Supplement
to
Field Indicators for Identifying
Hydric Soils
in New England

Version 3
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Introduction

The *Field Indicators for Identifying Hydric Soils in New England* ("Field Indicators") is a technical manual designed for use by persons who are experienced at observing and evaluating soil profiles. The authors of the Field Indicators have attempted to make the keys as user friendly as possible while at the same time not making the manual unwieldy because of too much information.

The authors are aware that the manual is widely distributed throughout New England and is mandated for making wetland delineations in certain states. The manual is used by individuals with varying degrees of expertise in soil science, some of whom may or may not understand the complexities that exist in soil systems. These complexities exist because soils are natural systems with associated variability. This variability may result in soils that are difficult to interpret for less experienced individuals because the soil development process may not always follow expected patterns. Therefore, this supplement was developed for less experienced individuals to explain some of these nuances.

Please note that this supplement addresses how to approach making a hydric soil determination. It does not address wetland delineation and is non-regulatory.

This supplement was written by David Rocque, Maine Department of Agriculture, reviewed by the New England Hydric Soils Technical Committee (NEHSTC), and published by the New England Interstate Water Pollution Control Commission. For more information on the NEHSTC, please see *Field Indicators for Identifying Hydric Soils in New England, Version 3. Field Indicators for Identifying Hydric Soils in New England, Version 3* and this supplement can be downloaded in PDF form from *www.neiwpcc.org/hydricsoils.htm;* a form for ordering hard copies is available on the same web page.

Before You Go Into the Field

A number of steps should be followed prior to making an actual hydric soil determination in the field. The first step is to learn as much as possible about the soils and any past land use activities at the site of the investigation before starting field work. Information about land use activities that may have disturbed the soils can be obtained by talking to the landowner(s), local residents and/or local, state or federal agency personnel working in the area. Current and past aerial photos are also excellent sources of information regarding land use activities. The local Natural Resources Conservation Service (NRCS) office is an excellent source for soil mapping information as well as descriptions of soil types found in the area of investigation. Included with the NRCS soil descriptions should be a list of soil types that may not be named in the delineations on the soil survey but are often found within a mapping unit as inclusions. Understanding the morphologies of the inclusions is as important as understanding the morphologies of the named soils in a map unit because, at the scale that the soil survey was done, you are as likely to encounter an inclusion as you are the named soil.

Making a Hydric Soil Determination

Making a hydric soil determination is not as simple as examining a soil auger boring or observing a soil profile and comparing it to a set of indicators. An experienced soil evaluator always takes a number of other factors into consideration before making a soil determination, hydric or otherwise. In fact, the decision of where you choose to make a soil observation is usually made on the basis of these other factors.

The reason for taking a number of factors into consideration when making a hydric soil determination is because you want support for assuming that soil characteristics observed are the result of morphological processes and not site alteration or past hydrologic conditions. These factors are frequently used by soil evaluators as a guide when deciding where soil observations should be made. This is

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based on the knowledge that there should be a plant/soil/hydrology relationship unless the site has been altered or is subject to unique conditions. If observed soil morphologies do not meet with expectations, attempts to determine why should be made. This often means making a number of other soil observations to see if the pattern holds or if the original observation is an anomaly or the result of alteration. It is not unusual for apparent redoximorphic features to be observed in a soil profile that may be formed not by morphological processes but by soil disturbance.

There are a great many mechanisms that can alter soil profiles so that they differ in appearance from those that haven't been altered including animal activity, human activity or tree throw. A soil evaluator must also consider the fact that the morphological features may be relict, which means they formed in response to a different wetness condition than is present today. Redoximorphic features take a very long time to disappear in a soil after the water table is lowered. **The soil evaluator must determine if the features observed are due to the soil forming process or by some other factor.**

