulics. In these situations, other data collection methods may be required.

All three methods examine the 30th and 70th percentile average rainfall. The 30th and 70th percentile is based on long-term (30 year) average precipitation records. This precipitation data is in the Climate Analysis for Wetlands Tables (WETS) tables, which were developed by the USDA-NRCS National Water and Climate Center (fig. 1). It should be noted that standard WETS tables report precipitation data in inches.

WETS Station : CHATOM, AL1566
Latitude: 3128 Longitude: 08815 Elevation: 00290
State FIPS/County(FIPS): 01129 County Name: Washington
Start yr. - 1971 End yr. - 2000

	Temperature (Degrees F.)			Precipitation (Inches)				
					30% chance will have		avg # of days w/.1 or more	avg total snow fall
Month	avg daily max	avg daily min	avg	avg	less than	more than		
January	60.0	35.5	47.8	6.70	4.36	8.05	7	0.0
February	65.0	38.2	51.6	5.99	4.12	7.13	6	0.0
March	72.8	44.8	58.8	6.88	5.31	7.98	6	0.2
April	79.0	50.9	64.9	5.29	3.14	6.42	5	0.0
May	85.6	59.7	72.7	5.64	3.35	6.85	6	0.0
June	90.2	66.0	78.1	4.73	3.36	5.60	6	0.0
July	92.8	69.0	80.9	5.92	3.77	7.13	7	0.0
August	92.0	68.2	80.1	4.59	3.19	5.46	6	0.0
September	88.3	62.9	75.6	4.14	2.30	5.04	5	0.0
October	79.8	51.9	65.8	3.35	1.71	4.22	3	0.0
November	69.8	43.3	56.5	4.96	3.17	5.98	6	0.0
December	62.6	37.8	50.2	5.44	4.03	6.38	6	0.1
Annual	-----	-----	-----	------	53.80	66.03	--	----
Average	78.2	52.3	65.3	------	------	------	--	----
Total	-----	-----	-----	63.63	------	------	69	0.2

Figure 1.—Example of WETS data indicating the 30th and 70th percentiles for monthly precipitation (Berkowitz et al., 2021).

All three methods consider monthly onsite rainfall measurements. A numerical value for precipitation is assigned such that one equals drier than normal, two equals normal, and three equals wetter than normal. Numerical values are then weighted to account for temporal effects (e.g., recent precipitation events). The computed values are then totaled to yield a cumulative score used to describe the period of precipitation as drier than normal, normal, or wetter than normal. This cumulative weighted precipitation score show normality based on the following scales:

1. Drier than normal: 6–9
2. Normal: 10–14
3. Wetter than normal: 15–18

Many users conduct rainfall normality analysis using the Antecedent Precipitation Tool (APT), which automates precipitation data collection and manipulation. Gutenson et al. (2023) provide instructions for using the APT to determine if the HSTS study period was normal, wetter than normal, or drier than normal (fig. 2). The APT applies the Adjusted Moving Total Antecedent Rainfall Method (i.e., Combined Method) and is available for download on the [APT website](#).

