Module 3: Determining if Under Normal Circumstances the Site Supports the Prevalence of FSA Hydrophytic Vegetation

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In this module, the course participant will be presented the decision-making process used to render a decision if the site supports under normal circumstances FSA Hydrophytic Vegetation". The FSA provides a definition of hydrophytic vegetation that must be used for FSA purposes. This definition differs from that used for Clean Water Act purposes. These differences are discussed along with the FSA concept of "normal circumstances". The FSA Wetland Identification Procedures provides for two decision-making options for this diagnostic factor: (1) Direct Observation or (2) Indicators.

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Module 3- Determining Under Normal Circumstances if a Site Supports a Prevalence of FSA Hydrophytic Vegetation.

Objectives

Upon completion of this module, the student will:

- Have an awareness of the FSA definition of hydrophytic vegetation.
- Have an awareness of how hydrophytes survive and reproduce in wet environments.
- Understand when direct evidence is used in the decision-making process and when Corps indicators are used.
- Understand the application of methods used by NRCS to characterize vegetation as is relates to wetlands and non-wetlands.
- Understand the analysis process of vegetative data and the decision-making process for determining a prevalence of hydrophytic vegetation.

Key Concepts

- The frequency and duration of excessive water on a given site can exert significance stress on plants. Many species that normally exist in wetlands have developed physiological and morphological adaptations that allow them to survive in excessively wet environments.
- The *National List of Plant Species That Occur in Wetlands* (Reed 1988) establishes a "wetland status indicator" for most plant species based on the estimated likelihood that species would occur in a Cowardin et. al. (1979) wetland. The information in this Plant List is used as a Corps indicator of the prevalence of hydrophytic vegetation on a FSA wetland.
- NRCS has adopted the use of the Corps Manual and its associated regional supplements to assist in the decision making process, with variances. In both documents, the Corps provides recommended sampling methods. Then the user is directed to use vegetative sampling data in the application of the Dominance Test (Corps Indicator 1) or in some situations the Prevalence Index (Corps Indicator 2). Some regional supplements have a rarely used third Corps indicator called Morphological Adaptations.

- Disturbance and changing climatic/hydrologic conditions can make decision making more difficult. The Corps provides recommended solutions to these problems in their 1987 Manual (Part IV; Sections F and G) and Regional Supplements (Chapter 5).

- Regardless of the methods used, or the Corps indicators observed, the decision (determination) of a presence or absence of a prevalence of hydrophytic vegetation is ultimately based on the decision of the agency expert that - the site under NC and NEC would meet the FSA definition of hydrophytic vegetation.

This module is designed to take 6-10 hours and includes required exercises. Links are provided to necessary information and additional learning opportunities.

Learning Concept 3-1: What is Hydrophytic Vegetation?

This Learning Concept is designed to take 30-45 minutes and includes office exercises. Links are provided as optional learning opportunities.

Similar to the "wetland" discussion in Module 1, historically there has been a wide range of concepts of what constitutes hydrophytic vegetation (or hydrophytes) – from the very narrow (only those species that grow in swamps, bogs, and marshes) to the very wide (all species that tend to be found on soils that are wet/moist. Remember, Martin (1953) concept using in Circular 39 where the "upper-end" was "moist-soil vegetation. Following the historical perspective, the Cowardin et. al. (1979) Wetland Classification System was discussed in Module 1. Cowardin et. al. stated that, in wetlands, "water creates severe physiological problems for all plants and animals except those that are adapted for life in water or in saturated soils." The use of "severe" is of interest, as the "application" of Cowardin's system by many might be viewed as moving down the wetness gradient from severe to "minor" – but that is an argument for policy makers.

For FSA purposes, Congress adopted the Cowardin et. al. definition of a hydrophyte as the FSA definition of "hydrophytic vegetation". Of importance, they did not adopt his hydric soil or wetland definition. The hydrophytic vegetation definition adopted by Congress is:

> "a plant (Cowardin used "any) growing in (1) water or (2) a substrate that is periodically deficient in oxygen during the growing season because of excessive water content."

Thus, the concept is how an individual plant is behaving on the site in question (sampling unit), not so much about the species that the plant belongs.

To obtain a full understanding, this definition is worthy of dissection.

- ***"a plant…"*** (Cowardin used "any) – First, the use of "plant" is important. The concept of hydrophytic vegetation is not a community-based concept, nor is it species-based. The concept is a single PLANT-BASED. Thus, this brings the definition down to the lowest level – the individual. So, our discussion here will be limited to an individual plant, unless otherwise noted.
- "a plant ***.."*** – Cowardin et. al. could have used "found", or "occurs" or other similar terms, but they used "growing". If it is growing in water or growing in a reduced substrate – it suggests an actually adaptation to the stressor of excessive water during maximum respiration (highest demand for oxygen). An annual species that invades a wetland site after the water recedes or during a period of drought, never grows in water or a reduced substrate and does not meet the FSA definition, regardless of its indicator status. That species might "occur in a wetland" but does not "grow" in wetlands during the wet portion of the growing season. This is one reason FSA decisions are based on what is growing during NEC. Any plant growing in an FSA wetland during the period of NEC would meet Cowardin et. al.'s definition.
- "a plant growing – Here, the definition allows for any plant growing in water to be hydrophytic. Some have suggested that this was referring to only aquatic plants, but most consider this to include ***a plant growing*** in ponded habitats too. In the administration of the WC provisions, NRCS assumes the latter.
- "a plant growing in (1) water or ***oxygen during the growing season because of excessive water content.***" -- To some, this gives credence to the argument that "(1)" was for non-rooted aquatics and "(2)" was referring to rooted plants. Regardless, Cowardin et.al. moves up the landscape position to include plants that are not just growing in water but also plants growing in a soil that is deficient in oxygen due to excessive water. First, let's look at the use of the term "periodically". This allows for plants that grow in wet soils only for a period of their life. The substrate needs not be permanently or semi-permanently wet. Of importance in "(2)" is the use of the term "***deficient***". The requirement is not being void of all oxygen or fully reduced, but rather just being "inadequate in quantity or supply". Partial soil reduction is deficient in oxygen as the supply is inadequate. Just the physical action of water replacing free oxygen can have an impact on plant respiration rates. The reduction in free oxygen is limiting the plant's ability to carry on normal biological processes. The reduction in oxygen is becomes a "stressor".

Let's re-assemble the term based on our discussion. For FSA purposes hydrophytic vegetation is

1. **any individual plant** that is **actively growing** in **water**, or
2. **any individual plant** that is **actively growing** in a **substrate** (soil or non-soil) that is **periodically** (during the period of NEC) **deficient** (inadequate in supply) in **oxygen** (being deficient also includes the quality of the oxygen, so if it tied up in a state that is not as available, it is still deficient), **during the growing season** (all of this must be occurring during the growing season, but this can be assumed from the requirement of "actively growing") **because of excessive water content**

(plants growing in substrates deficient in oxygen due to other reasons such as soil compaction would not meet the definition)

Now that we know what the law says, we can review what the regulations say about hydrophytic vegetation. In Section 12.31 (On-site Wetland Identification Criteria), the Secretary repeats the statutory definition of hydrophytic vegetation then in (7CFR12.31(b)(1) state that "***A plant shall be considered to be a plant species that occurs in wetland if such plant is listed in the National List of Plant Species that Occur in Wetlands.***" So the rule supports the Act that hydrophytic vegetation is "A Plant" and that is listed in the Plant List, this would include a plant with any indicator including FACU and UPL. The Cowardin (and Reed 1988) and the FSA concept is that all plants listed are "hydrophytes", regardless of their indicator status and all plants listed are not hydrophytes or hydrophytic vegetation depending on their behavior on the site in question. It is very important that the agency expert understand that the Act and the regulations support that decisions regarding a prevalence of hydrophytic vegetation can (and should) be made on what is happening on within the sampling unit (plant growing in water or a substrate deficient in oxygen), rather than if the dominant species are within a certain species.

> "*The individualistic concept of a hydrophytic recognizes that plant species may exhibit considerable plasticity or ecological amplitude in their adaptation to wet environments*" (Tiner, 1991)

For these reasons, the FSA Procedures encourage the decision to be made based on the conditions during NEC – Would the plants during this period be growing in water or a substrate deficient in oxygen? If the site visit is made during these ideal conditions, then the decision can be made based solely on the FSA definition of hydrophytic vegetation regardless of species. However, most site visits are made outside of ideal conditions (outside of NEC). In these situations, the best decision making tool is the Corps indicators as tempered with best professional judgment (past experiences regarding what the site would look like during NEC).

The rule goes on to states (7CFR12.31(3)) that "The determination of prevalence of hydrophytic vegetation will be made in accordance with the current Federal wetland delineation methodology in use by NRCS at the time of the determination. The FSA Procedures are the "current Federal wetland delineation methodology".

Now we know what is in the law and in the regulations. That is that

- hydrophytic vegetation is singular (individual plant based) and that any plant on the National Plant List can be considered as a plant species that occurs in wetlands, regardless of the indicator statute.
- the Secretary directed that NRCS shall base the decision of a prevalence of hydrophytic vegetation on the current methodology in use by NRCS at the time of the determination.
- the FSA procedures are the "current methodology".

