Module 2.

How are wetlands identified and classified?

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Wetland types

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What types of wetlands are there?

- Emergent

- Scrub/Shrub

- Forested

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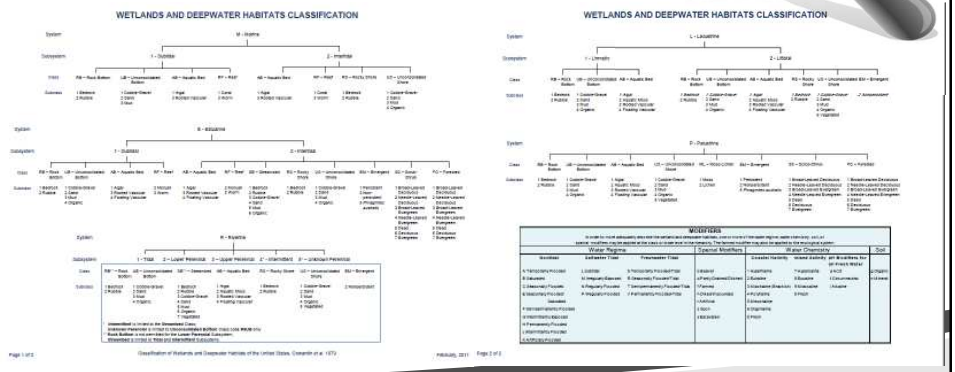
However

This is actually much more complicated:



Cowardin et al. 1979

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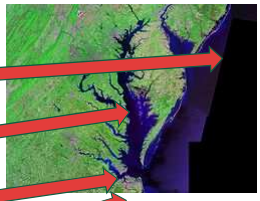
This is actually much more complicated:

- Marine Systems
- Estuarine Systems
- Riverine Systems
- Lacustrine Systems
- Palustrine Systems



- Rock Bottom
- Unconsolidated Bottom
- Aquatic Bed
- Unconsolidated Shore
- Moss–Lichen Wetland
- Emergent Wetland
- Scrub–Shrub Wetland
- Forested Wetland

Palustrine Wetlands

P - Palustrine

EM – Emergent	SS – Scrub-Shrub	FO – Forested
1 Persistent	1 Broad-Leaved Deciduous	1 Broad-Leaved Deciduous
2 Nonpersistent	2 Needle-Leaved Deciduous	2 Needle-Leaved Deciduous
5 *Phragmites australis*	3 Broad-Leaved Evergreen	3 Broad-Leaved Evergreen
	4 Needle-Leaved Evergreen	4 Needle-Leaved Evergreen
	5 Dead	5 Dead
	6 Deciduous	6 Deciduous
	7 Evergreen	7 Evergreen

PFO1= Palustrine Deciduous Broad-Leaved Forested Wetland

Modifiers

MODIFIERS

In order to more adequately describe the wetland and deepwater habitats, one or more of the water regime, water chemistry, soil, or special modifiers may be applied at the class or lower level in the hierarchy. The farmed modifier may also be applied to the ecological system.

Water Regime			Special Modifiers	Water Chemistry			Soil
Nontidal	**Saltwater Tidal**	**Freshwater Tidal**		**Coastal Halinity**	**Inland Salinity**	**pH Modifiers for all Fresh Water**	
A Temporarily Flooded	L Subtidal	S Temporarily Flooded-Tidal	b Beaver	1 Hyperhaline	7 Hypersaline	a Acid	g Organic
B Saturated	M Irregularly Exposed	R Seasonally Flooded-Tidal	d Partly Drained/Ditched	2 Euhaline	8 Eusaline	t Circumneutral	n Mineral
C Seasonally Flooded	N Regularly Flooded	T Semipermanently Flooded-Tidal	f Farmed	3 Mixohaline (Brackish)	9 Mixosaline	i Alkaline	
E Seasonally Flooded/ Saturated	P Irregularly Flooded	V Permanently Flooded-Tidal	h Diked/Impounded	4 Polyhaline	0 Fresh		
F Semipermanently Flooded			r Artificial	5 Mesohaline			
G Intermittently Exposed			s Spoil	6 Oligohaline			
H Permanently Flooded			x Excavated	0 Fresh			
J Intermittently Flooded							
K Artificially Flooded							

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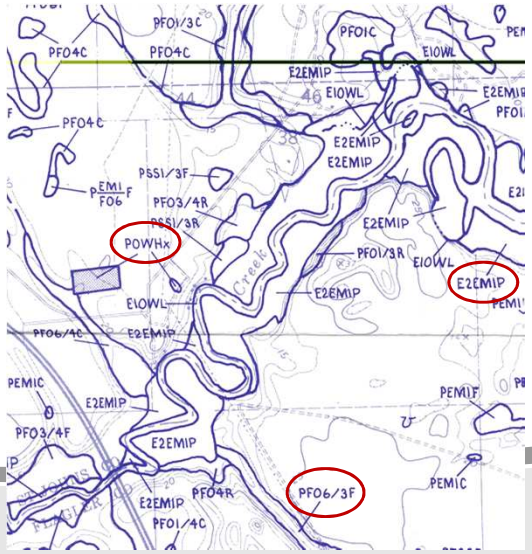
National Wetland Inventory Map



E2EM1P = Estuarine Intertidal Emergent Persistent Irregularly Flooded

PFO6/3F= Palustrine Forested with Deciduous and Non-Deciduous Species, Semi - Permanently Flooded

PoWHx = Palustrine Fresh Open Water Permanently Flooded Excavated

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Forested & Scrub-Shrub Wetlands

1. **Broad-leaved deciduous**
2. **Needle-leaved deciduous**
3. Broad-leaved evergreen
4. **Needle-leaved evergreen**
5. Dead
6. **Deciduous**
7. **Evergreen**