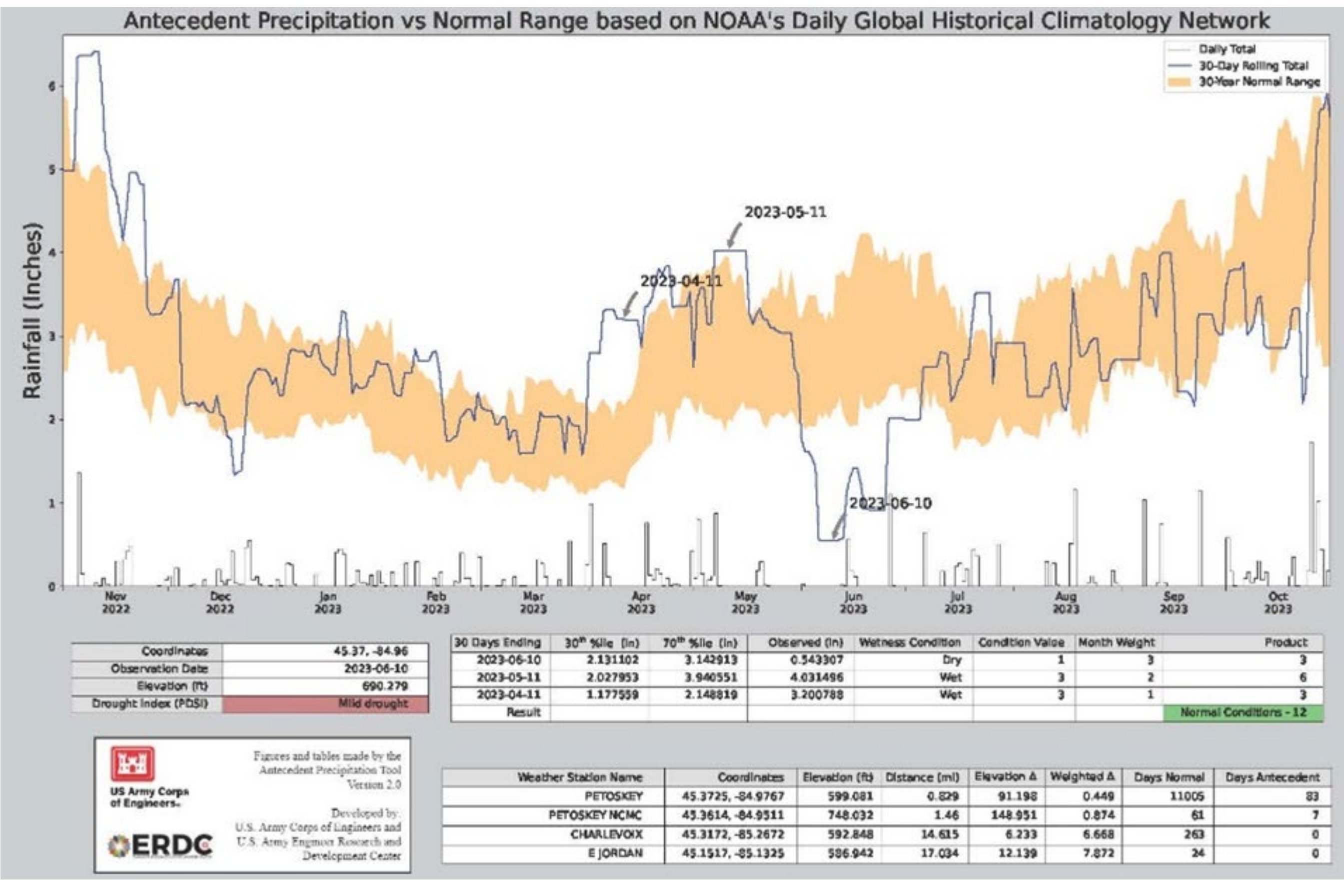

Figure 2.—Example output from the APT displaying the rainfall (bar chart), 30-day rolling precipitation average (line chart), and range of normal precipitation (shaded area). The tables below the chart indicate the drought condition, rainfall normality, and weather stations used for the analysis. Note that the WETS precipitation values are presented in inches.

Soil Saturation

A soil layer is considered saturated, flooded, or ponded if the pore water has a pressure equal to or greater than atmospheric pressure (Soil Survey Staff, 1999; Vepraskas and Sprecher, 1997). This definition of saturation does not include the capillary fringe above the water table (i.e., the tension saturated zone) where water is held at a pressure less than atmospheric pressure. Saturation, flooding, or ponding associated with the HSTS are measured in accordance with findings of the National Research Council (1995).

Methods for Measuring Saturation

Saturated water will flow into wells, piezometers, or open boreholes. Guidance on construction and installation of piezometers and ground water wells in addition to automated data logger installation, monitoring, and data analysis can be found in Sprecher (2008) and USACE (2005). The following three methods can be used to measure saturation with the HSTS.

1. Shallow ground water wells can be monitored by automated data loggers or direct observations;
2. Piezometers can be installed in the study area. A series of piezometers should be installed above and below the restrictive layer to accurately measure saturation. It should be noted that piezometers reflect water pressure at the bottom of the device; or
3. Open boreholes can be used to measured water level depths by direct observation.

Required Depths and Restrictions for Saturation Measurements

1. Two measurements are required when using piezometers. One in the upper portion of the soil profile at a depth of approximately 25 cm and one in the subsoil at a depth of approximately 100 cm.
2. Although shallow wells provide sufficient evidence of soil saturation in most soils, they may not be appropriate for use in soils where restrictive layers or perched water tables occur near the soil surface. If confining layers including low-permeability clays, dense till, or other aquitards are encountered, additional measurements may be needed.

Saturation Measurements Duration Requirements

Generally, to prove saturation, water table monitoring must be conducted across a full field season. At a minimum, one dry–wet–dry hydrologic cycle that covers the normal wet portion of the growing season needs to be included.

1. Water table measurements should be collected, at a minimum of once per week; however, daily observations are recommended.
2. If manual readings are taken weekly, then a period of three consecutive readings must meet the threshold to satisfy the criteria of the HSTS.
3. Saturation measurements recorded with a shallow well or piezometer, at depths and parameters described above, need to be conducted for the following periods:

a. Seven consecutive and 18 cumulative days for Vertisols in Louisiana and Texas, or
b. Fourteen consecutive days for all other soils.

Documentation of Saturation Measurements

1. Water table data should be presented for each piezometer or well at each study location and summarized in tabular and graphic forms indicating when the required saturation criteria (less than or equal to 14 consecutive days within 25 cm) was met (fig. 3).