So what is in the FSA Procedures?

Because the FSA considers any plant growing in water or growing in a substrate that is at least periodically deficient in oxygen as hydrophytic vegetation and because the rule allows for "a plant" belonging to a species listed on the National List, regardless of the indicator status, to be hydrophytic vegetation the FSA Procedures prefer that decision be based on how the prevalence of plants are behaving on the site in question. NRCS allows for the use of Direct Observation to base the decision.

The Direct Observation option is used when a site is visited during optimum conditions or Normal Circumstances. This would be when the site has not had a post-1985 drainage action and the site is exhibiting NEC (hydrologic conditions are reflective on those conditions that would occur during the wet portion of the growing season under normal climatic conditions).

Just by chance, it is unlikely that the site visit can be made during NC. Thus, the FSA Procedures allow for in the absence of direct observation (outside optimum conditions), for a Corps indicator from a Corps Supplement (e.g. 50:20 rule and Prevalence Index) to be used.

What have we learned thus far?

- The decision is best derived from the way individual plants are behaving within the sampling unit.
- The ultimate question is how are they "behaving" on the site in question.
- The Corps indicators (species-based) can be used when the site visit is made outside of NC. But the answer (presence or absence of an Corps indicator) the agency expert must consider if the answer is consistent with what the decision would be if the site could be visited under NEC. Best professional judgment is used in rendering the final decision ("In general, *wetland determinations on difficult or problematic sites must be based on the best information available to the field inspector, interpreted in light of his or her professional experiences and knowledge of the ecology of wetlands in the region*" – from Chapter 5 of the Corps Regional Supplements, italic used by the Corps for emphasis). This the idea that findings outside of NC (indicators) need to be tempered with best professional judgment is supported in the FSA Procedures and the Corps Supplements.

If a bald cypress tree is found growing on a well drained soil (example - loamy natural levee beside a bayou) that is never saturated long enough to begin the reduction process (anaerobic) is the bald cypress hydrophytic, per the FSA definition of hydrophytic vegetation?

Another common misperception is the concept that a plant community (for FSA Wetland ID purposes) can be hydrophytic or not. Only individual plants are hydrophytic - species and communities are not. The mandate in the FSA wetland definition (and in the Corps definition) is that the sampling units support a "prevalence of hydrophytic vegetation". We make decisions at the community or sampling unit scale based on the "sum total, or norm within the sampling unit. In other words, are most of the plants within the community being assessed (sampled) behaving as hydrophytic vegetation (growing in water or growing in a reduced substrate sometime during the year) within the sampling unit? If so then the sampling unit supports a prevalence of hydrophytic vegetation. If not then the sampling unit does not support a prevalence of hydrophytic vegetation. This decision can be made based on direct observation during NC or by the use a Corp Indicator when the site visit is made outside of NC and the indicator is suggestive of the conditions during NC.

In the next Learning Concept we'll take what we have learned about the FSA hydrophytic vegetation definition and expand these ideas to ecological concepts.

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Learning Concept 3-2: Scientific Foundations and Principles of Hydrophytic Vegetation.

This Learning Concept is designed to take 30-45 minutes and includes office exercises. Links are provided as optional learning opportunities.

In the FSA definition, hydric soils are linked to the presence of hydrophytic vegetation. Likewise, the FSA wetland hydrology criterion is linked to the presence of hydrophytic vegetation (as defined by Congress). Thus, of the three wetland diagnostic factors, hydrophytic vegetation is given the highest priority in FSA. On an unaltered site, you can't have FSA hydric soils or wetland hydrology without having a prevalence of plants that meet the FSA concept of being hydrophytic.

Why is this important to me? In their administration of the CWA, the Corps and EPA do not have the same definitions of hydrophytic vegetation, or hydric soils, nor do they have the same vegetative link in the criteria for CWA wetland hydrology. The concept of hydrophytic vegetation for CWA purposes is species, not how individual plants are behaving.

Thus, when making FSA wetland determinations, significant time and consideration should be allocated to making decisions about whether the area in question supports a prevalence of **plants** growing in (1) water or (2) a substrate that is periodically deficient in oxygen during the growing season because of excessive water content.

Plant Stress

Except for managed communities, all plant habitats are extreme with respect to one environmental characteristic or another, at least periodically. Factors such as shade, drought, temperature, flooding, herbivory, herbicide use, excess salts or heavy metals, and deficiencies or excesses in nutrients can create stress on a plant's ability to become established, survive, and/or complete its life cycle. The factors listed above are commonly referred to as "stressors". Seldom are individual plants subjected to a single stressor; but rather they must deal with many stressors across various levels of intensity.

Over time the influence of stressors has resulted in some species being more competitive (adaptive) when presented with a particular stressor or suite of stressors and being less competitive in other situations. When presented with two strong stressors (i.e. shade and wetness), a plant that can tolerate **both** stressors simultaneously will have a competitive advantage over a plant that is adapted to only one of the two stressors. This can be easily viewed when visiting a wet sunny herbaceous wetland. These sites will have a completely different herbaceous plant community than what occurs at a wet, shady site.

Poison ivy (*Toxicodendron radicans*), is a shade tolerant species, but not particularly tolerant of ponding. This species might be a dominant in a wet, shady site, but it might

be virtually absent in full sun at a site with the same wetness regime (hydropattern) and soils. It is "replaced" by "sun-loving" and "wetland tolerant" species such as soft –rush (*Juncus effusus)*. What gives? In the shade, poison ivy can move up the wetness gradient and become more competitive than plants tolerant of more wetness but that can't deal effectively in low light situations (another stressor). Thus, wetness alone will have a different impact on a plant community than wetness in conjunction with another stressor or suite of stressors. Individuals (and species) will tend to move up and down the hydrologic gradient depending on their ability to compete with multiple stressors.

Another common example can be seen with soil texture and pH. A common southern tree, sugarberry (*Celtis laevigata)*, is rarely found on wet acid loamy floodplain soils. Within these floodplains, sugarberry tends to occur more commonly on the better drained sites such as natural levees and other sediment deposits that are at higher elevations within the floodplain interior ( ). However, on wet alkaline clayey bottomlands in the same region, sugarberry is often very common in shallow channel scars that pond water for long periods. Why? Clays and alkaline soils are high stressors to most plants. The plants adapted to wet loamy acid soils common to the southeastern U.S., such as overcup oak (*Quercus lyrata*), bitter pecan (*Carya aquatica),* and willow oak (*Quercus phellos)* are more competitive than sugarberry on these soils. But they do not occur on alkaline clays. In fact, few overstory tree species other than sugarberry and green ash (*Fraxinus pennsylvanica)* can deal with all three stressors working together (wet, alkaline, and clayey). In this situation sugarberry moves up (toward wetter) in its traditional moisture gradient and capitalizes on the opportunity presented.

Why is this important to me? Most plant species do not have a simple linear relationship to soil moisture gradient. They are responding to an array of stressors - not just water. Reed's (1988) plant list "predicts" which species commonly occur in wetlands across the entire region, not within a single sampling unit. Agency experts must recognize that it is how individual plants (see how we are getting back to an individual plant) are behaving on the site in question that is most important in the wetland identification process. Reed (1988) understood that each individual plant listed occurs in wetlands. The indicator status is the likelihood that the species would occur in wetland across the entire region, not the likelihood of the species occurring in a single wetland. FACU species can dominate a wetland and FACW species can dominated any particular nonwetland. In fact, this is not that rare.

So is the plant list and the Corps indicators of no value? Absolutely not, they provide very strong circumstantial evidence and can be used to assist in the decision making process when the site is visited outside of NC.

You will find that, with experience, which species that do have a very strong relationship with saturation or ponding (this is why NRCS requires that agency experts are experienced - "demonstrates the proficiency" – in their work area) and which do not have a strong relationship. You will find that this changes with other stressors such as shade, pH, soil texture, salts, etc. In the FSA Procedures and in the Corps Supplements This "professional experience and knowledge (Corps Supplements)" serves as the integral piece of the puzzle (preponderance of evidence).

References:

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Lin. J., P.A. Harcombe, M.R. Fulton, and RW Hall 2004. Sapling growth and survivorship as affected by light and flooding in a river floodplain forest of southeast Texas. Oecologia 132: 428-435

Battaglia, L.L, and R.R. Sharitz. 2006. Response of floodplain forest species to spatially condensed gradients: a test of the flood-shade tolerance trade-off hypothesis. Oecologia 147: 108-118.

Tiner, Ralph W. 1991. The Concept of a Hydrophyte for Wetland Identification. Individual Plants adapt to wet environments. BioScience Vol. 41, No. 4 pp 236-246

When visiting a site, the experienced individual's (an agency expert) first observation regarding vegetation is stressors – not species. The agency expert will ask:

- How many stressors are there?
- What are they?
- How intense are they?
- What do I know about each species "tolerance" to different stressors?

Those with less experience need to ask the questions too. The problem is that the answers are elusive - they are site and regionally specific and have never been documented in the literature. Only through experience are these insights acquired.