Evaluating the Site

Once properly calibrated for the site and having established a plant/soil/hydrology relationship, the next step is to determine depth and duration of the water table in the soil during the growing season. This is accomplished by observing the presence or absence of redoximorphic features (these include what were formerly called mottles) in the soil. Redoximorphic features form in soils which are periodically or permanently saturated during the time of year in which plants and soil microorganisms are active. They are the result of biochemical processes which result in reduction, translocation and/or oxidation of iron and manganese. In order to decide whether or not the features observed in the soil are due to existing soil wetness conditions, a number of factors should be considered:

1. **Position in the landscape** – is the site on a knoll, side slope, or lowland area? In order for a soil to be hydric, it needs to be

in a landscape position to receive adequate hydrology. This can include a large, flat knoll but would usually not include the top of a convex knoll. If the site is on a side slope, how steep is the slope and how far down the slope is the site? Groundwater must be depleted of oxygen so that reduction in the soil can occur. The steeper the slope, the less likely the soil will be sufficiently anaerobic to create hydric soil morphologies even if the soil has a seasonal water table at or near the surface during the growing season. Therefore, determining whether or not the site is in a position to receive adequate amounts of ground and/or surface water so that it can maintain an anaerobic water table high enough in the soil to develop hydric soil morphologies is an important first step in the site evaluation procedure.

2. **Time of Year and Length of Time Seasonal Water Table is Present** – Do not make a hydric soil determination based solely upon a single observation of the depth to the water table or depth to soil saturation!. In order to create reducing conditions in a soil, the seasonal water table must be present at the time of year that microbes are active and plants are (or would be if present) growing. A soil with a seasonal water table present at the surface during the winter months, does not necessarily provide evidence of the hydrology requirement and may not lead to the development of reducing conditions. The same is true for a water table observed after a heavy rain event. Between four and seven days of saturation are needed for all of the oxygen to be depleted from a saturated soil and reducing conditions to be created. If a soil pit is excavated right after a heavy rain and soil saturation is observed to near the surface, verify that hydic soil morphology is present in the soil profile. It is possible that your observation of soil saturation is simply a "flashy" (not present long enough to create reducing conditions) water table and is not present long enough to create a hydric soil.

3. **Vegetation** – Determine the wetland status of the vegetation at the site. Hydric soils should have wetland vegetation and vice versa. However, if a soil at a site has been disturbed, the

hydrology has been altered, or the vegetation has been planted, a typical plant-soil relationship may not exist. The wetland status of the various vegetation layers should also be taken into consideration. If the trees are one frequency of occurrence status while the lower vegetation layers are another, there may have been a change in hydrology. Another clue for site alteration is vegetative vigor. Wetland species may be growing over an extensive area but doing much better in some places than others. This may be an indication that the hydrology is insufficient to support wetland vegetation in some areas (where it is failing to thrive) while it is adequate in other areas (where it is still thriving). Unique vegetative trends at a site, due to site specific climate factors, may result in a confusing mix of vegetation but upon close observation, a trend can generally be observed where one or more plant species grow in varying abundance along a transect. This/these species may be the hydric soil indicator species for a specific site. Such sites include cool areas in higher elevations or near the ocean.

4. **Signs of alteration** – A site may be altered by filling, cutting, pushing, grading otherwise disturbing the soil. Sometimes signs of alteration are obvious, especially if the activity recently occurred or if there are abrupt landform changes. Natural landscapes are generally smooth in transition and are seldom abrupt (cliff faces and stream terraces are examples of exceptions). Vegetation can also be used at times to determine if a site has been altered, as some species are common pioneer species of disturbed soils. Therefore, knowing the typical pioneer species in your area can aid in determining if a site has been altered or not. A few pioneer species common to New England are - Black Locust (Robinia pseudoacacia), Sweet Fern (Comptonia peregrina) Smooth and Staghorn Sumac (Rhus glabra and R. hirta), Gray Birch (Betula populifolia), Buckthorn (Rhamnus frangula and R. cathartica), and Poplars (Populus sp.). Look also for signs of stress expressed by vegetation. This may be a clue to altered hydrology.