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Leaves

Needle-leaved


American Holly

Broad-leaved

Evergreen

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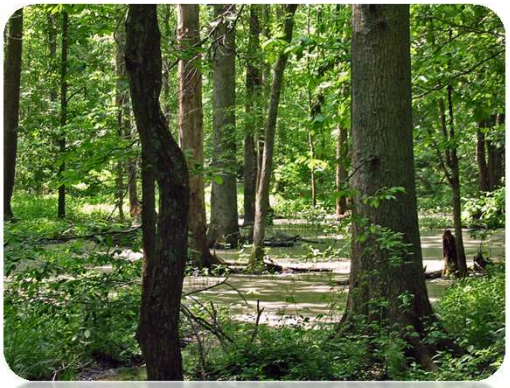
Forested & Scrub-Shrub Wetlands

1. **Broad-leaved deciduous**
2. Needle-leaved deciduous
3. Broad-leaved evergreen
4. Needle-leaved evergreen
5. Dead
6. Deciduous
7. Evergreen



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Forested & Scrub-Shrub Wetlands

1. Broad-leaved deciduous
2. **Needle-leaved deciduous**
3. Broad-leaved evergreen
4. Needle-leaved evergreen
5. Dead
6. Deciduous
7. Evergreen

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Forested & Scrub-Shrub Wetlands

1. Broad-leaved deciduous
2. Needle-leaved deciduous
3. **Broad-leaved evergreen**
4. Needle-leaved evergreen
5. Dead
6. Deciduous
7. Evergreen

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Wetland delineation

What does a delineator look for?

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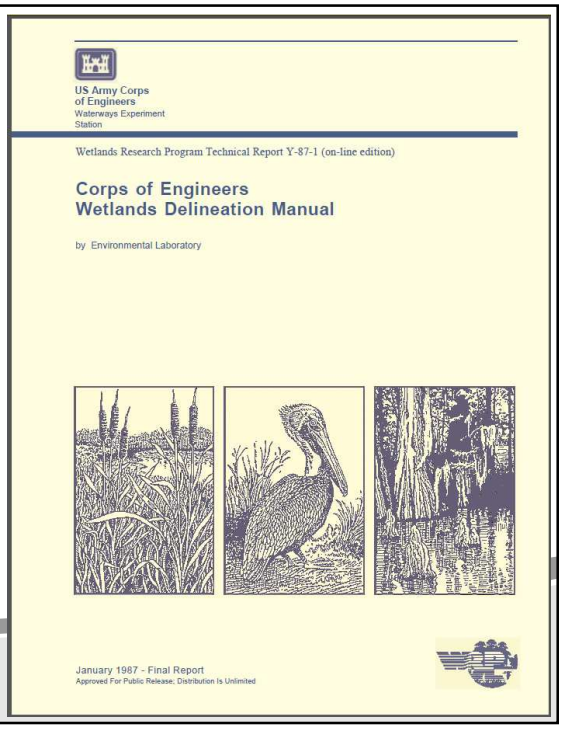
Corps of Engineers Wetland Delineation Manual

http://el.erdc.usace.army.mil/elpubs/pdf/wlman87.pdf



Definition

Wetland: Those areas that are <u>inundated or saturated by surface or ground water</u> at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of <u>vegetation</u> typically adapted for life in <u>saturated soil conditions.</u> Wetlands generally include swamps, marshes, bogs, and similar areas.

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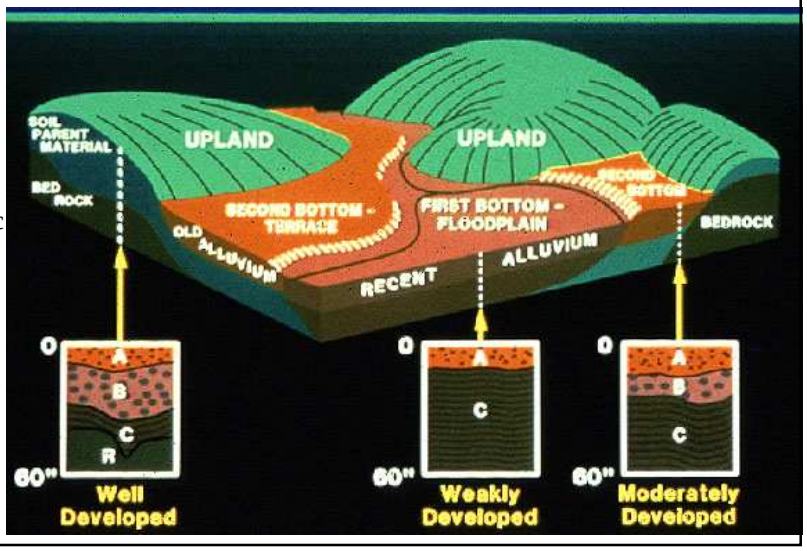
Factors That InfluenceWetland Ecology (Hydrology, Soil Development, Biological Responses) Primarily Derive from the HydroGeoMorphology

Climate
Parent material
Topographic relief
Organisms
Time



Vegetation

The prevalent vegetation consists of macrophytes that are typically adapted to areas having hydrologic and soil conditions described (in *a)* above. Hydrophytic species, due to morphological, physiological, and/or reproductive adaptation(s), have the ability to grow, effectively compete, reproduce, and/or persist in anaerobic soils conditions

Soil

Soils are present and have been classified as hydric, or they possess characteristics that are associated with reducing soil conditions.

Figure 1.—The soil on the right is hydric. It meets the requirements of indicator S7 (Dark Surface). From the surface and to a depth of 10 cm, value is 3 or less and chroma is 1 or less. Below 10 cm, the matrix has chroma of 2 or less. The soil on the left is not hydric. It does not have a dark surface horizon thick enough to meet the requirements of indicator S7 and does not meet the requirements of any other indicator.