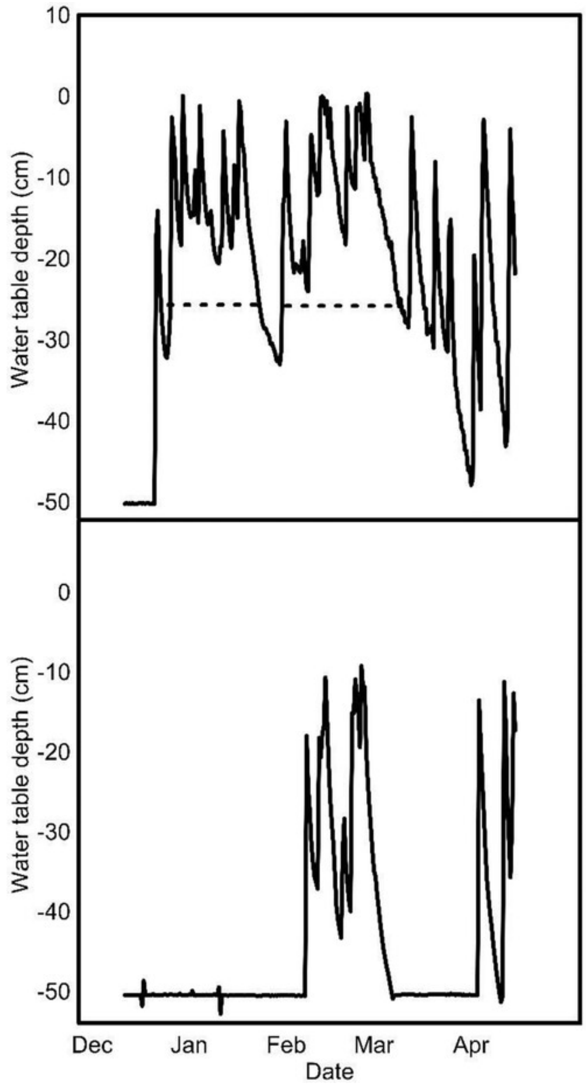

Figure 3.—Top: Example of water table monitoring data collected at a study location that meets the saturation requirement of the HSTS because the water table remains within 25 cm of the soil surface for more than 14 consecutive days. The saturated condition criterion is met during two separate periods, as indicated by the dashed lines. Bottom: Water table monitoring data from a study location that failed to meet the requirements of the HSTS, since the water table is elevated yet fails to remain within 25 cm of the soil surface for 14 consecutive days (data from Berkowitz et al., 2014). These study locations have a year-round growing season (Berkowitz et al., 2021).

Definition and Application of Anaerobic Conditions

Anaerobic is defined as a situation in which molecular oxygen is virtually absent from the environment. The HSTS requires that users document the presence or absence of anaerobic conditions within the upper part of the soil profile during the same period when soil saturation occurs. The depth at which anaerobic conditions must be observed varies with soil texture and measurement technique. The HSTS provides three approved methods to document anaerobic conditions in the soil:

1. Indicator of Reduction in Soils (IRIS) devices;
2. Oxidation–Reduction Potential (also called Redox Potential but for the HSTS we will refer to it as Eh) measurements (Eh); and
3. Alpha-alpha dipyridyl indicator dyes.

IRIS Devices (Tubes or Films)

1. Requirements for using IRIS:
   a. The NTCHS requires five IRIS devices must be installed (fig. 4).
   b. A minimum of three out of five IRIS devices must have at least 30 percent iron removed from a zone 15 cm or more thick. Note: IRIS devices can have an accumulation of iron-sulfide (FeS) after the Fe is stripped off and is considered part of the stripped area (Castaneda et al., 2024).
   c. The zone of removal must begin within 15 cm of the surface for all soil textures.

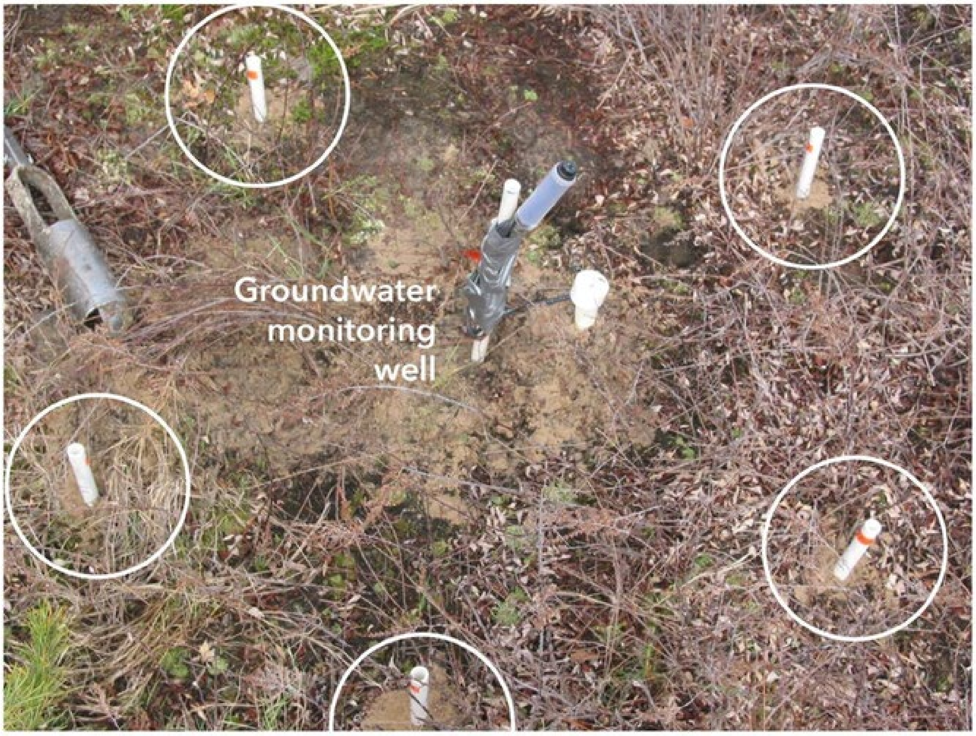

Figure 4.—Equipment installed in support of HSTS data collection. Note that a nest of five IRIS devices (circled) surround a shallow groundwater table monitoring well. The well is outfitted with an automated data logger (Berkowitz et al., 2021).

2. Documentation when using IRIS:
   a. Images of the IRIS devices provide adequate documentation of the iron removal. Several image analysis tools aid in documenting study results and should also be included to communicate that the sample locations meet all the requirements of the HSTS (fig. 5).