5. **Signs of hydrology** – Another factor to look for at a site is signs of wetland hydrology such as silt lines on trees and leaves, drift lines, tidal racks, water-stained leaves and pit and mound landscape where water stained leaves, wetland vegetation or other signs of wetland hydrology may be found in the pits.

Evaluating the Soil Profile

Before making a hydric soil determination, become calibrated to (familiar with) the soil forming process at the particular site. Every site has a unique combination of factors that sometimes can result in the development of morphological features, which differ from other sites and/or standard indicators of drainage class. Observe at least one soil profile by excavating a soil pit (do not use soil borings for these calibration pits) in an obvious upland and at least one in an obvious wetland area before evaluating soils in the transition area. Make sure to look at moist soil colors, which may require the use of a water spray bottle. This is particularly important when looking for low chroma colors. Dry soils can be significantly lower in chroma than they are when moist, resulting in a false positive of a hydric soil until moistened. By comparing the morphological characteristics of the various sites, it is possible to get an indication of what to look for in the transition zone soils. Once calibrated, auger borings may be used to do additional hydric soil determinations at a site. Additional calibrations, however, may be needed if the parent materials change or if the soil profile changes due to other factors.

The best approach to determining the depth to seasonal water table in a soil profile, is to start at the bottom of the profile and work up. For soils with dense restrictive layers located below friable surface soils on gentle to moderate slopes (basal tills in particular), morphological characteristics indicative of wetness may be few or absent within the restrictive layer. These soils may have a seasonally perched groundwater table for a long enough duration during the biologically active season and move slowly enough to become anaerobic so that reduction can occur. However, the combination of moving groundwater and dense subsurface horizons

may prevent saturation of the restrictive layer so that there are few morphological indicators of wetness within the layer. For such a soil to be considered hydric, the necessary morphological characteristics would usually be observed within the friable soils above the restrictive layer. Working from the top down may allow for making an incorrect hydric soil determination, particularly if you stop when you find the first apparent morphological sign of a seasonal water table. Seeing a gap between the highest morphological indicators of wetness in a soil profile and those lower in the profile means that the highest features are most likely not due to a seasonal water table. It is critical to make a connection from the highest indication of redoximorphic features to the point where they become more obvious and there should be a progressive increase in wetness indicators as you move deeper into the profile (except for hardpan soils on a slope where the indicators should increase in strength with depth until reaching the hardpan).

Experience and professional discretion are very useful when attempting to determine whether or not features in the soil are redoximorphic features. Following are a few of the clues that experienced soil evaluators commonly use to help them make the judgement call as to whether or not they are looking at redoximorphic features or features resulting from some other process:

1. **Look for bark covered plant roots.** It is rare to see woody, bark-covered roots growing very far below the seasonal water table (where the water is stagnant) as they need oxygen to respire. The exception is for long slopes with a subsurface restrictive layer (typically, basal tills). In such sites, the groundwater is usually not stagnant and therefore is not anaerobic. These sites would not have hydric soils though they may have a seasonal water at or near the surface because they lack hydric soil morphological characteristics.

2. **Look for oxidized rhizospheres in the upper soil horizons of field areas.** Oxidized rhizospheres are a form of pore linings. They look like redox concentrations and are found on the surface of live plant roots or soil material adjacent to them. Oxidized rhizospheres are particularly common in wet

A or Ap horizons (fields) where soils are darkened by organic matter. These should be bright if they are evidence of current hydrologic conditions. Beware of mixing and incorporation of pieces of the B and/or E horizons into the A or Ap horizon as a result of the plowing process. Also do not confuse oxidized rhizospheres (associated with live plant roots) with decomposing plant roots (dead plant roots).

3. **Look for pore linings, concretions and/or nodules, or soft masses.** These are commonly found in A, Ap, and B horizons. Pore linings are accumulations on the faces of soil pores. Nodules and concretions are hard redox concentrations that can be crushed under pressure (unlike a rock fragment). Soft masses are soft accumulations of iron. These are good indicators of wet conditions when coupled with other indicators.