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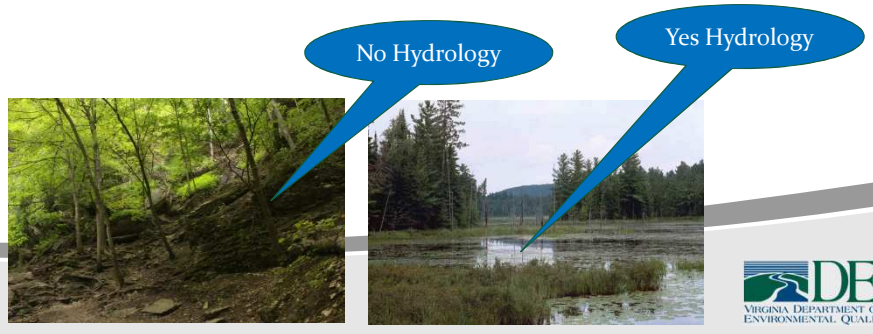
Hydrology

The area is inundated either permanently or periodically at mean water depths ≤ 6.6 ft, or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation.



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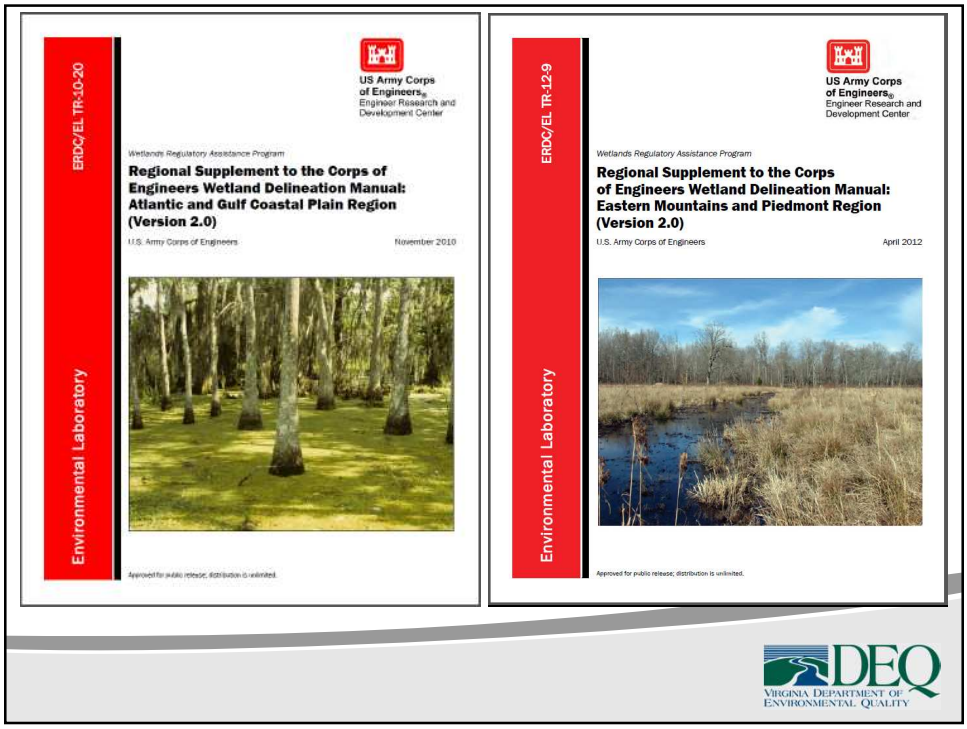
ERDC/EL TR-10-20
Environmental Laboratory
US Army Corps of Engineers
Engineer Research and Development Center
Wetlands Regulatory Assistance Program
Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0)
U.S. Army Corps of Engineers
November 2010
Approved for public release; distribution is unlimited.
ERDC/EL TR-12-9
Environmental Laboratory
US Army Corps of Engineers
Engineer Research and Development Center
Wetlands Regulatory Assistance Program
Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0)
U.S. Army Corps of Engineers
April 2012
Approved for public release; distribution is unlimited.
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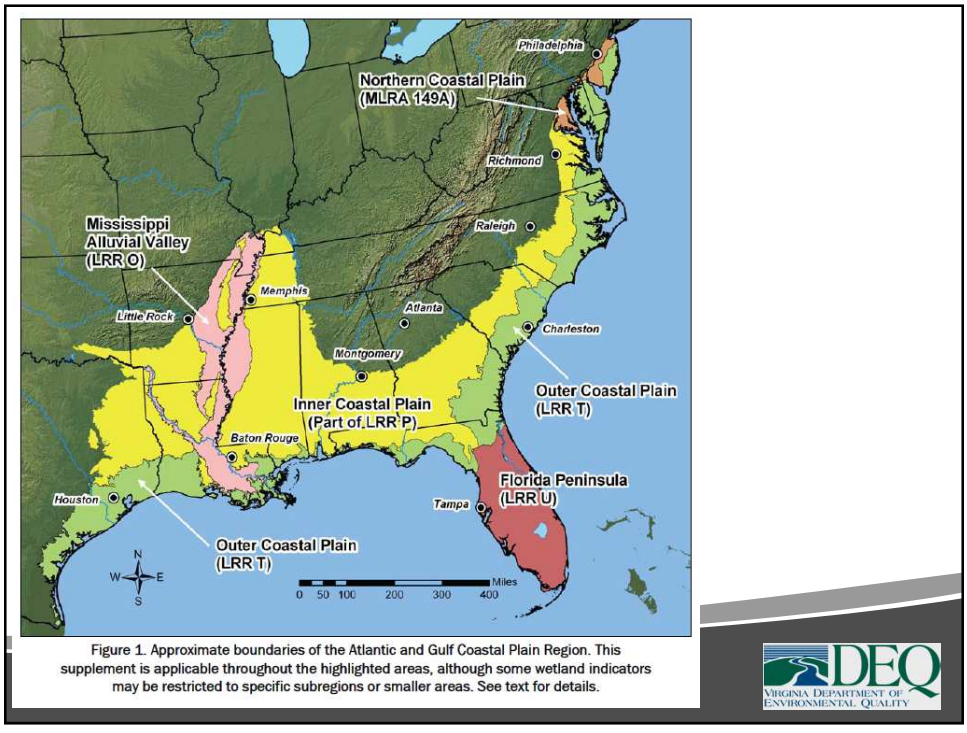
Philadelphia
Northern Coastal Plain (MLRA 149A)
Richmond
Raleigh
Mississippi Alluvial Valley (LRR O)
Memphis
Little Rock
Atlanta
Charleston
Montgomery
Outer Coastal Plain (LRR T)
Inner Coastal Plain (Part of LRR P)
Baton Rouge
Florida Peninsula (LRR U)
Houston
Tampa
Outer Coastal Plain (LRR T)
N
W
E
S
0 50 100 200 300 400
Miles
Figure 1. Approximate boundaries of the Atlantic and Gulf Coastal Plain Region. This supplement is applicable throughout the highlighted areas, although some wetland indicators may be restricted to specific subregions or smaller areas. See text for details.
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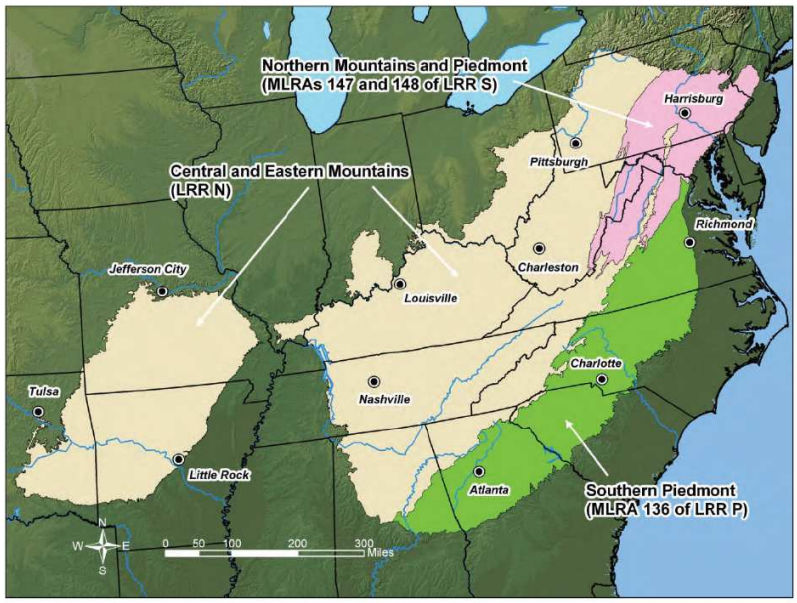