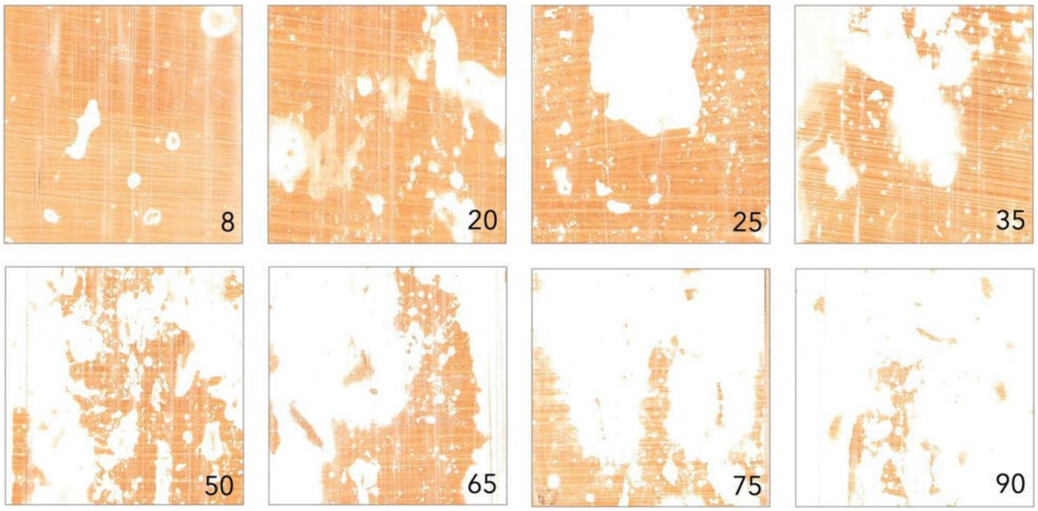

Figure 5.—Images of IRIS films showing a range in iron removal patterns (white zones show where reduction occurred). The percentage of iron removal is noted in the lower right corner of each film and was calculated using Adobe Photoshop (Berkowitz et al., 2021).

3. Duration requirements using IRIS:
   a. There is not a standard duration of IRIS device deployment; however, IRIS measurements are best captured during the normal wet portion of the growing season.
   b. Maximum period of IRIS device deployment should not exceed one annual wet-dry cycle.
4. Advantages of using IRIS devices:
   a. They are less expensive and far simpler than measurements of Eh (and associated soil pH determinations)
   b. They can be used on any soil unlike alpha-alpha dipyridyl dye, which only works for soils containing iron.
   c. They integrate soil conditions across space and time compared with other approaches, which provide documentation for a single point in time.
5. Disadvantageof using IRIS devices:
   a. They require several measurement to develop time series.

Eh Measurements Using Platinum Tipped (Pt) Electrodes

1. Requirements:
   a. Eh instruments must be calibrated. Patrick, Gambrell, and Faulkner (1996) and Vepraskas et al. (2016) provide guidance on the construction, cleaning, and calibration of Pt electrodes for collecting field measurements of soil Eh.

b. The NTCHS recommends that a minimum of five Pt electrodes be installed to ensure measurements are replicated. Multiple Pt electrodes are commonly used to provide more precise estimates of soil Eh account for variability in the data.

c. Installation depth for the Pt electrodes are as follows:

   1) 10 cm for flooded or ponded soils that typically do not saturate;
   2) 12.5 cm for sandy textured soils; or
   3) 25 cm for all other soils.

d. Onsite soil pH measurement must be documented in conjunction with Eh measurements (Faulkner, Patrick, and Gambrell, 1989; Vepraskas et al., 2016).

2. Documenting and interpreting Eh data:

   a. A minimum of three of the five Pt electrodes must have Eh measurements of less than 175 millivolts (mV) at a neutral pH 7.

   b. Anaerobic conditions are presumed to occur when the Eh are below the line shown in figure 6; corresponding to a threshold of:

   Eh = 595-60(pH)

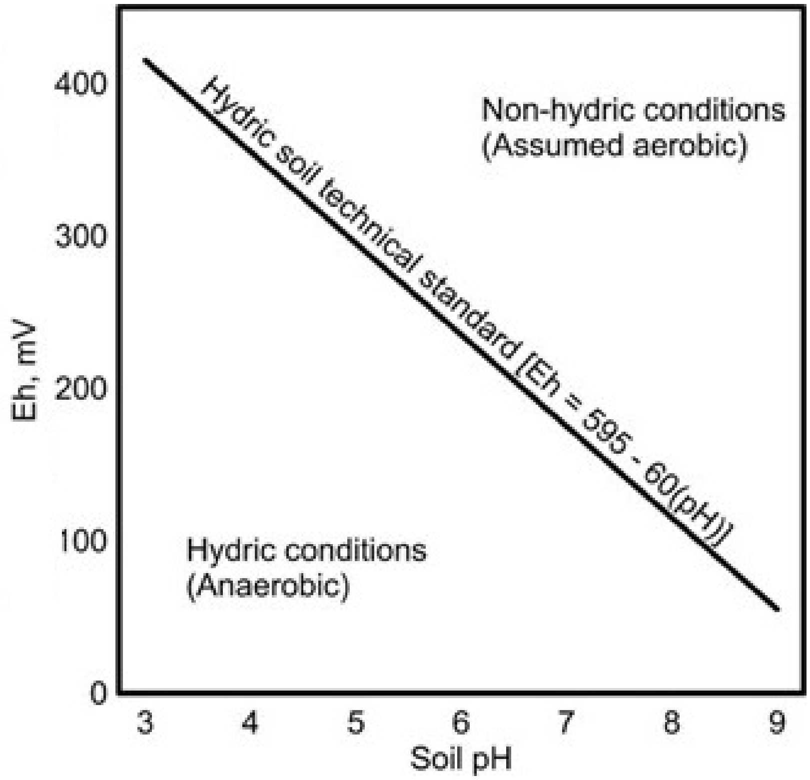

Figure 6.—Eh–pH diagram used to determine if Eh measurements meet the anaerobic conditions requirement of the HSTS. Measurements occurring below the line meet the anaerobic conditions criteria of the HSTS (Berkowitz et al., 2021).

c. Examples of Eh values for oxygen (O_2)reduction based on experimental studies are shown in an article by McBride (1994). Figure 7 shows the O_2 compared to water (H_2O) reduction threshold as derived using the equation:

$$Eh = [1229 + 59\log(PO_2)1/4 - 59(pH)]$$

with a partial pressure of O_2 equal to 20.3 kPa (0.2 atm). The Fe $(OH)^3$: Fe^{2+} threshold using the equation:

$$Eh = [1{,}057 - 59\log(Fe^{2+}) - 177(pH)]$$

with an activity of dissolved species equal to 10−6 M. These equations are as computed by Vepraskas et al. (2016).