4. **Study the redoximorphic features.** If redoximorphic features have diffuse boundaries, they are more likely to be an indication of present wetness conditions than those with more distinct boundaries. Also look for halos around redox depletions as good evidence of recent formation. Redoximorphic features representing current hydrology typically should be distinct or prominent in contrast to the matrix color of the soil, except for sandy soils where they may be more subtle.

5. **Depth to redoximorphic features.** Pay close attention to the depth at which redoximorphic features are observed. Generally, only record depths to that point at which you observe at least 2% redoximorphic features (common occurrence – see chart in the Appendix of the Field Indicators for estimating percent redoximorphic features) are observed. Not only is it difficult to find redoximorphic features if they represent less than 2% of the surface area, it is also difficult to determine whether or not they are redoximorphic features. They should also be observed at that same depth across the pit since they represent the depth to seasonal water table or capillary fringe. They typically appear as a band. Beware of

apparent redoximorphic features that only can be found at a particular depth in one section of a soil profile within a pit. These are probably not a true indicator of the depth to saturation in that soil. The only exception is for soils that have soil horizons which are not parallel to the soil surface. In such cases, the capillary fringe may follow the soil horizon and result in varying depth to saturation in the pit.

6. **Observe the matrix color of soil horizons in which suspected redoximorphic features have been found.** Except for problem soils such as sands (particularly sandy Spodosols), redox features generally are not evidenced in bright colored (high value and chroma) soil horizons. Be suspicious of what appear to be redox features in bright colored soil horizons and make certain they connect to a depth where you are confident there is a water table.

7. **Thickness of Organic Matter Horizon** – In forested areas, organic matter accumulates on the soil surface over time. The thickness of the organic matter horizon varies for a number of reasons but is generally only a couple of inches thick. It may, however, significantly increase in thickness if one or more conditions exist which inhibit the activity of microorganisms that normally decompose the organic matter. The most common conditions inhibiting microorganism activity in the soils of New England are 1) the lack of oxygen due to wetness and 2) cold temperatures. Determine the cause for organic matter accumulations observed at a site by studying soil profiles along a transect, perpendicular to the slope. If organic matter is accumulating due to cool temperatures, note that upland soils also have thick organic matter accumulations. If organic matter is accumulating due to wetness, thinner organic matter accumulations on upland soils will be observed. Also, look at the structure of the highly decomposed organic matter. If it has good structure, it probably did not form under saturated conditions. Organic matter (excluding loose leaf litter), which accumulates in saturated conditions is generally structureless.

8. **Color and Thickness of A or Ap Horizon** – Organic matter is typically incorporated into the A or Ap horizon which causes it to be a darker color than sub-horizons. Under conditions where there is an abundance of free oxygen, soil organic matter accumulations are in equilibrium with organic matter decomposition so there is no net increase over time unless organic matter is added to the soil by a landowner. Typical A or Ap horizons of better-drained soils are bright brown or light brown color. Under conditions similar to those where organic matter accumulates on the soil surface of forested areas, it will also accumulate in the A or Ap horizon of the soil (cool temperatures and/or wetness). These A or Ap horizons are typically much darker in color and may even look black. They also may be quite thick, particularly if the soil is at the base of a slope where deposition of eroded material from above can accumulate. The thicker and darker the color, the greater the amount of organic matter there is. However, organic matter may also accumulate due to heavy organic matter applications by a farmer. Determine whether or not the color and thickness of an A or Ap horizon is due to wetness by comparing the similar horizons of an obvious upland soil with the soil in an area that appears to be wetter. The wetter area should have a thicker and darker A or Ap horizon unless cold temperatures or organic matter additions are a factor. If that is the case, look closely at the A or Ap horizon for other signs of wetness such as oxidized rhizospheres, soil structure, nodules, concretions or pore linings. In all cases, look immediately beneath the A or Ap horizon for morphological signs of wetness. If they are absent, the A or Ap horizon color and thickness is most likely not an indication of wetness.