A site with very few/mild stressors (loamy soils, low salts, free sun, moderate fertility and mild pH) that supports species common to wetlands should be a clue that the vegetation is "telling the hydrology story" very accurately. If the site is salty, shady, clayey, very acid or very alkaline, excessively fertile or has low fertility - you might want to ask yourself: Are the species occurring on this site here because of wetland hydrology (or the lack of wetland hydrology), or are they there due to something else? The agency expert should always be "reading the land" for clues of potential problematic situations (false positives and false negative with regard to Corps indicators). The identification of wetlands for the trainee is, by necessity, a step-by-step process. However, for the agency expert, it is a constant series of questions regarding the clues being provided by stressors and individual plant responses to those stressors. In the following discussion topic, we will delve even deeper into how plants deal with growing in water or substrates deficient in oxygen.

Why is this important to me? This relates to the importance of National Policy (NFSAM) placed on the States to establish State Rosters of Agency Experts that limits the list to only experienced staffs who have demonstrated proficiency in applying the FSA Wetland ID Procedures. This is because the federal agencies have been provided great leeway by the courts in the utilization of their technical expertise (technical experts) in decision making. NRCS considers this leeway granted by the federal courts, not as a right, but rather as a responsibility that should not be abused.

Anaerobic Stress Due to the Presence of Water

Plants depend upon a supply of oxygen from their environment to support respiration and various other life-sustaining processes. A plant's access to oxygen is often inhibited by environmental conditions that restrict oxygen to a part or all of the plant (Hook and Crawford, 1978; Jackson, Davies and Lambers, 1991). Saturation and inundation can inflict significant stress on plants by limiting available atmospheric oxygen to plant roots or even the entire plant if totally submerged. Although water contains oxygen, this oxygen does not diffuse as readily into plant tissues as oxygen in the gaseous form. The result is that these excessively wet areas can experience frequent and long-term anaerobic (absence of free oxygen) conditions. Without sufficient oxygen, most plant species are unable to survive for more than a few hours or days and cannot develop sufficiently to reproduce. At a minimum their growth and reproductive rates are reduced.

Note: it is not by coincidence that Congress added to the requirement that plants on an FSA wetland not only be able to withstand wet conditions long enough to grow but long enough to regenerate (the FSA hydric soil definition is that the soil (in its undrained conditions) is/was wet often enough and long enough to "support growth **and regeneration** of hydrophytic vegetation".

Hydrophytes have evolved physiological, reproductive, and morphological features/processes that enable them survive and reproduce in anaerobic conditions produced by periodic or long-term soil saturation and inundation.

- Physiological adaptations in plants generally include various special biochemical processes that allow hydrophytes to process and/or store toxic metabolic by-products that accumulate in anaerobic conditions.
- Reproductive adaptations include the development of prolonged seed viability, seed germination in low oxygen environments, and flood-tolerant seedlings.
- Morphological adaptations are structural modifications that can be readily observed. Such modifications most often provide the plant with increased buoyancy or support and, in some cases, may facilitate the uptake of nutrients and/or gases (particularly oxygen).

Of the three, morphological adaptations can (on occasion) be helpful when identifying wetlands. Not all species occurring in areas having anaerobic soil conditions exhibit morphological adaptations for such conditions. Below are some of the more commonly viewed morphological adaptations to anaerobic soil conditions:

1. Buttressed tree trunks (Photo 1). Tree species commonly develop enlarged trunks at or just above the ground in response to frequent inundation.

2. Pneumatophores (Photo 2). These are modified roots and may serve as respiratory organs in species subjected to frequent inundation or soil saturation.

Cypress knees are classic examples, but other species may also develop pneumatophores.

3. Adventitious roots (Photo 3). Sometimes referred to as "water roots," adventitious roots occur on plant stems in positions where roots normally are not found. These may appear as small fibrous roots protruding from the base of trees or roots on stems of herbaceous plants and tree seedlings in positions immediately above the soil surface. Such features usually develop during periods of prolonged soil saturation sufficient to destroy most of the root system.

4. Shallow root systems. When soils are inundated or saturated for long periods during the growing season and anaerobic conditions develop, most species with deep root systems cannot survive. Consequently, most species capable of growth during periods when soils are oxygenated only near the surface have shallow root systems. In forested wetlands, windthrown trees (Photo 4) are often indicative of shallow root systems.

5. Inflated leaves, stems, or roots (Photo 5). Many hydrophytic species have or develop spongy tissues (aerenchyma) in leaves, stems, and/or roots that provide buoyancy or support and serve as a reservoir or passageway for oxygen.

6. Polymorphic leaves (Photo 6). Some herbaceous species produce different types or shapes of leaves, depending on the water level at the time of leaf formation. For example, water plantains produce strap-shaped leaves when totally submerged, but produce broader, floating leaves when plants are emergent.

7. Floating leaves (Photo 7). Some species produce leaves that are uniquely adapted for floating on a water surface. These leaves have stomata (pores) primarily on the upper surface and a thick waxy cuticle that restricts water penetration.

Photo 1. Buttressing of tree trunks.

Photo 2. Pneumatophores of Cypress trees (Cypress knees).

Photo 3. Adventitious roots.

Photo 4. Windthrown tree showing shallow root system.

Photo 5. Inflated leaves.

Photo 6. Polymorphic leaves.

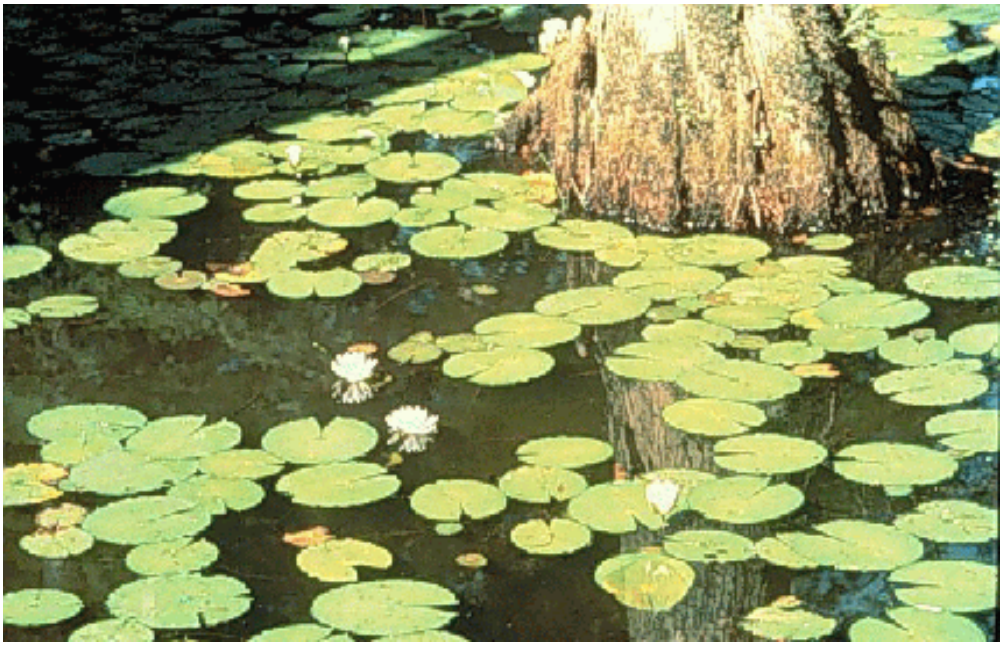

Photo 7. Floating leaves.

8. Floating stems (Photo 8). A number of species (e.g., alligator weed) produce matted stems that have large internal air spaces when occurring in inundated areas. Such species root in shallow water and grow across the water surface into deeper areas. Species with floating stems often produce adventitious roots at leaf nodes.

9. Hypertrophied lenticels (Photo 9). Some plant species (e.g. Gleditsia aquatica) produce enlarged lenticels (raised pores) on the stem in response to prolonged inundation or soil saturation. These are thought to increase oxygen uptake through the stem during such periods. CAUTION:

10. Multiple stems or stooling (Photo 10). Some woody hydrophytes characteristically produce several trunks of different ages or produce new stems arising from the base of a growing individual in response to inundation.

11. Oxygen pathways to roots. Some species have a specialized cellular arrangement that facilitates diffusion of gaseous oxygen from leaves and stems to the root system.

Photo 8. Floating stems.