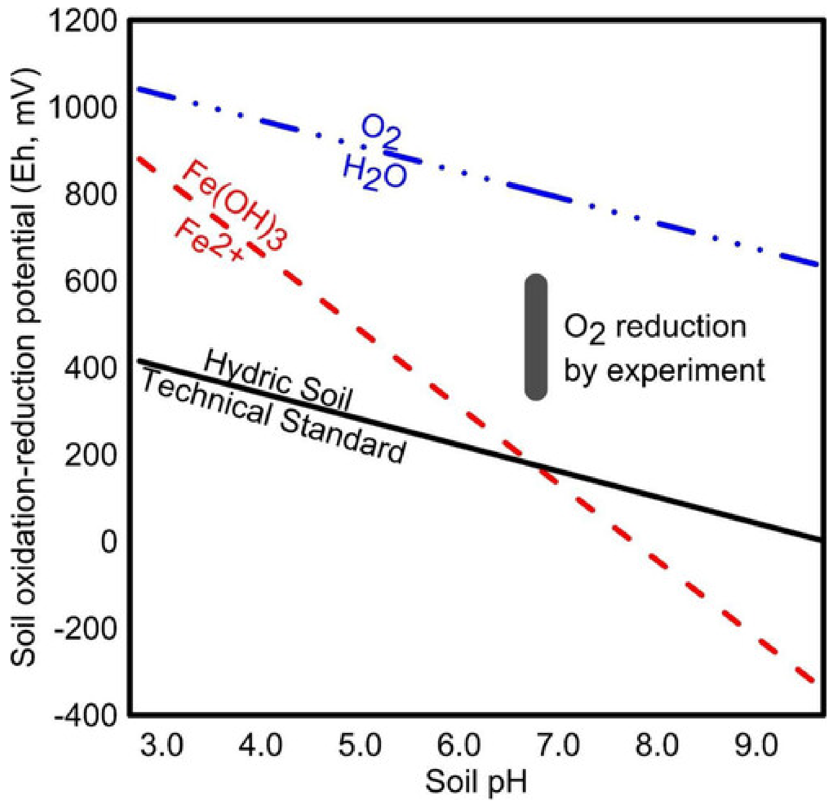

Figure 7.—Eh-pH diagram depicting the HSTS anaerobic conditions threshold used for hydric soils identification in comparison with the theoretical thresholds for O_2 and $Fe(OH)^3$ reduction, along with experimental values for O_2 reduction (Berkowitz et al., 2021).

d. Given the complexities of Eh measurements, reporting the data in both tables and figures will aid in data interpretation for HSTS applications. Figure 8 gives an example of reporting Eh data. In this graph, 3 of the 5 electrodes display anaerobic conditions after week 10. Thus, the site meets the anaerobic conditions requirement of the HSTS. This is also shown in tables in the HSTS journal article (Berkowitz et. al., 2021).

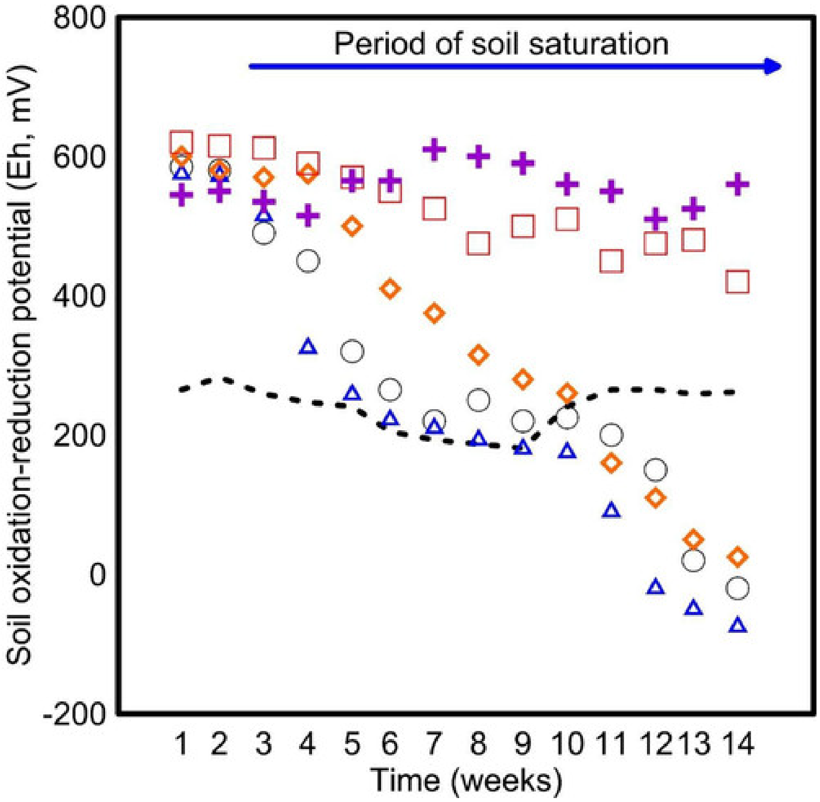

Figure 8.—Five replicate Pt electrodes (installed at the same depth) measuring soil Eh over a period of time. The dashed line represents the Eh threshold required for the soil to be considered anaerobic for HSTS application (Berkowitz et al., 2021).