Making a Hydric Soil Delineation

There are several factors to take into consideration when doing a hydric soil delineation. These include position in landscape, vegetation, indicators of hydrology and signs of soil disturbance. **Before making a soil observation in the hydric soil boundary**

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(transition) area, become calibrated to the soil forming process at the particular site. This is because there may be subtle or significant soil forming processes at work that will result in the development of morphological features unique to the site and which may vary from those described in the Field Indicators Manual. Excavate a soil pit in an obvious upland area and an obvious wetland area (along a transect is ideal) to see how the soils for your site respond to the various drainage conditions. After determining what soil morphologies to look for, move to the suspected transition boundary and begin looking at those soils. It is recommended that soil pits be used for this calibration work. Once calibrated, auger borings may be used to do much of the delineation work. Soil pit, however, should be excavated from time to time to confirm your boundary location. In addition, it may be necessary to do more than one calibration transect if the soil parent material changes (glacial till to a sediment or an outwash, etc.).

Making Hydric Soil Delineations in Problem Soils

Problem soils include: sandy textured soils, spodosols, altered soils, soils with sandy layers (which may be dominated by loamy textures), cryic soils, soils of red parent material, soils with dark mineralogy, and folists or soils with folistic epipedons. It is important to remember that the soil evaluator is looking for signs of morphology in the soil that are the result of oxidation and reduction of iron and manganese similar to those described in the Field Indicators. It is always important to look for more than one sign of wetness morphology, but even more so in problem soils. **Do not limit soil profile evaluations and determinations to the observation of one seemingly obvious morphological characteristic. That is one of the greatest pitfalls for the less experienced hydric soil evaluator. Make the connection to other wetness morphologies immediately beneath the depth of the initial observations.**

1. **Sandy Soils** – Because redoximorphic features are expressed in a much more subtle manner in sandy soils than in loamy soils, **it is even more important to become calibrated to the soil forming processes at one of these site.** Look at obvious wetland and upland soil profiles to determine what features to look for in soil profiles at the hydric soil boundary. Be careful to work from the bottom of the soil profile to the top. Look for soil horizon colors to aid in making a hydric soil determination and beware of soil disturbance activities which may create what appear to be redoximorphic features. Beware of soils which have some spodic development. These soils may or may not be spodosols (see below). Vegetation may also be problematic since there is a much smaller capillary fringe in sandy soils than finer textured soils (wet sandy soils tend to be less anaerobic than wet fine textured soils and plants respond accordingly). It is not uncommon to find a hydric, sandy soil which may not be dominated by hydrophytic plants, especially if the site is hummocky and the plants are growing mostly on the mounds.

2. **Spodosols** – Spodosols, particularly sandy textured Spodosols, are some of the most difficult soils to evaluate because of the unique soil forming processes involved. In an undisturbed state, they have a gray leached layer (E horizon) which is typically located immediately beneath the organic duff horizon in forested settings (mostly softwood forests). Immediately beneath the E horizon is a spodic horizon (Bh, Bs or Bhs), which is where organic materials, aluminum and (often times) iron accumulate after leaching from the E horizon. It is typically dark reddish to black in color. This horizon then typically grades into another B horizon, which is less red or black. Quite often, there is some mixing of the top horizons leaving a mottled appearance that can be confusing even to the experienced soil scientist. Sometimes the soil forming process can leave indistinct boundaries between horizons that appear to be mottled. It is often necessary to observe several soil profiles within the various drainage classes when evaluating spodosols in order to find undisturbed profiles. Pay particular attention to the differences in thickness of the organic horizons, thickness, color and presence or absence of redox features in the E horizon and thickness, color and consistency of the dark-colored B horizons. Consider the setting of the soil observation site. Look at the vegetation, look for rooting depth, look at the matrix color of the soil, and make sure there is a connection from the uppermost wetness features to the more definite redox features below. In a field that wasn't plowed deeply, the remains of an E horizon may be found or you may find spots of E horizon mixed into the Ap horizon. Sometimes spots of gray E horizon are found near spots of reddish or yellowish B horizon material, which looks very much like redoximorphic features. Other hints: generally, non-hydric spodosols have thin, white-colored E horizons whereas hydric spodosols generally have thicker but grayer-colored (or darker) E horizons. Also, almost all hydric spodosols are sandy-textured soils but there are many frigid and cryic temperature regime (cooler temperature) non-hydric spodosols of varying textures. In most non-hydric spodosols, the dark-colored B horizon is relatively thin (less than 1 inch) and is not firm or cemented. In hydric spodosols, the dark-colored B can be several inches thick, is usually very dark, and is often cemented or has concretions. The best expression of E horizons and dark-colored B horizons is with soils that have thick organic duff horizons. That is why it is important to take into consideration the reason for a thick organic matter horizon (cool temperatures vs. wet conditions). Also note that thicker E horizons and dark B horizons occur in depressions or around a boulder where organic matter accumulates.