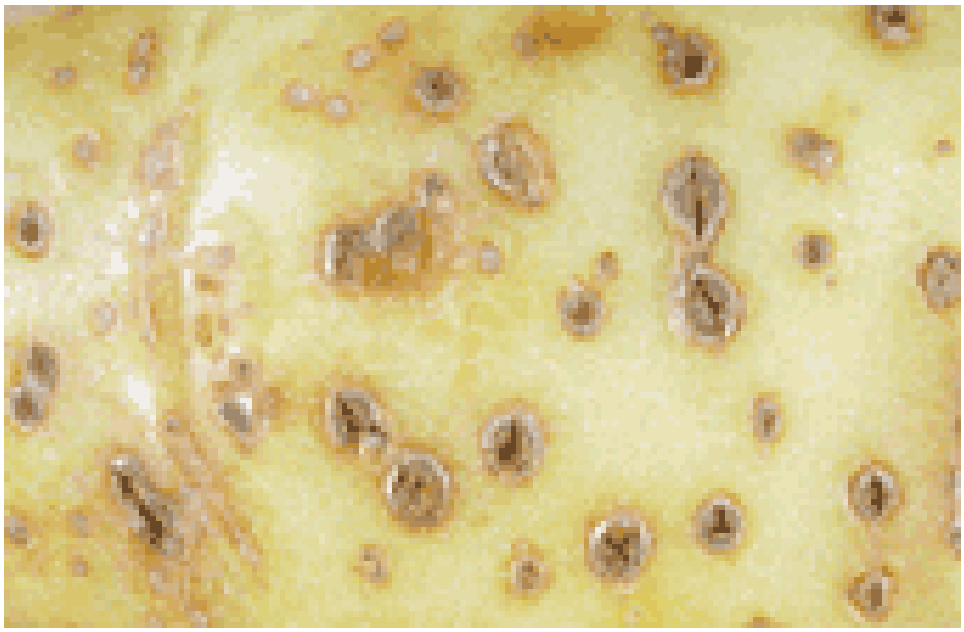

Photo 9. Hypertrophied lenticels.

Photo 10. Multi-trunk tree.

Name a single wetland species that occures in your area of which you are familar and its morphological adaptation. Those less experienced may need to search the internet or obtain assistance from an individual with more experience with plants of the area.

Why is this important to me? Morphological adaptations can provide visual cues to the agency expert on a site's normal hydropatterns. Some adaptations are common to ponded situations only, while others are more or less common in saturated situations. However, agency experts should be aware that not all species occurring in areas subject to periodic anaerobic conditions exhibit morphological adaptations. Furthermore, many plant species found in non-wetlands also exhibit some of these features. For example, many non-wetland species exhibit polymorphic leaves, lenticels on stems, or multiple stemmed trunks. In addition, not all adventitious roots develop as a result of inundation or soil saturation. Aerial roots on woody vines are very common and are not normally produced as a response to inundation or soil saturation. **NOTE:** Knowledge and skills are acquired by making repeated site visits during different seasons and different conditions over many years. Training alone is not a substitute for "getting one's feet wet".

By now you should have a sound foundation regarding what is meant by hydrophytic vegetation for FSA purposes and how plants are in a constant fight for survival against other plants that may (or may not) have an adaptive advantage to the same stressors. Make a brief review of the preceding information presented in this module before moving to the next concept.

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Learning Concept 3-3: Selection of Method.

This Learning Concept is designed to take 30-45 minutes and includes office exercises. Links are provided as optional learning opportunities.

This concept (selection of method) is conducted in consideration of each of the three diagnostic wetland factors. Thus, this discussion is provided here (in the hydrophytic vegetation module because vegetation is the driving force in this process.

The first decision is to decide whether the Routine or the Comprehenive Method is most appropriate. This decision is already made for the NRCS agency expert, as policy (FSA Wetland ID Procedures), indicates that NRCS has not adopted the Comprehensive Method. Therefore, the agency expert is required to utilize the Routine Method. The Routine Method employs three levels (Levels 1, 2 and 3) of routine determinations, which are discussed in the Corps Manual.

If you do not rember from Module 2, the three Levels, then access the Corps Manual and find Section C. Selection of Method in Part IV- Methods. Read the discussion of the three Levels of a Routine Determination. If, by remote sensing, an agency expert views plants growing in water (using numerous remote tools) and decides that this condition is within the concept of NC and NEC then:

- Is their a reason to collect data that is only indicative of plants growing in water, or plants growing in a substrate that is deficient in oxygen?
- Which would give you more confidence - direct evidence of plants growing in water during the period of NEC or collecting sampling data outside of the period of NEC and applying one of the Corps indicators of a predomiance of FSA hydrophytic vegetation?

The value of remote sensing tools should never be underestimated. These tools provide opportunities to view a site during different years and conditions. A single site visit may be just that – a snapshot of conditions at a single point in time and not necessarily representative of normal conditions.

- With all of the remote sensing tools available to NRCS, would it be accurate to suggest that decisions for at least one of the three wetland factors cannot be made using remote sensing methods?
- In a cropland situation, where the site in question is devoid of reliable onsite data, what are your options?
- Would you feel more comfortable with published soil-plant association information or a few twigs of plant material left after plowing?
- What about a stand of annuals that germinated after a recent storm event?

- Which is more reflective of the plants that would grow during NEC if the site was allowed to return to NC?

Often (and possibly too often), onsite data is viewed as superior to remotely sensed information. With the FSA defintion of hydrophytic vegetation being linked to (1) plants growing in water, or (2) plants growing in a substrate deficient in oxygen without reference to any particular species of plants, does that view have merit?

Why is this important to me? Remember your review of the Corps concept of hydrophytic vegetation based on the Corps definition – "*the sum of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produces permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present."* Would remote sensing data or field data carry more weight based on the Corps definition? Because the Corps uses a species-based concept, the field data would carry more weight. This also explains why the plant list is a better decision tool for the Section 404 or the WC provisions. By this point in the learning process, you should start to understand the uniqueness of what is meant by "hydrophytic vegetation" for the FSA and how it can differ from the Corps definition and concept. This becomes important if your decision is questioned by someone more familiar with the Section 404 wetlands and Section 404 hydrophytic vegetation. You now have some of the information needed to better explain your decision. Now, for FSA purposes if you viewed plants growing in water on numerous compliance slides or photos, do you really care about the species? No, as the definition has been met regardless of the species. Thus, remote sensed data is of more value regarding a determination of a prevalence of hydrophytic vegetation for FSA purposes than for 404 purposes.

Access the Corp Manual and read Subsection 1 – Onsite Inspection Unnecessary. Regarding a simple decision on the prevalence of FSA hydrophytic vegetation, can you invision utilizing this method (Routine; Subsection 2) for in any situations in your work area? It is important to understand that, in the FSA Procedures, the phrase "State Offsite Methods" is defined as methods that supplement the Routine, Subsection 2 section of the Crop Manual. By using the State Technical Committee process, States can constuct SOMs to assist in the decision-making process using the unique remote sensing resources available to them.

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Learning Concept 3-4: Corps Indicators of a Prevalence of Hydrophytic Vegetation.

This Learning Concept is designed to take 30-45 minutes and includes office exercises. Links are provided as optional learning opportunities.

You should now understand what constitutes hydrophytic vegetation for FSA wetland ID purposes. It is not any particular species, but rather how **individual plants** are behaving on a site in question (a "plant" growing in water, or a "plant" growing in an anaerobic substrate). Under ideal site conditions, the particular species is of no concern. However, species occurrence can be indicative (using the Corps indicators) of wetland conditions when a site visit is conducted outside of NEC. This is an invaluable tool for agency experts that allows for the wetland identification season to be extended well outside of NC.

In a perfect world, we would make all decisions under NC and during NEC. We could then just take a photo of plants growing in water or a saturated substrate and move on to the other factors (soils and hydrology). After all, the mandate for a FSA wetland regarding vegetation is a predominance of plants growing in water or a reduced substrate (not fully reduced either - simply deficient). The problem is that site visits are rarely conducted during NC. This is particularly true on agricultural sites. Even if the visit is made during the period of NEC (wet season), are the hydrologic conditions normal? By definition, these conditions would only occur in 5 out of 10 years or, in the arid west where long-term cycles come into play, in 25 out of 50 years.

As discussed in Module 2, the Corps indicator-based approach to wetland identification allows for the use of approved Corps indicators (circumstantial evidence) to make a decision. So, the information provided by Reed (1988) on the likelihood of a particular species to occur in a wetland serves as a Corps indicator of what the site conditions would be during NC and NEC.

The foundation of the approved Corps indicators (indicators 1 and 2 in each regional supplement) of a prevalence of hydrophytic vegetation is the *National List of Plants Species That Occur in Wetlands* (Reed, 1988, commonly referred to as the "Plant List"). As introduced in Module 1, the Plant List was developed by an interagency panel of national and regional experts. These individuals categorized plant species according to their likelihood of occurrence in wetlands versus non-wetlands based on Cowardin et. al.'s wetland definition/concepts (remember Cowardin et. al.'s wetland criteria are more "inclusive" than the FSA or the CWA).

The 1988 Plant List is subdivided into regions based on USF&WS administrative regions. Plant species are assigned a national wetland indicator status. Regional

panels then modify the national status base on their experiences of how the species behaves in that region. There are 7 major categories or wetland indicator status:

Corps indicator Code	Wetland Type	Comment
OBL	Obligate Wetland	Occurs almost always (estimated probability 99%) under natural conditions in wetlands.
FACW	Facultative Wetland	Usually occurs in wetlands (estimated probability 67% 99%), but occasionally found in non-wetlands.
FAC	Facultative	Equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%).
FACU	Facultative Upland	Usually occurs in non-wetlands (estimated probability 67%-99%), but occasionally found on wetlands (estimated probability 1%-33%).
UPL	Obligate Upland	Occurs in wetlands in another region, but occurs almost always (estimated probability 99%) under natural conditions in non-wetlands in the regions specified.
NI	No indicator	Insufficient information was available to determine an indicator status).
NO	No occurence	The species does not occur in that region.