3. Duration required for measuring Eh:

   According to USDA-NRCS (1991), the delineation of hydric soils in the United States is based on the percentage of time Eh is less than 200 mV during the growing season.

   a. Data collection is to be completed over one wetting and drying cycle.
   b. To meet the definition of hydric soils and to show anaerobic conditions in the soil, Eh measurements need to be below the threshold (shown in fig. 9). The figure shows Eh measurements taken once a week to show a period of saturation.
   c. Data on sampling period, replicates, uncorrected and corrected Eh measurements, soil pH values, and whether each Pt electrode is considered anaerobic should be evaluated independently for each study site to determine if sufficient data has been collected to make a determination of hydric soil (Berkowitz, 2021).

4. Advantages of using Eh measurements:

   a. The ability to track changes in soil conditions in response to environmental factors (e.g., wetting and drying cycles);
   b. The capacity to use automated data logging techniques; and

   c. The ability to link Eh values with specific mineral transformations (e.g., chemical reduction of iron and sulfur) (Rabenhorst et al., 2009).
5. Disadvantages of using Eh measurements
   a. Time and expense of construction and installation of Pt electrodes;
   b. The need to measure soil pH over time;
   c. The inherent variability associated with microsites of soil oxidation and reduction;
   d. The plating or fouling of the electrode surface can induce error; and
   e. The need for additional data interpretation to differentiate aerobic and anaerobic soil conditions based upon Eh-pH phase diagrams (Vepraskas et al., 2016).

Alpha-Alpha Dipyridyl Dye (liquid or strips)

The alpha-alpha dipyridyl dye reacts with reduced, ferrous iron to form a red or pink color (fig. 10; Childs, 1981). Additional guidance regarding the application of alpha-alpha dipyridyl dye is provided in NTCHS (2009) and Berkowitz et al. (2017).

1. Requirements for using alpha-alpha dipyridyl dye:
   a. A positive reaction to dye must occur within 60 percent or more of a layer in least two of three samples.
   b. A positive reaction must occur within the following depths
      1) A 5-cm layer in the upper 10 cm in soils that inundate but do not saturate;
      2) A 6.25-cm layer of the upper 12.5 cm in sandy textured soils; or
      3) A 10-cm layer of the upper 30 cm in all other soils.
2. Documenting and interpreting the data using alpha-alpha dipyridyl dye:
   a. Results of alpha-alpha dipyridyl dye reaction should be documented with photographs and summarized in tabular form (see tables in Berkowitz et. al, 2021) (fig. 9).

Figure 9.—A soil exhibiting anaerobic conditions through the application of alpha-alpha dipyridyl dye embedded in paper test strips. Note that the positive reaction results in a red or pink color occurring over approximately 80 percent of the soil surface, which is above the 60 percent required to document anaerobic conditions in HSTS studies (Berkowitz et al., 2021).

3. Requirement for duration using alpha-alpha dipyridyl dye:
   a. Reaction to alpha-alpha dipyridyl dye must be documented during the period that saturation, flooding, or ponding of the study site is recorded.
   b. At a minimum, within the upper 25-cm zone the soils should show a positive reaction to the dye from two separate applications occurring 2 weeks apart.
   c. Preferably, additional dye applications will be made, such that three or more consecutive weekly measurements are greater than a 14-day period of soil saturation.
4. Advantages of using alpha-alpha dipyridyl dye:
   a. The reaction of alpha-alpha dipyridyl dye is rapid, inexpensive, and does not require the level of effort associated with equipment installation using IRIS devices or Pt electrode studies (Vepraskas et al., 2016). Positive reactions to the dye are typically visible within 1 minute of application.

5. Disadvantages of using alpha-alpha dipyridyl dye:
   a. Degradation of alpha-alpha dipyridyl dyes can occur with exposure to light and heat. Maintaining liquid dye and paper strips in cool and dark conditions is recommended. Effectiveness of the dye may need to be periodically checked.
   b. Dye may react with the metal or iron in spades, augers, other tools, and some knives. These implements can contaminate the soil with metal filings, which will also produce a false positive reaction.
   c. Reactions to the dye may take longer in soils with low amounts of ferrous iron. In addition, the dye only reacts with reduced iron and will not work in soils that do not contain iron oxides and hydroxides.

Data Collection Required to Support the HSTS

1. A minimum of three study areas (with each having hydric and nonhydric components) at replicated within a wetland are required for a hydric soil indicator to be considered by the NTCHS for additions or changes to the "Field Indicators of Hydric Soils."
   a. Within each study area, two study sites with each site containing a hydric and nonhydric location are required to provide replication and account for some variability in soil morphology, hydrology, and Eh (fig. 10).