3. **Altered Soils** – These are probably the most difficult soils to evaluate for drainage class because it is very difficult to determine whether features observed in the soil are the result of disturbance, indicative of the drainage class of the soils from which fill came, or if they developed in response to current drainage conditions. Because it is so difficult to make this distinction and because of the infinite possibilities of soil characteristics it would be very difficult to develop a reliable key to assist in the evaluation of altered soils. Even vegetation is not a reliable indicator. Facultative wetland species

frequently colonize an altered site because of soil compaction. A decrease of air spaces and pores in the soil can result in an anaerobic environment which favors hydrophytes (approximately 50% of the volume of typical upper soil horizons is pore space). Sensitive fern (Onoclea sensibilis) is a plant species commonly found growing in compacted, non-hydric soils. Close scrutiny is required of altered soils to pick up on one or more signs of drainage class. Remember that the exact same morphological processes will occur in an altered soil as one in a natural state. The difference between a naturally developed soil and an altered soil is the altered soil may have a number of features made by the alteration activity or formed at the site where fill was removed from and not by the soil morphological process in its current location. Observe a number of soil profiles to find what is different in the profiles that appear to be hydric as compared to those which appear to be upland. Pay close attention to rooting depth, organic matter accumulation (not additions), and apparent redox features not found in areas that appear to be uplands. Also note a difference in soil matrix color between suspected wetland and upland sites. Another clue is the absence of expected soil horizons and/or the presence of soil horizons not expected to be found. Occasionally, more than one sequence of horizons may be found if old fill is present that has been in place long enough to start developing its own set of horizons. Do not simply rely on a hydric soil indicator key developed for natural soil morphologies. Once all of the differences in soil characteristics between the wetland and upland sites have been noted, a key for delineating hydric soils on that particular site can be developed by the site evaluator.

4. **Soils With Sandy Layers** – Sometimes a site is encountered where the dominant texture in the upper 20 inches of soil is finer than loamy fine sand but there is a coarser (loamy sand or coarser) layer. This sandy layer usually does not have the necessary morphology for the soil to key out as being hydric using the keys for a loamy fine sand or finer textured soil. All of the other morphologies may be present except for that in the sandy layer. Typically, the sandy layer is at the base of an A or Ap horizon. In such cases, use a combination of morphological requirements (those for coarse textured soils as well as those for fine textured soils) to make a hydric soil determination. For instance, if you evaluate a soil that is dominantly sandy loam in the upper 20 inches with a 7 inch dark Ap horizon immediately underlain by a 6 inch loamy sand horizon with 5% or more redox concentrations and a 3 chroma matrix color but no depletions which is underlain by a chroma 2 or less matrix sandy loam horizon with redox concentrations; that soil should be keyed out as hydric. There is a seasonal water table connection between the dark Ap horizon and low chroma matrix. The connection is in a sandy textured horizon which has the necessary morphology for a sandy soil. This is a case of using Best Professional Judgement for an unusual condition not covered by the Manual. Use a combination of the sandy keys and non-sandy keys in this case because of the combination of textures, even though it is dominantly one texture. This of course should be coupled with observing other clues such as the position in landscape, vegetation and rooting depth.