Figure 1. Approximate boundaries of the Eastern Mountains and Piedmont Region. Subregions used in this supplement correspond to USDA Land Resource Regions (LRR) and Major Land Resource Areas (MLRA). This supplement is applicable throughout the highlighted areas, although some indicators may be restricted to specific subregions or smaller areas. See text for details.

Investigations

Desk Review

+

Field Investigation

→

Wetland Delineation

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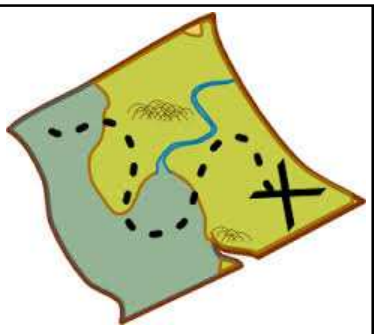
Desk Review

Desk Review

- Topographic maps (USGS)
- Aerial photographs (Locality/Google)
- Soil maps (USDA/NRCS)
- National Wetland Inventory Map



Field Investigations

Vegetation

Wetland Plants

Useful Classifications for ESC and SWM

Wetland species classification:

Obligate (OBL) → almost always in wetlands (≥ 99%)

Facultative Wet (FACW) → usually occur in wetland (67-99%

Facultative (FAC) → can occur in wetland and upland (33-67%)

Facultative Upland (FACU) → usually occur in upland (1-33%)

Upland (UPL) → almost always in uplands (≤ 1%)

Examples of some Physical Adaptations

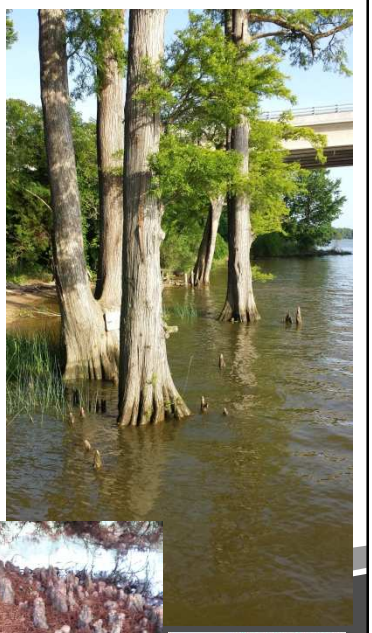
Buttressed trunk	Floating leaves
Pneumatophores	Hypertrophied lenticels
Adventitious roots	Multitrunks/stooling
Shallow root system	

Buttressed trunk

Pneumatophores

A specialized root that grows upwards out of the water or mud to reach the air and obtain oxygen for the root systems of trees that live in swampy or tidal habitats. The "knees" of mangroves and the bald cypress are pneumatophores. Also called air root.