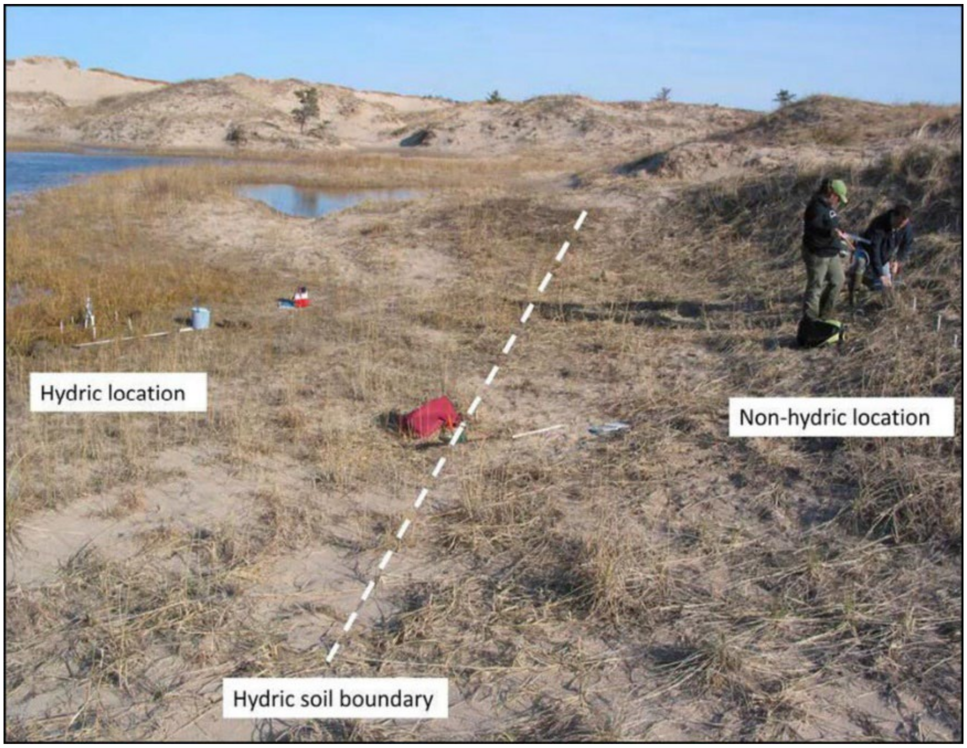

Figure 10.—Example of paired hydric and nonhydric study areas. Soils descriptions, soil saturation and anaerobic condition monitoring, and precipitation normality analysis are conducted at each study area when applying the HSTS (NTCHS, 2015).

2. All site information, including photographs, soil profile description and landscape information that an experienced soil scientist could use to determine whether a field indicator of hydric soils currently exists (fig. 11).

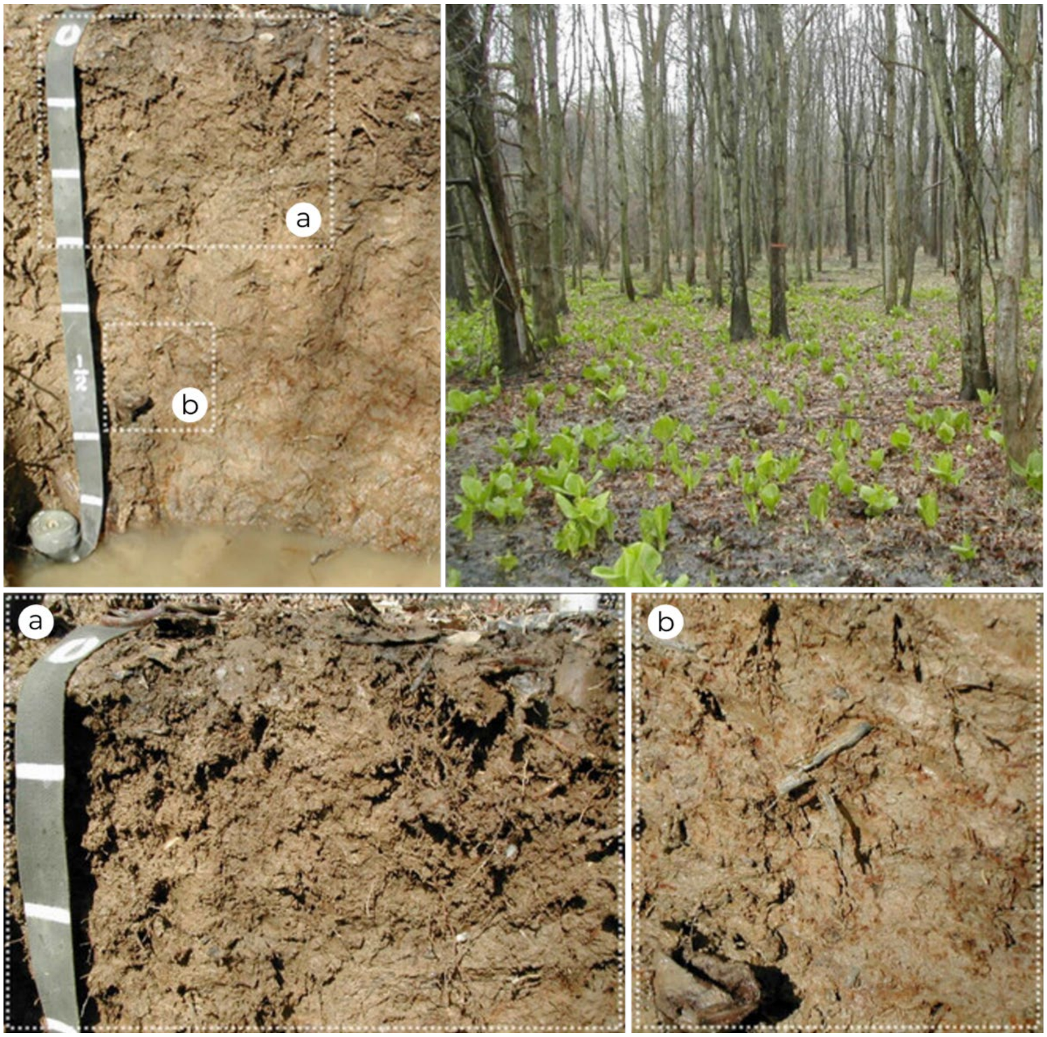

Figure 11.—Soil profile (top left) and landscape setting investigated using the HSTS in the Mid-Atlantic Piedmont Province of Maryland (top right). Close-up images of the shallow (bottom left) and deep portions (bottom right) of the soil profile highlighting specific morphological features (redoximorphic concentrations and depletions of iron in this example). Note: Field indicator F19—Piedmont Flood Plain Soils was developed for use in these settings (Berkowitz et al., 2021).