NOTE: If a species does not occur in wetlands in any region, it is not on the National List. For some species the panels felt that further clarity was warranted regarding the likelihood of the species to occur in a wetland. So for some species, the indicator is provided a positive (+) or negative (-) modifier. The positive sign indicates an affinity toward a higher likelihood of occurring in a wetland. A negative indicates a lower affinity to occur in a wetland. Thus, a FAC- does not occur in a wetland as often as a FAC, while a FAC+ species tends to occur more often in a wetland that does a FAC species. Most consider FAC- species as non-hydrophytes and FAC, FAC+, FACW, and OBL species as hydrophytes but the fact is that all **species on the list act as hydrophytes and meet the FSA definition of hydrophytic vegetation on some sites, while even OBL species (99% occurrence in wetland) behave as non-hydrophytes 1% of the time.**

The Plant List is only a tool that is suggestive, indicative, or predictive of how particular species <u>might</u> behave if the site visit could be made during NC and NEC.

Take a moment to access the National Plant List at http://www.fws.gov/pacific/ecoservices/habcon/pdf/National%20List%20of%20Plant%20Species%201988.pdf.

- View pages 1-13 to familiarize yourself with who developed the list and how the information to assign indicator statuses was obtained.
- Take a look at the region map and the first page of the indicator status list to see how it works.
- What region represents your work area?
- Choose a species that your are familiar with in your work area and think would at least sometimes occur in a Cowarin et. al. wetland. Find the regional indicator status for that species.
- What does this tell you about the species?
- Do you agree with the regional panel's mid-1980's decision?

In 2006, The U.S. Army Corps of Engineers (Corps) accepted the administrative responsibility for the National Wetland Plant List (NWPL) from the U.S. Fish and Wildlife Service (FWS). Updating the NWPL has been a cooperative effort of the Army Corps of Engineers (Corps), the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the Natural Resources Conservation Service, The Biota of North America (BONAP), states, Indian Nations, the academic community, and the scientific portion of the public. Each region of the United States is represented by a panel consisting of botanists or ecologists from each of the four lead federal agencies; these panels will initiate draft wetland plant ratings. Once the update of the NWPL is completed, this plant list will supersede Reed, 1988 as the approved list for use in federal wetland determinations and the list will be maintained on a web-based system. For more information regarding the process of updating the plant list visit https://rsgis.crrel.usace.army.mil/apex/f?p=703:1:1223660959248466.

Each Regional Supplement to the Corps Manual provides two or three Corps indicators of a prevalence of hydrophytic vegetation:

Corps indicator 1: The Dominance Test. This Corps indicator utilizes the 50/20 Rule (from the 1987 manual) and only considers dominant species. In most regional supplements all FAC species (even FAC-) are assumed to be behaving as hydrophytic vegetation.

Corps indicator 2: The Prevalence Index. This is a more sensitive (and time intensive) approach that uses all species weighted by percent cover. This approach considers FAC species as neutral (neither hydrophytic or non-hydrophytic) and results in decisions regarding vegetation that are more similar to SCS decisions made prior to the 1994 MOA. Based on each regional supplement, this Corps indicator can only be applied in certain situations (when soils and hydrology are confirmed but the Corps indicator 1: Dominance Test is not met).

Some studies have found that the results of from the application of PI better align with hydric soil indicators and or wetland hydrology than do the results of the application of the Dominance Test (Dewey et. al 1996, Wakeley et. al. 1996). In a study of sites across the U.S., Wakeley and Lickvar (1997) found a disagreement at a rate of 16% when the two methods are applied to the same site data.

Corps indicator 3: Morphological Adaptations. Some supplements the Corps provides for this seldom used Corps indicator. It basically allows for the assumption that FACU and UPL species exhibiting documented morphological adaptations within an apparent wetland (meeting hydric soils and wetland hydrology indicators but not meeting Corps indicators 1 or 2 for vegetation. Basically, the observation of plants exhibiting adaptations is suggestive that the individuals (plants) are behaving as hydrophytic vegetation even thought the species tend to occur more often than not in non-wetlands.

References

Wakeley, J.S., S.W. Sprecher, and R. W. Lichvar. 1996. Relationships among wetland indicators in Hawaiian Rain Forest. Wetlands 16(2):173-184.

Wakely, J. S. and R. W. Lichvar. 1997. Disagreement between plot-based prevalence indices and dominance ratios in evaluations of wetland vegetation. *Wetlands* 17:301–309. CSA

Dewey, J.C., S.H. Schoenholtz, J.P. Shepard, and M.G. Messina. 1996. Issues related to wetland delineation of a Texas, USA, bottomland hardwood forest. Wetlands 26(2):410-429.

Why is this important to me? The verification that a Corps indicator has been met is highly suggestive (but not absolute) that the site would support a prevalence of FSA

hydrophytic vegetation under NC and during NEC. We will go into more detail on the decision-making process later in this Module, but what is important now is that you become familiar with these Corps indicators and how to apply vegetative sampling data to the primary decision making Corps indicators (Corps indicators 1 and 2).

Corps indicator 1: Exercise. These type of concepts are difficult to understand without practice. Take a moment to access a Regional Supplement to the Corps Manual at http://www.usace.army.mil/cecw/pages/reg_supp.aspx and read about Corps indicator 1 (Dominance Test). Study the example in Table 3 of the vegetation section of the supplement. After you think that you understand the concepts, play with the example by taking away one or more species and/or changing the percent covers. With this new example (based on your modification of the example), see if you can decide if Indiator 1 is met.

Do not move to the next discussion, until you have an understanding of :

1. How to decide if a species is a dominant (using 50% and/or 20%)
2. How to decide if the plant community is hydrophytic.

This Corps indicator is used in the majority of the hydrophytic vegetation decisions. Make take the time needed to fully grasp the concepts and the math.

Corps indicator 2: Exercise. Once you feel comfortable with Corps indicator 1 read the discussion under Corps indicator 2 - the Prevalence Index procedure. Refer to the example in Table 4 of the vegetation section of the supplement. After you master the concept in the example, manipulate the data in Table 4 (change percent cover and or drop some species). Play with this to see how different changes in the data change the PI. Note that as the findings deviate from a 3.0 (approaches a 1.0), the data is providing more confidence that under NC and NEC the site would support plants growing in water or an anaerobic substrate. As the PI approaches 5.0, the confidence is greater that the vegetative data are obviously indicating not hydrophytic. The decision threshold is at 3.0.

Corps indicator 3: Exercise. Only a few regional supplements provide for a third Corps indicator of a prevalence of hydrophytic vegetation. Review the Supplement for your region(s). Do they provide for Corps indicator 3: Morphological Adapations? If so, read the concepts and the application until you understand when and how this Corps indicator is applied. If not move to the next Concept.

It is worthy of repeating that (1) Corps indicator 3 is only applied to species that have an wetland indicator status of FAC- or drier, and (2) adaptations observed must occur on individuals growing in suspected wetland landscapes **but not on individuals of the same species growing** in the non-wetland landscape positions – a very rare situation in the field.

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Learning Concept 3-5: Difficult and Problematic Areas.

This Learning Concept is designed to take 30-45 minutes and includes office exercises. Links are provided as optional learning opportunities.

Disturbance–Based Problems

The Corps Manual provides for situations where disturbance has significantly altered or removed indicators. Similar to NRCS, the Corps (in their 1987 Manual) refers to these situations as sites not supporting NC, and the user is referred to Section F: Atypical Situations. For FSA wetland identification, the agency experts are directed to also utilize Section F when NC (as defined by NRCS and presented in Module 2) is not met. In addition to Section F, each regional supplement provides additional avenues to assist in decision-making related to problems associated with disturbance under Chapter 5: Difficult Situations.

If it has been a few days since you completed Module 2, it is recommended that you review the concepts of NC and NEC before proceeding with this Learning Concept.

- How and when does disturbance alter the decision-making process?

Disturbance that merely results in a shift to an earlier stage in plant succession (the predictable order of the development of a vegetation community over time) does not typically affect the viability of wetland determinations/delineations. For example, the harvest of trees from forests can shift the overall plant community from a fully stocked forest to a plant community dominated by more sun-loving woody and herbaceous (non-woody) species. If the forest prior to harvest was a wetland, the resulting plant community after harvest will also be dominated by species adapted to grow in the same wet conditions. Although the plant species may be changed, the hydrophytic nature of the new plant community should be similar to the pre-harvest community.

There are situations, however, that can be problematic as it relates to disturbance.

- Annuals will commonly invade disturbed sites. These annual are often reflective of very short term hydrologic conditions immediately prior to the site visit and may not be reflective of NEC.
- In cropland settings, hydrophytic annuals are very common (even in non-wetlands) as the seed-bank of species adapted to wetter environments have been less affected than their non-hydrophytic counterparts.