(The American Heritage Science Dictionary)



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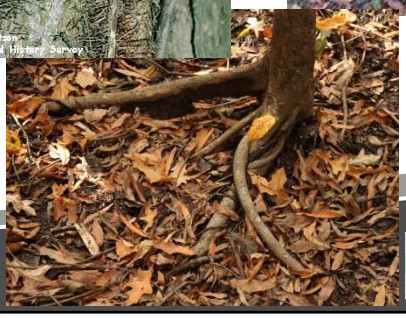
Adventitious roots



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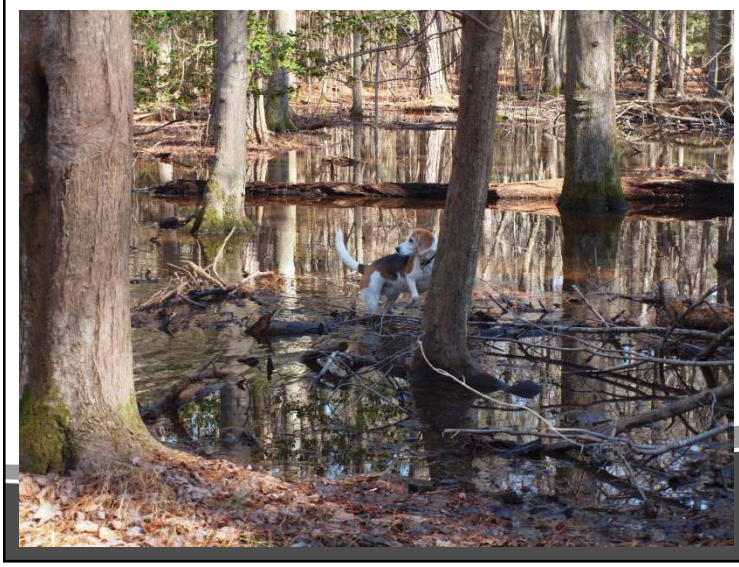
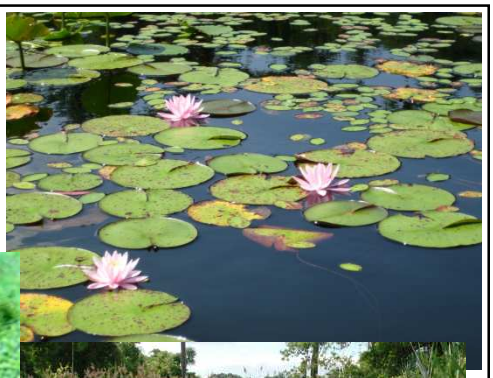
Adventitious roots

Shallow Root Systems



Floating leaves



Hypertrophied lenticels

Multitrunks/Stooling

http://rsgisias.crrel.usace.army.mil/nwpl_static/data/DOC/lists_2014/States/pdf/VA_2014v1.pdf

Cold Regions Research and Engineering Laboratory

ERDC/CRREL

US Army Corps of Engineers

ERDC
INNOVATIVE SOLUTIONS for a safer, better world

State of VIRGINIA 2014 Wetland Plant List

Lichvar, R.W., M. Butterwick, N.C. Melvin, and W.N. Kirchner. 2014. *The National Wetland Plant List*: 2014 Update of Wetland Ratings. Phytoneuron 2014-41: 1-42.

http://wetland_plants.usace.army.mil/

Lilium superbum L. (Turk's-Cap Lily) Photo: Charles Lewallen

User Notes:
1) Plant species not listed are considered UPL for wetland delineation purposes.
2) A few UPL species are listed because they are rated FACU or wetter in at least one Corps region.
3) Some state boundaries lie within two or more Corps Regions. If a species occurs in one region but not the other, its rating will be shown in one column and the other column will be BLANK.

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36 pages

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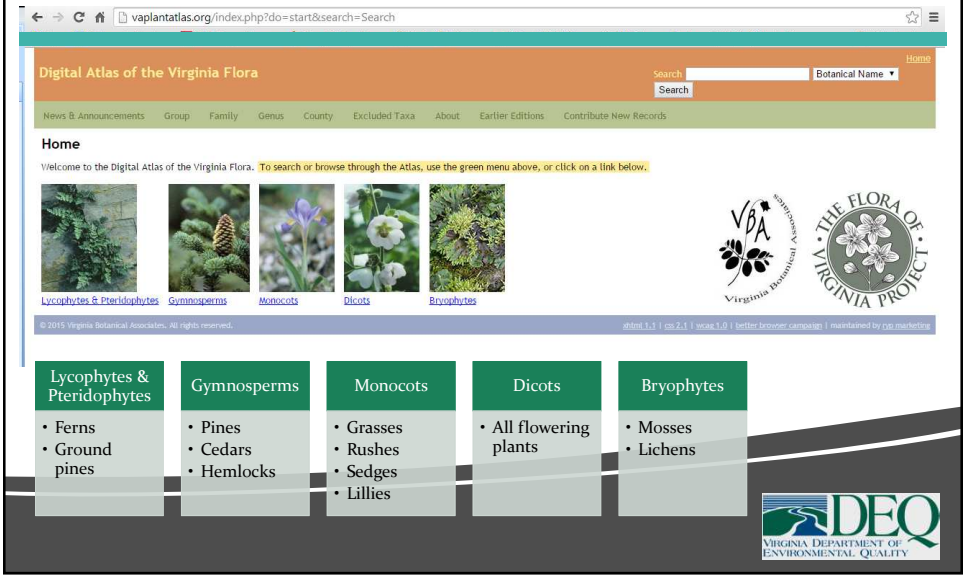
State of VIRGINIA 2014 Wetland Plant List