5. **Folists and Soils With Folistic Epipedons** – Organic matter thickness has a direct correlation to microorganism activity in the soil. The thicker the organic matter horizon, the lower the microorganism activity level. There are two primary causes of reduced microorganism activity in New England soils: wetness and cold summer temperatures. Folists and soils with folistic epipedons are those soils with thick organic matter horizons on the mineral soil surface but which did not form due to wetness. Histosols other than folists and soils with histic epipedons are those soils, which have thick organic matter accumulations due to wetness. Generally, histosols which formed due to wetness form in low areas or at least level areas where water accumulates and stays for extended periods of time. If a soil pit is excavated into the underlying mineral soils, strong wetness morphology indicators should be observed. If a soil pit is excavated in a folist or soil with a folistic epipedon, wetness morphology in the upper part may be lacking or layer of boulders may be encountered. In a few

instances, particularly in high elevation soils on sloping sites, redox concentrations beneath the organic matter horizon may be observed but no redox depletions or low chroma matrix is generally encountered. These soils are folists or soils with folistic epipedons and should not be confused with histosols or soils with histic epipedons which formed due to wetness. In order for them to be classified as histosols which formed due to wetness, there should be a low chroma matrix immediately beneath of the organic matter horizon. Beware of generalizing wetness conditions on the basis of vegetation found growing on folists or soils with folistic epipedons. Plants growing in these soils are often responding to unique climatic conditions rather than hydrologic conditions which favor the development of hydric soils. However, a vegetative trend (one or more species that favor drier sites and one or more species that favor the wetter sites) which can assist in making a hydric soil delineation, can usually be found upon close observation.

6. **Cryic Soils** – Cryic soils are those soils that form in areas with cool summer temperatures. In New England they are only found at high elevations (mountains) or along the downeast coast of Maine. They typically have thick organic matter horizons (folistic epipedons are not unusual) and many are spodosols or have spodic development. Follow the applicable guidance listed above when evaluating these soils (spodosols and/or soils with thick organic horizons).

7. **Soils With Red Parent Materials** – Soils formed in red parent materials in New England are generally found in areas of Mesozoic geologic materials. Almost all of these materials are in found in Connecticut; however, Massachusetts has a few areas as well. Soils developed in red parent materials are a challenge for hydric identification because the red, iron-rich parent materials inhibits formation of "normal" hydric morphology (i.e., gray colors due to strong reducing conditions). Examples of soil series developed in red parent materials include: Bash (on flood plains), Cheshire and Wethersfield (well drained), Ludlow and Watchaug (moderately well drained), Wilbraham (poorly drained) and Menlo (very poorly drained). If you are in an area where these soils have been mapped by NRCS, be aware that you are most likely dealing with red parent materials soils. As with all problem soils, a landscape transect approach is the first step to making an informed decision as to drainage class. Describe a soil in an obvious upland and an obvious wetland to understand what particular soil morphology is related to the wetness gradient. To determine the hydric/non-hydric boundary, look for a change in soil matrix chroma (e.g. from 4 chroma to 3 chroma) from the upper position to the lower position, look for redox depletions (i.e., gray mottles), reddish black manganeese concentrations, and redox concentrations. The National Technical Committee for Hydric Soils (NTCHS) Indicators include a test indicator for use in red parent materials. It is test indicator TF2 – which states: "In parent material with hue of 7.5 YR or redder, a layer at least 4" thick with a matrix value of 4 or less and chroma 4 or less and 2% or more redox depletions or redox concentrations as soft masses or pore linings, or both. The layer is entirely within 12" of the soil surface". This indicator has not been validated in New England but it does provide a starting point for use in our red parent material soils.