3. A soils description is required. Vasilas and Berkowitz (2016) and Vepraskas (2013) provide guidance on describing hydric soils. The soil description used in HSTS studies are equivalent to soils data collected as part of a wetland delineation (USACE 2012; USDA-NRCS 2024) (fig. 12). At minimum a soils description needs:
   a. Depth and thickness of soil layers,
   b. Moist matrix colors,

c. Redoximorphic features (abundance, type, color, and location),

d. Soil textures, and

e. Presence of existing field indicators of hydric soil.

SOIL Sampling Point: 1A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (cm)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 2/1	100					Loamy/Clayey	
5-12.5	10YR 3/1	97	7.5YR 4/3	3	C	PL	Loamy/Clayey	Distinct redox concentrations
12.5-20	10YR 4/3	95	7.5YR 5/6	5	C	PL/M	Loamy/Clayey	Prominent redox concentrations
20-50	2.5Y 5/3	90	10YR 5/6	10	C	M	Sandy	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5)
- __ Organic Bodies (A6) **(LRR P, T, U)**
- __ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- __ Muck Presence (A8) **(LRR U)**
- __ 1 cm Muck (A9) **(LRR P, T)**
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Coast Prairie Redox (A16) **(MLRA 150A)**
- __ Sandy Mucky Mineral (S1) **(LRR O, S)**
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Dark Surface (S7) **(LRR P, S, T, U)**
- __ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- __ Thin Dark Surface (S9) **(LRR S, T, U)**
- __ Loamy Mucky Mineral (F1) **(LRR O)**
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Marl (F10) **(LRR U)**
- __ Depleted Ochric (F11) **(MLRA 151)**
- __ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- __ Umbric Surface (F13) **(LRR P, T, U)**
- __ Delta Ochric (F17) **(MLRA 151)**
- __ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- __ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- __ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- __ 1 cm Muck (A9) **(LRR O)**
- __ 2 cm Muck (A10) **(LRR S)**
- __ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- __ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- __ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- __ Red Parent Material (TF2)
- __ Very Shallow Dark Surface (TF12)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: None

Depth (inches): ____

Hydric Soil Present? Yes X No ____

Remarks:

NO FIELD INDICATOR OF HYDRIC SOIL MET

NOT F6 – REDOX DARK SURFACE DUE TO <5% REDOX CONCENTRATIONS IN LAYERS 1 AND 2
NOT F3 – DEPLETED MATRIX DUE TO CHROMA >2 IN LAYERS 3 AND 4
NOT A11 – DEPLETED BELOW DARK SURFACE DUE TO ABSENCE OF A DEPLETED MATRIX IN LAYERS 3 AND 4
NOT F8 – REDOX DEPRESSIONS DUE TO LANDSCAPE RESTRICTIONS (NOT IN A DEPRESSION SUBJECT TO PONDING)

HYDRIC SOIL TECHNICAL STANDARD SUMMARY:

GROUD WATER REMAINED WITHIN 25cm OF THE SOIL SURFACE FOR 35 CONSECUTUVE DAYS (DATA LOGGER # 193443)

4/5 IRIS TUBES DISPLAYED >30% IRON REMOVAL IN TH EUPPER 15cm OF THE SOIL SURFACE

DATA COLLECTION OCCURRED DURING A DRIER THAN NORMAL PERIOD

LOCATION MET THE HYDRIC SOIL TECHNICAL STANDARD

US Army Corps of Engineers — Atlantic and Gulf Coastal Plain Region – Version 2.0

Figure 12.—Example of how to document HSTS Using a USACE form. The form shows a soil description of a study location and what soil components were absent, preventing the soil from meeting an existing field indicator of hydric soil. It did, however, meet the requirements of the HSTS based upon IRIS device and groundwater table monitoring data. The precipitation data demonstrated that the study occurred during a normal or drier than normal period.

4. Onsite precipitation data and an analysis of precipitation normality is required,
5. Documentation showing if the soil meets saturation requirements of the HSTS, and
6. Documentation showing if the soil meets the anaerobic criteria defined by the HSTS.

Reliability of HSTS When Working with Problematic Soils

The NTCHS acknowledges that some hydric soils do not exhibit any characteristics of the approved field indicators of hydric soils for a variety of reasons (e.g., problematic parent materials, recently deposited, or disturbed soils). It must also be noted that the HSTS cannot identify a hydric soil that formed under conditions of saturation, ponding, or flooding that no longer exhibit these characteristics due to hydrologic alterations. Finally, if the HSTS is met in wetter than normal conditions or is not met in drier than normal conditions, then further study of the site is needed by collecting data during a normal precipitation year.

Conclusions

The HSTS provides a quantitative method for evaluation of whether a soil meets the definition of a hydric soil through the evaluation of the occurrence of saturated and anaerobic conditions under normal precipitation.

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