- In late-season site visits (even on unmanaged sites), non-hydrophytes annuals may become more abundant. This is particularly true for plowed fields. These species are adapted to germination and growth outside of the period of NEC (after the site de-waters). As a reminder, all decision should be representative of

conditions that occur during NC and NEC. If the application of wetland hydrophytic vegetation indicators (using data from this late season vegetative flush) results in a different decision that what would be rendered during the period of NEC, then the site does not represent NC and further consideration and alternative methods are mandated.

- Areas treated or managed for forage production commonly lack the forbs, reducing the species richness of the site. These areas are commonly monotypic and may provide erroneous information in regard to what species would occur without management inputs.

Reflect on your experiences in cropland, pastureland, and or hayland fields. Where are the weeds? In a pasture or hayland field, are they on the best soils where soil is seldom exposed by hoof action or rutting? In a cropland field, are they on the well drained portions were the plow has free movement and the soil is broken into small peds? Is it where chemical applications have been applied during optimum soil moisture conditions? Or, are weeds more common in wet portions of the field where the crop is sparse and competition is less?

Why is this important to me? When conducting a wetland determination or delineation on a site that has been subjected to a disturbance that shifts the successional stage of the vegetation community, it is not typically necessary to employ special methods (Section F and Chapter 5) for determining the prevalence of hydrophytic vegetation. However, in instances where NC does not exist (Corps indicators lacking or not reflective of what would occur in the absence of the disturbance), special methods must be used to determine whether a site would have exhibited a prevalence of hydrophytic vegetation prior to the post-1985 alteration. Remember, all decisions are based on the normal not the abnormal.

Again, the hydrophytic vegetation decision should be similar to what you would find if sampled the site during in a minimally disturbed conditions during NEC. If it is suspected that the vegetative data is providing a false positive or false negative due to disturbance then adjustments in methods and or timing of the visit are mandated.

Access the 1987 Manual on the Corps Webpage. Go to Part IV: Methods. Do a "find" for this section on "normal circumstances". Where does the manual direct you when you don't meet NC? Find all of the places in the text (Part IV) that use NC and see what the manual says.

Go to Section F and read the entire section. Think about disturbed situations that you might face on lands associated with agricultural operations in your work area. Does Section F provide viable solutions related to vegetation? Pause and think. These problems are what makes FSA wetland Identification unique to what the Corp might face.

Access a Regional Supplement to the Corps Manual at http://www.usace.army.mil/cecw/pages/reg_supp.aspx. Read Chaper 5 about areas

exhibiting problematic vegetation situations. Note that in the supplements (unlike the 1987 Manual) the Corps did not separate disturbance-based problems from climate-based problems. As you read, familiarize yourself with the procedures for assessing hydrophytic vegetation among the problematic situations related to disturbance. Consider how NRCS considered NC in relation to 1985. If confused go back to the NC discussion in Module 2.

Climate-based Problems

Challenges with the potential to get a false positive or false negative are not limited to disturbance-based problems. More common regarding vegetation is changes in the plant community from changes in the climatic (amount of precipitation, evaporation rates, transpiration rates, snow accumulation, snow melt rates, rainfall intensity and timing based on land-cover in the wetlands watershed). The hydrologic condition - from each of these ever-changing climate-based hydrologic inputs and outputs – that results during the normal wet portion of the growing season is referred to as normal environmental conditions (NEC). The period of the year (season) when these wet conditions normally occur is referred to as the period of NEC.

Our charge as agency experts, is to render a decision, if under NC and a under NEC, the plant community (sampling area) being assessed would support a prevalence of (1) plants growing in water, or (2) growing in a substrate deficient in oxygen.

More often than not, the decision is predictive as we are not able to visit the site under NC and NEC. Additionally, the fact that plant communities are dynamic as each plant attempts to compete with other plants as normal and abnormal climate-based stressors (drought, cold, wetness, drying hot winds) are thrown their way. The application of the Corps methods regarding hydrophytic vegetation indicators can't be applied blindly nor with disregard for the condition (hydrologic) of the site when the observed (inventoried) plants were germinating and growing. If it is suspected that the plant community is significantly different that what would occur during NEC, the alternative methods are available. In Section G: Problem Areas of the 1987 Manual the Corps addressed situations where the community might not be reflective of NEC. Climate-based problems as they relate to vegetation are magnified in hot and/or arid regions of the U.S. where the concept of normal is so difficult.

So the real question for FSA purposes is so much what is growing on the site at the time of the site visit, but rather what plants would be growing at the end of the period of NEC and would they be growing in (1) water or (2) in a substrate that is deficient in oxygen?

Go to Part IV of the Corps Manaul and do a "find" for normal environmental conditions. What does the Corp Manual recommend. Do their suggestion apply to your work area? After consideration of what is provided in Section G, access you regional supplement and read the parts in Chapter 5 that address NEC issues. These are the methods and considerations that best address potential climate based decisions.

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Learning Concept 3-6: Onsite Inspection Necessary (Section D. Routine Determinations; Subsection 2)

This Learning Concept is designed to take 30-45 minutes and includes office exercises. Links are provided as optional learning opportunities.

A decision is made that an onsite inspection (data collection) is necessary to make a decision of a prevalence of hydrophytic vegetation. What then? First consideration is which vegetation sampling method best fits the situation (project and site conditions).

Vegetation Sampling Decisions

There are three general strategies used to gather vegetative data within a sampling area: plot-less methods, plot-based methods, and line-transect methods.

The 1987 Manual provides a plot-less method in the Routine Less Than 5 Acres in Size and a plot-based method in the Routine Greater Than or Equal to 5 Acres in Size. Most regional supplements present alternative plot-based methods. Inexperienced individuals will want to apply those methods provided by the Corps with little modification, if any. As experience is gained, modification of the standard methods presented by the Corps may be warranted. This option is supported by the Corps in the flexibility discussion (introduction) and again in the regional supplements. However, if an alternative sampling method is used, the reason for the change should be documented.

Go to the 1987 Manual and read the flexibility discussion in Part 1:Introduction. Understand that the agency expert is provided with opportunities to vary from the standard sampling methods presented by the Corps, but understand that there needs to be a reason for using another method and that reason should be noted.

The Three Common Vegetative Sampling Strategies

It is important that NRCS agency experts (and others) understand that there is an array of specific vegetative sampling methods that fall under each of the three common strategies. For example, there are hundreds of methods in the literature on plot-based methods alone. The Corps provides a few specific methods within the plot-based and plot-less strategies, while providing no specific point-intercept method.

Plot-less Methods – The Corps provides a plot-less method in their vegetative sampling method described in Part IV; Routine; Level 1; Areas Less-Than 5 Acres in Size, where the user visually divides the site into different plant communities (sampling units), and then estimates the percent cover of each species within the plant community (sampling unit) being considered. This is a very rapid and easily applied method. For

FSA wetland determinations, this methods will be the most commonly applied sampling method.

It must be understood, that in the FSA Procedures, NRCS made it clear that the 5-acre threshold used by the Corps will not be used by the NRCS agency expert. Rather the ability to visually divide the site into different sampling units based on changes in the plant community will dictate which method is used:

- Routine, Section 2 Subsection 2 (Level 2 determination) – Areas Equal to or Less than 5 acres in Size, or

- Routine, Subsection 2 (Level 2 determination) – Areas Greater Than 5 acres in Size

The term "plot-less" is somewhat of a misnomer as some boundary always exists (you have to stop your consideration somewhere). What separates the plot-less from plot-based methods is that the plot-less methods do not have a defined size or shape and the extent of the assessment (boundary) are diffuse and determined visually. Because of this, the plants occurring along the boundary between two sampling units are typically not considered in the estimates.

There are two general approaches used to collect data using any plot-less method: the meandering assessment approach and the fixed survey approach.

- The meandering assessment approach involves conducting a survey of the plant community (sampling area) that does not follow any fixed bearing, but rather the investigator meanders through the site, taking note of the plant community as they walk. A decision is made for the entire unit as a whole. This method can be more accurate than the fixed ocular survey method (next bullet), but should be reserved for experienced staffs (agency experts).

- The fixed ocular survey approach (the Corps refers to this as the "*selection of representative observation points*") is the foundation to the Areas Equal to or Less Than 5 Acres in Size method. As a reminder - the FSA Procedures state that this method (Areas Equal or Less than 5 Acres) will meet the needs of NRCS and their clients (program participants) for FSA purposes, barring rare situations where visibility is too limited to divide the project into different sampling units (based on changes in the community). Thus, it is very important for those who desire to be on a State List of Agency Experts to spend the time learning the details of this sampling method as described in the Corps Manual.

  Basically, this approach consists of the investigator standing at a fixed point (representative of the community) and viewing a portion of the unit (no fixed distance) or the entire unit. The species and their percent cover estimates (absolute cover) are made. If necessary, the investigator moves to another

representative area and makes another estimate. This is repeated until the agency expert determines that the sampling unit is represented by the data.

The Corps method as described in their Manual is even more simplistic than described above. The individual selects an area within the sampling unit (community) that "best represents the characteristics of the entire community". The data from the "representative" area are used to base a decision for the entire community.

Essentially, the agency expert has the responsibility to collect enough data to adequately represent the unit. The Corps method would work fine in monotypic communities or those with even species distribution.