Atlantic and Gulf Coast Plain

Eastern Mountains and Piedmont

Scientific Name	Authorship	AGCP	EMP	Common Name
Abies balsamea	(L.) P. Mill.		FAC	Balsam Fir
Abies fraseri	(Pursh) Poir.		FACU	Fraser's Fir
Abutilon theophrasti	Medik.	FACU	UPL	Velvetleaf
Acalypha gracilens	Gray	FAC	FAC	Slender Three-Seed-Mercury
Acalypha rhomboidea	Raf.	FAC	FACU	Common Three-Seed-Mercury
Acalypha virginica	L.	FACU	FACU	Virginia Three-Seed-Mercury
Acer negundo	L.	FAC	FAC	Ash-Leaf Maple
Acer nigrum	Michx. f.	UPL	FACU	Black Maple
Acer pensylvanicum	L.	FACU	FACU	Striped Maple
Acer platanoides	L.	UPL	UPL	Norway Maple
Acer rubrum	L.	FAC	FAC	Red Maple
Acer saccharinum	L.	FAC	FACW	Silver Maple
Acer saccharum	Marsh.	FACU	FACU	Sugar Maple
Acer spicatum	Lam.	UPL	FACU	Mountain Maple
Achillea millefolium	L.	FACU	FACU	Common Yarrow
Acnispon americanus	(Nutt.) Rydb.	FACU	FACU	American Deerweed
Aconitum reclinatum	Gray		FAC	Trailing White Monkshood
Aconitum uncinatum	L.	FAC	FAC	Southern Blue Monkshood
Acorus americanus	(Raf.) Raf.	OBL	OBL	Several-Vein Sweetflag
Acorus calamus	L.	OBL	OBL	Single-Vein Sweetflag
Actaea pachypoda	Ell.	FACU	UPL	White Baneberry
Actaea podocarpa	DC.		FACU	Mountain Bugbane
Adiantum capillus-veneris	L.	FACU	FACU	Southern Maidenhair
Adiantum pedatum	L.	FACU	FAC	Northern Maidenhair
Aegopodium podagraria	L.	FACW	FACU	Bishop's Goutweed
Aeschynomene indica	L.	FACW	FACW	Indian Joint-Vetch
Aeschynomene virginica	(L.) B.S.P.	FACW	OBL	Virginia Joint-Vetch
Aesculus flava	Ait.	FACU	FACU	Yellow Buckeye

http://vaplantatlas.org/



Lycophytes & Pteridophytes	Gymnosperms	Monocots	Dicots	Bryophytes
• Ferns • Ground pines	• Pines • Cedars • Hemlocks	• Grasses • Rushes • Sedges • Lillies	• All flowering plants	• Mosses • Lichens

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What's in a name?

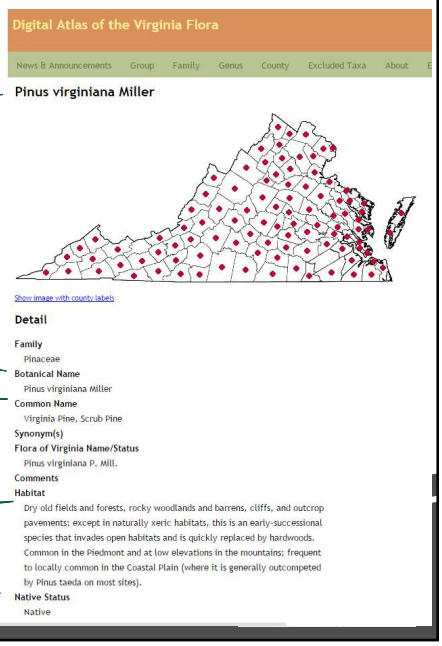
Pinus virginiana Miller?

Botanical name

Common name(s)

Habitat

Native status


Digital Atlas of the Virginia Flora

News & Announcements Group Family Genus County Excluded Taxa About

Pinus virginiana Miller

Show image with county labels

Detail

Family
Pinaceae
Botanical Name
Pinus virginiana Miller
Common Name
Virginia Pine, Scrub Pine
Synonym(s)
Flora of Virginia Name/Status
Pinus virginiana P. Mill.
Comments
Habitat
Dry old fields and forests, rocky woodlands and barrens, cliffs, and outcrop pavements; except in naturally xeric habitats, this is an early-successional species that invades open habitats and is quickly replaced by hardwoods. Common in the Piedmont and at low elevations in the mountains; frequent to locally common in the Coastal Plain (where it is generally outcompeted by Pinus taeda on most sites).
Native Status
Native

Soils

Hydric Soils

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Definition of a Hydric Soil

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



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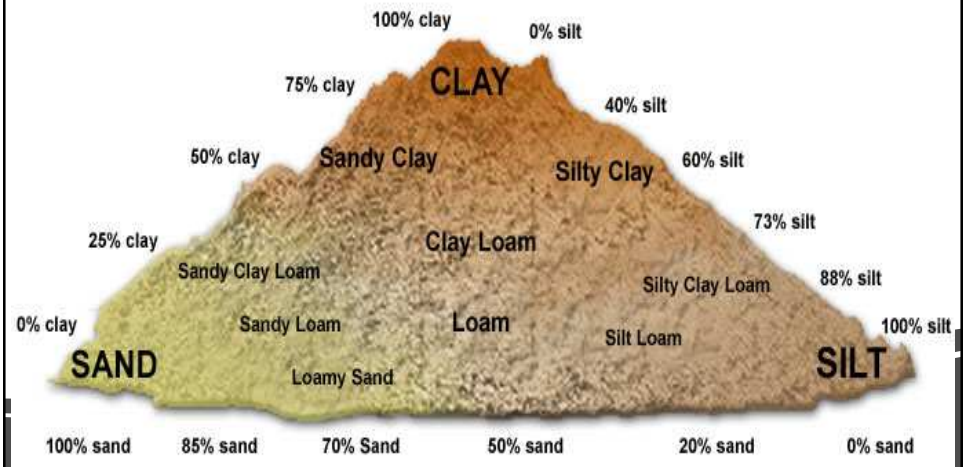
Hydric soils



What happens to soils when they are flooded?