If more than one observation point is used, then the data is the averaged by species to obtain estimates for the entire sampling unit. Caution should be made that each fixed ocular survey represents about the same portion of the area. Another option is to estimate (at each stop), what percentage of the entire sampling unit is the data from the point representing. This is done at each stop (fixed ocular point). Weighted averages by species are incorporated into the analysis to account for the fact that one observation stop might represent 15% of the area and another might represent 30%, while the third would represent the remainder (55%). The total must be 100%.

Refer to the Corps Manual and find the Routine, Level 1 – Areas Equal to or Less than 5 Acres in Size. Read about this method as it relates to vegetation thru step 7. In particular, pay close attention to the fact that this is a fixed ocular point plot-less method and that only one "point" is used. If you are unfamilar with weighted averages, it might be of value to do an internet search or visit with someone familiar with the concepts and calculations and the use of weighted averages is used in Corps indicator 2: Prevalence Index and has a multitude of other applications in resource assessments.

- **Plot-based methods** – This is the most common strategy for sampling of vegetation communities for resource assessment purposes. These methods differ from plot-less methods, as they always have a reference point (middle of a circle or corner of a square) and quantifiable dimensions. There are two general plot configurations typically used to sample vegetation when conducting wetland determinations using a plot-based method: (1) standard plot size/dimension and (2) variable size/dimension (change the shape and size to fit the community being sampled).

  When employing a plot-based sampling method, the sampling intensity (plot size and number) should be such that the plant community being assessed is well represented by the data. Sparsely vegetated sites might require larger plots or more plots than when sampling densely vegetated sites. Monotypic sites will

typically require smaller plots and/or fewer plots than will sites with greater species richness, particularly if the species distribution is non-uniform (Figure 1).

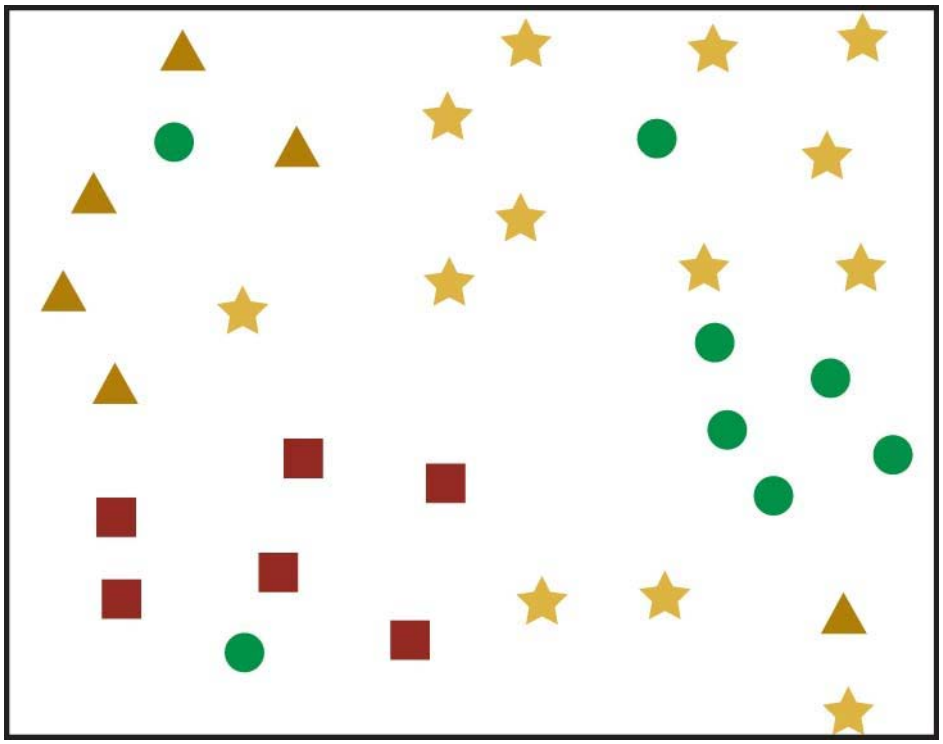

Figure 1. Areas with high species richness and non-uniform distribution provide for unique sampling and data analysis challenges. Multiple sampling efforts, or conducting a single visual sampling effort using the plot-less method, are typically the most appropriate sampling methods. In this example, the star and circle meet the 50/20 dominance test, with 30% and 24% respectively. The COE PI might be more appropriate in this situation, particularly if one or more of the two dominant species are FAC (FAC dominated community).

In using standard plots size/dimension, the plot size, number, and shape are predetermined and are typically based on a guidance document (Regional Supplements, 1987 Manual, vegetative sampling text books). Standard plots work well for larger sampling units with less variability in topography (macro-topography), particularly for sites with high species richness and even distribution (uniformly, Figure 2).

The size and shape of the plot is tailored to the physical attributes of the community being characterized, but circles are best, followed by squares. The error in plot-based sampling is near the edge or perimeter. If the shape is altered for a long and narrow plant community (i.e. along a toe-slope where water is seeping out of the upland), the significant errors are assured. In these situations, more and smaller square or circular plots that are contained within the narrow

sampling area would have more value. Or, other strategies might be more appropriate than plot-based methods.

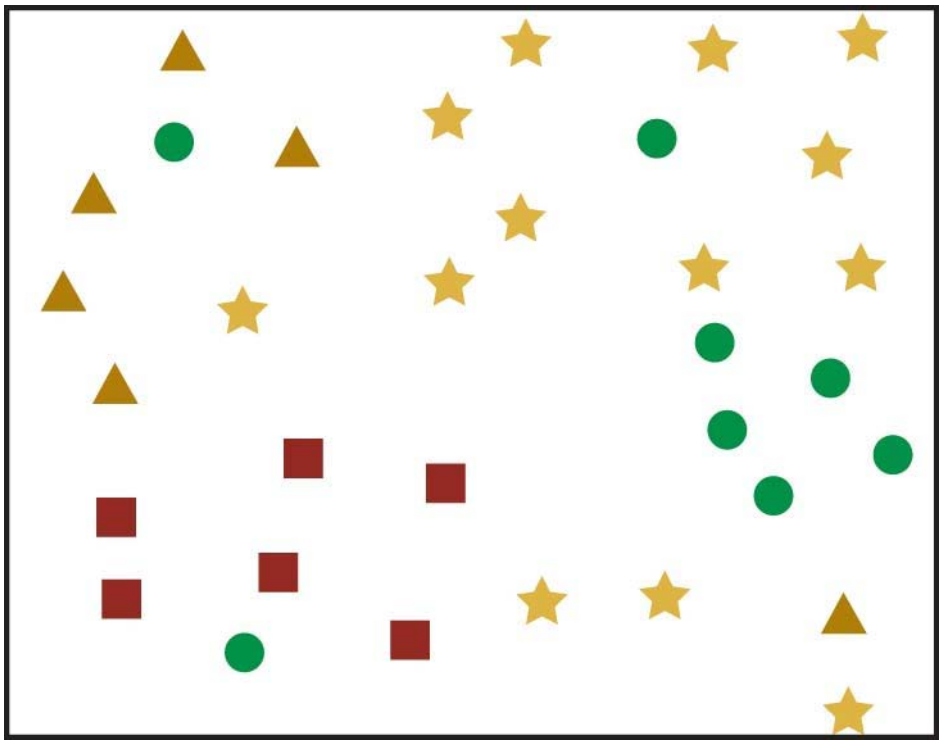

Figure 2. Areas with high species richness and non-uniform distribution provide for unique sampling and data analysis challenges. Multiple sampling efforts, or conducting a single visual sampling effort using the plot-less method, are typically the most appropriate sampling methods. In this example, the star and circle meet the 50/20 dominance test, with 30% and 24% respectively. The COE PI might be more appropriate in this situation, particularly if one or more of the two dominant species are FAC (FAC dominated community).

Refer to the Corps Manual and find the Routine, Level 1 – Areas Greater Than 5 Acres in Size. Read about this method as it relates to vegetation (thru Step 20 (c). Is it a plot-less or plot-based method. How does it differ from the method provided for Areas Less than or Equal to 5 Acres? Take your time – this is very important. Do you notice that vegetative layers (strata) are introduced and sampled independently? This method is the basis for most optional methods provide in the regional supplements.

Now access "your" regional supplement and find the sampling method(s) presented. How do they differ?

Why is this important to me? In Table 1 of the Corps Supplements (Chapter 1), the Corps provides for what parts of the 1987 manual are replaced by the supplements. If you are unfamiliar with Table 1, you will want to access it before moving to the next discussion.

The sampling methods described in Routine Greater Than, and Less Than 5-acres are **NOT replaced** by the sampling methods presented in the supplements. Based on the flexibility options provided in the 1987 Manual, the vegetative sampling method described in the supplements **can be used in lieu of those in the Manual** - base on the sole judgment of the agency expert. This is likely the most misunderstood concept presented in the supplements – that is that **the sampling methods presented do not replace those in the Corps Methods**.

- **Point-Intercept methods -** An array of point-intercept methods can be found in the literature. The benefit is that data are collected and estimates are not used. This is worthy of repetition. The plot-less methods and plot-based methods presented by the Corps all rely on visual estimates. Point-intercept methods collect data at each point. Thus, the data can be replicated by anyone, regardless of their training level or personal bias.

  Some point intercept methods can be very time consuming and data hungry, but that can be said with some plot-based and plot-less methods as well. In this method, individual plants encountered while walking a line between two points are noted. Set intervals (typically every other pace) are determined based on the length of the transect, species richness along the transect, and plant cover along the transect. Individual plants occurring along a line perpendicular to the ground at the "toe of the boot" are documented. The use of the term "point" is somewhat misleading as the point is actually a very small plot and the size of the point may vary depending on the site conditions. For example in sparsely vegetated sites, the point might be as large as a coffee can lid. In densely vegetated areas, the point will need to be very small. Many find point-intercept sampling method to be more easily and more rapidly applied than either plot-less or plot-based methods. If a point-intercept method is used, it should be referenced from the literature, or fully described.

  Point-intercept methods are likely the most appropriate method for long linear plant communities, such a toe-slope positions and vegetative rings around the edge of a depressional wetland. Where they are more difficult to apply is for forested communities with many layers (strata) and some herbaceous communities with very dense and tall vegetation.

This is an optional exercise reserved for more experienced students. If you have experience with plot-less and plot-base methods provided by the Corps, you may want to practice this sampling technique. First estimate the percent cover by species using occular methods. Then run a point-intercept across the same area. Compare your results. Which would you be more comforable dedending? Hint: You will want to learn this technique in a site with low growing or sparse herbaceous vegetation.

Decisions Regarding the Prevalence of Hydrophytic Vegetation

As is explained in the FSA Procedures (Part III), decisions about each factor are made independent of the other factors and are based on the preponderance of evidence. The amount of evidence is left to best professional judgment of the agency expert. What should never be lost is that the legal mandate for hydrophytic vegetation (or any diagnostic factor) is that the agency expert is able to confirm the FSA definition/criteria for that factor.

If direct evidence was observed (viewed the sampling unit during the site visit or from remote sensed data) and most of the plants in the area (sampling unit) being considered were (1) growing in water or (2) growing in a substrate deficient in oxygen due to excessive water content and conditions, AND the direct evidence was reflective of NC and NEC - then the decision can be made very quickly and with much confidence.

If it is confirmed that the site is ponded, or saturated to the surface, during the period of NEC and those hydrologic conditions are normal, but the vegetation on the site has been removed from disturbance (e.g. plowed, treated with herbicide) - then it can it be assumed that under NC plants would be growing in water or growing in a substrate deficient in water during a normal year (NEC) and under NC. This would be direct evidence. Again, direct evidence can be from onsite visits or from remote sensing tools.

If direct evidence is not available, then the approved Corps indicators (indirect evidence) are used to assist in the decision. Being circumstantial evidence, Corps indicators are not fail proof, but they should be used with confidence as they have undergone much review and scrutiny. The decision at this level (factor level) remains a preponderance of evidence.

Use of Indirect Evidence (Corps indicators) - Assume that you have visited a site, collected vegetation data, and have performed all of the necessary calculations required to determine whether a prevalence of hydrophytic vegetation exists. The most important decision you must make is whether or not the data you collected and performed tests on is actually representative of the normal conditions of the site. For example, your analysis of vegetation data indicates that the vegetation community on a site meets a Corps indicator from a regional supplement (or Corps Manual for areas without a supplement). Does this mean that a prevalence of hydrophytic vegetation exists on the site? Maybe not.

What if the vegetation data you collected and analyzed was from a community that represents the natural levee of a stream or river that is rarely, if ever, is inundated or saturated with water? Would you decide that the site exhibits a prevalence of hydrophytic vegetation based on the FSA definition/criteria for a prevalence of hydrophytic vegetation? No, as during NEC, the definition is would not be met.

Why is this important to me? Remember that the definition of hydrophytic vegetation used by the Corps in the development of their wetland identification procedures (Corps Manual and Supplements)

is “species” and “adaptation” based. The FSA concept/definition is plant and occurrence based. Using the Corps concept/definition, a FACU species is assumed to be a non-hydrophyte. Using the FSA hydrophytic vegetation concept/definition this is not true. Yes, a FACU plant suggests that, during NC and NEC, it would not be growing in water or a substrate. But remember, FACU species occur in wetlands too. So, meeting a Corps indicator is not proof-positive, it is evidence that must be tempered with the landscape position and predicted hydropatterns at the plant’s location. This can be applied to plants found growing on a site, regardless of their wetland indicator status.

The situation described above is intended to inform you that the possibility exists that the vegetative community on a site can pass one or more “tests” for the prevalence of hydrophytic vegetation but not actually be hydrophytic vegetation. Quite obviously, this situation (false positive or false negative) would often occur more where the vegetative community on a site is dominated by FAC species.

In these situations, the plant data analysis is providing a false positive or false negative indicator for the question: Does a prevalence of hydrophytic vegetation exist in this sampling unit/plant community? For FSA purposes the answer is always based on how the plants would behave or function during NC and NEC.

If it is decided that a Corps indicator is providing a false positive or false negative for the FSA criteria of a prevalence of hydrophytic vegetation, it should be explained on the data sheet the basis for rendering a decision that differs from a Corps indicator.

Stop Time: _____

Learning Concept 3-7: Summary of Making a Decision on the Prevalence of FSA Hydrophytic Vegetation.

The FSA definition of hydrophytic vegetation differs from that of the Corps' definition and the avenue by which an agency expert arrives at a decision as to whether a site supports hydrophytic vegetation may differ from that of the individual using the Corps Methods. Of the three wetland criteria (vegetation, soils, and hydrology), the FSA considers vegetation as being critical as a wetland diagnostic factor as it is part of the definition or criteria for the other two factors.

The FSA concept of hydrophytic vegetation comes directly from Cowardin et al. (1979) and is plant-based (how plants on the site in question are behaving). Hydrophytic vegetation is defined in the law as "a **plant** growing in water", or a **plant "**growing in a substrate that is deficient in oxygen."

The 1988 Plant List (List of Plants that Occur in Wetlands) was developed as an appendix to Cowardin's classification, and understandably within this same plant-based concept. That is, individuals or ecotypes within any species "behave" differently when faced with challenges (stressors) and opportunities (competitive advantages). Any plant on the 1988 list can occur in wetland and can be a dominant in a wetland. Similarly, any plant on the list can occur outside of a wetland and can be a dominant in a non-wetland community. The plant list provides evidence on the likelihood (not by site, but across the region) that these plants might be expected to occur. Users should not interpret the plant indicator status provided by Reed (1988) as the likelihood that a species will dominate any single community being visited, but rather as the likelihood that a species will "occur" in a wetland within the region as a whole. For example, at any given site a FACU species may "behave" like a FACW when faced with specific conditions such as clay content, salts, soil pH, or other stressor. But, within the region as a whole, it is more likely (hence FACU) to not occur in wetlands.

According to the original concepts of the list, each species on the list can be a hydrophyte, or not a hydrophyte. And at any location, each species on the list can be a dominant in a wetland or a dominant in a non-wetland. For FSA purposes, it is what is happening on the site in question that is the issue, and not as much about the "trend" within a species. Thus, the list (for FSA purposes) is used as an indicator (circumstantial evidence) for situations when the site visit (or remote resources) is not representative of NEC.

The Corps concept for CWA purposes is more about the trend within a species as their hydrophytic vegetation definition is "species-based" – "hydrophytic vegetation is prevalent in an area when the dominant **species** comprising the plant community or communities are typically adapted to life in saturated soil conditions". "When the dominant **species** in a plant community are typically adapted for life in anaerobic soil conditions, hydrophytic vegetation is present."

Again, based on the FSA hydrophytic vegetation (plant-based), it is possible that an agency expert could determine the presence of hydrophytic vegetation regardless of the plant species present, if the agency expert observed a prevalence of plants growing in water or under anaerobic condition under NC, including NEC (direct evidence).

With all of this said, it is not possible to observe every site under NEC. In fact it would be the rare exception. For that reason, the FSA Procedures allow the agency expert to employ approved Corps indicators (indirect evidence) to arrive at a decision of the presence of FSA hydrophytic vegetation. Participants in the training need to understand that the use of a Corps Indicator for hydrophytic vegetation will be the most common tool used the decision making for FSA hydrophytic vegetation.

Learning Concept 3-8: Knowledge Assessment - Field Exercise

Identify a site that you either know or suspect is a wetland and that you can access for field exercises for the Hydrophytic Vegetation, Hydric Soils, and Wetland Hydrology modules. Using this training module, the Corps Manual, the National Plant List, and the appropriate Regional Supplement, collect vegetation data on the site via visual survey. NOTE: If you are not strong in plant species identification, ask a coworker who is knowledgeable in plant ID to assist you. After collecting the vegetation data, perform the calculations for Corps Indicators 1 and 2 on a copy of the data sheet located in the back of the appropriate Regional Supplement. Make a decision as to whether there exists a prevalence of hydrophytic vegetation and write a short summary of your efforts, including a brief description of the site, the outcome of your Corps Indicator 1 and 2 calculations, and how you arrived at your decision.

End of Activity