- They become anaerobic … or O_2 depleted
- O_2 = energy so microorganisms need to get energy elsewhere
- Energy is most easily supplied by iron (Fe) and manganese (Mn) in the soil some by Sulfur (S)

What happens to soils when they are flooded?

- $Fe^{3+} \rightarrow Fe^{2+}$ & $Mn^{4+} \rightarrow Mn^{2+}$
- Red color → grey & invisible → black concretions
- Sulfur (SO_4^{2-}, protein, etc.) → H_2S

Remember? Definition of a Hydric Soil

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



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Definition of a Hydric Soil

- How long does it take to "develop anaerobic conditions"?
  - as little as 2 days in a lab, possibly in as little as 1 week in the field
- The "upper part":
  - the major portion of the rooting zone, usually 6 to 12 inches
- "formed under conditions of"
  - that artificial drainage does not alter hydric soil status. However, it can alter soil properties:
    - less organic matter
    - compaction
    - shift microbial populations
    - change pH and salinity

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What happens to soils when they are flooded?

- $Fe^{3+} \rightarrow Fe^{2+}$ & $Mn^{4+} \rightarrow Mn^{2+}$
- Red color → grey & invisible → black concretions

- Grey soils
- Oxidized (red) root channels (redox concentrations)
- Mottled look

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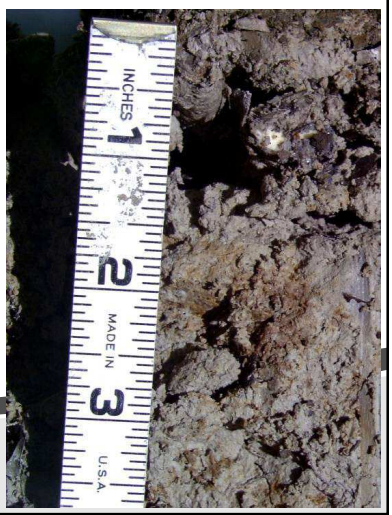
Some Examples (but do not d.i.y.!)

Oxidized root zones/mottling

Mn Concretions



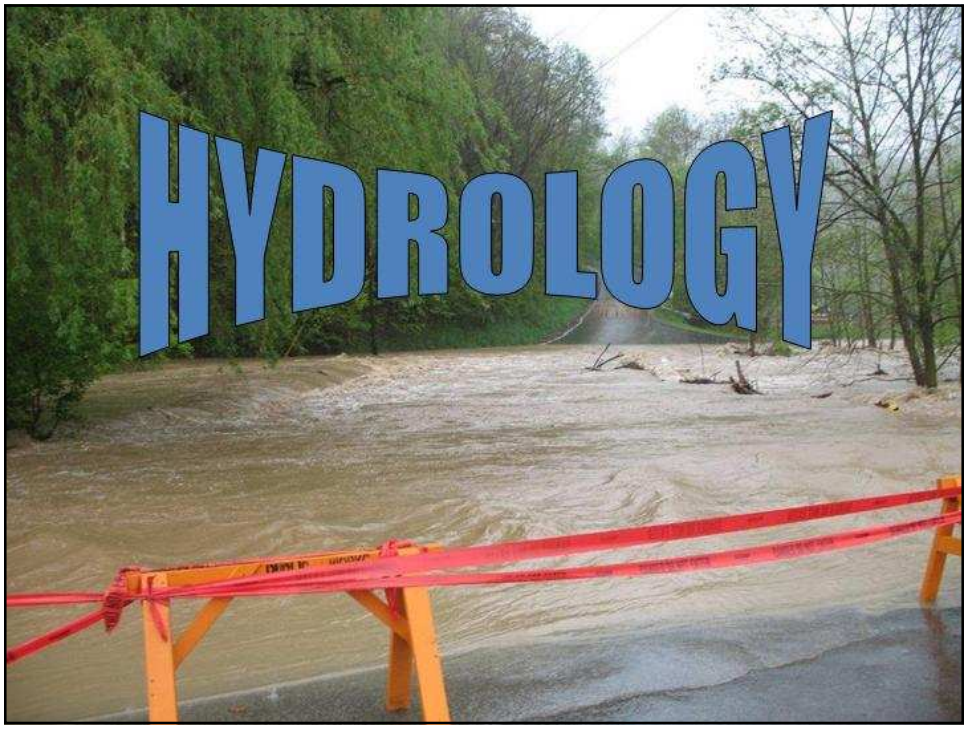
Munsell Soil Color Charts

Typical Colors of Mineral Hydric Soils

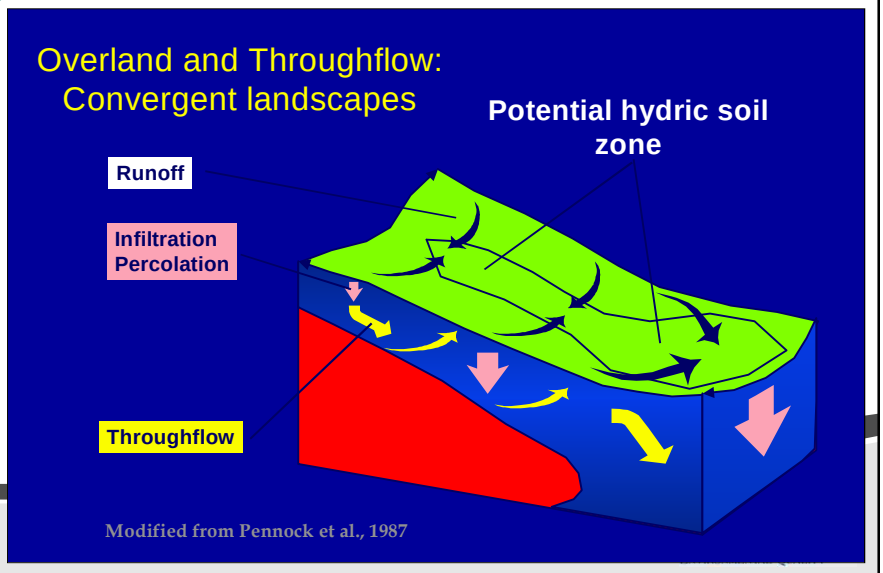
1987 ACOE Manual definition

- Matrix chroma of 2 or less in mottled soils.
- Matrix chroma of 1 or less in unmottled soils.
- Measured immediately below the A-horizon or at 10 inches, whichever is shallower.

On the left a hydric soil with characteristic "gray" colors (Chroma <2), on the right a nearby upland soil with characteristic "brown" colors.



Wetlands are an expression of water on the landscape



Wetland Hydrology

Need: Periodically inundated or have saturated soil conditions some time during the growing season

An area has wetland hydrology if it is inundated or saturated to the surface continuously for at least 5% of the growing season in most years (50% probability of recurrence). These areas are wetlands if they also meet hydrophytic vegetation and hydric soil requirements.

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Wetland Hydrology

Wetland Hydrology … How?

- Stream gage information
- Field observations
  - Visual observation of inundation
  - Visual observation of saturation
  - Water marks
  - Drift lines
  - Sediment deposition
  - Drainage patterns

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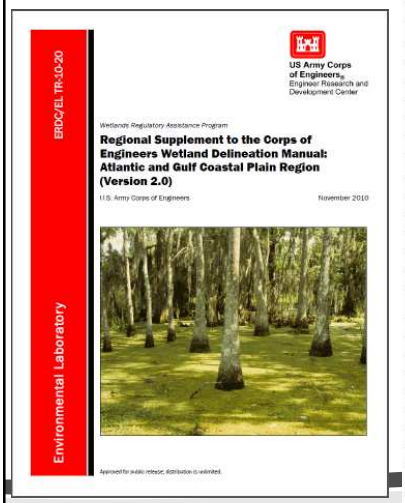

Table 10. Wetland hydrology indicators for the Atlantic and Gulf Coastal Plain Region.

Indicator	Category	
	Primary	Secondary
Group A – Observation of Surface Water or Saturated Soils		
A1 – Surface water	X	
A2 – High water table	X	
A3 – Saturation	X	
Group B – Evidence of Recent Inundation		
B1 – Water marks	X	
B2 – Sediment deposits	X	
B3 – Drift deposits	X	
B4 – Algal mat or crust	X	
B5 – Iron deposits	X	
B7 – Inundation visible on aerial imagery	X	
B9 – Water-stained leaves	X	
B13 – Aquatic fauna	X	
B15 – Marl deposits	X (LRR U)	
B6 – Surface soil cracks		X
B8 – Sparsely vegetated concave surface		X
B10 – Drainage patterns		X
B16 – Moss trim lines		X
Group C – Evidence of Current or Recent Soil Saturation		
C1 – Hydrogen sulfide odor	X	
C3 – Oxidized rhizospheres along living roots	X	
C4 – Presence of reduced iron	X	
C6 – Recent iron reduction in tilled soils	X	
C7 – Thin muck surface	X	
C2 – Dry-season water table		X
C8 – Crayfish burrows		X
C9 – Saturation visible on aerial imagery		X
Group D – Evidence from Other Site Conditions or Data		
D2 – Geomorphic position		X
D3 – Shallow aquitard		X
D5 – FAC-neutral test		X
D8 – Sphagnum moss		X (LRR T, U)

Visual Observation of Saturation

Standing water in pit within 12”, or entering the hole from <12”

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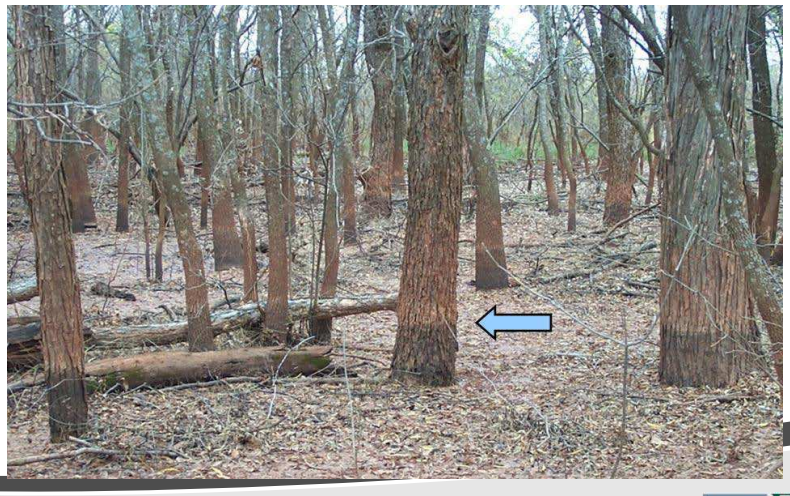
Water Marks



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Drift Lines

Sediment Deposition

Drainage Patterns

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Other signs of hydrology

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Other Factors that Influence Hydrology

- Location in the landscape
  - depressions, drainage ways, shorelines, and flats are generally the wettest parts of the landscape
- Proximity of bedrock or impermeable soil layers
  - shallow bedrock or slowly permeable soil horizons may perch water near the soil surface
- Soil texture and drainage
  - fine-textured soils drain more slowly and retain water longer than coarser soils
- Plant cover
  - type of cover affects the rate of water loss through transpiration

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QUESTIONS

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