Wetland Classification as per Cowardin et al. 1979

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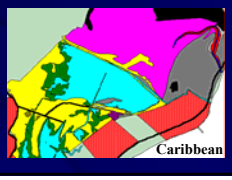
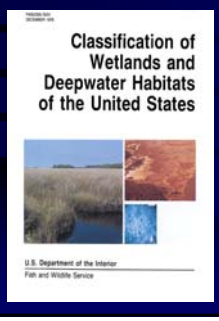
Why Classify Wetlands?

1) Delineate their edges
   - Boundary of development
2) Estimate their area
   - Management, Excavation, Mitigation
3) To Create maps



Classification of Wetland and Deepwater Habitats of the United States

http://www.npwrc.usgs.gov/resource/1998/classwet/classwet.htm



FWS/OBS-79/31
December 1979

Lewis Cowardin (USFWS)
Virginia Carter (USGS)
Francis Golet (URI)
Edward LaRoe (NOAA)

Biological Classification System
- Wetlands
- Deepwater Habitats

Jurisdictional ➡ *USACE 1987 Manual*

Boundary Between Wetland and Deepwater Systems

Non-tidal:

>2 m (6.6 ft) in Depth

(low water level—fall)

Emergent Plants!

Permanently flooded rivers and lakes

Tidal:

Extreme low water level (spring tides)

Permanently flooded brackish marshes or marine areas

The Classification System

Hierarchical Structure

Systems (5), Subsystems (8), Classes (11), Subclasses (28), Dominance Type, Modifiers (3)

Marine

Estuarine

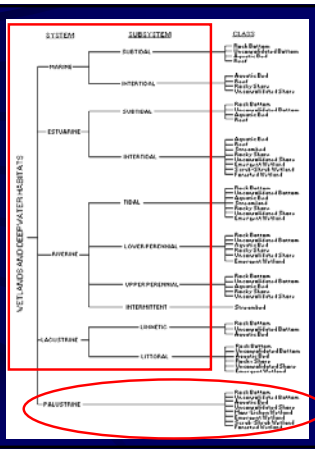
Riverine

Lacustrine

Palustrine

- *Hydrologic*
- *Geomorphic*
- *Chemical*
- *Biological*

Hierarchical Structure



Marine System

Open ocean overlying the continental shelf and its coastline, where salinities are >30 ppt except at the mouths of estuaries.

1) Extreme high water limit of spring tides

OR,

2) Wetland emergent vegetation

OR,

3) Estuarine system
If #2 not present

4) Continental shelf
(ocean extent)

"High-energy Systems"

Subsystems:

Subtidal: Substrate is continuously submerged (deepwater)

Intertidal: Substrate is exposed and flooded by tides (wetland)

Marine Subsystems

Intertidal

Subtidal

Splash Zone

Estuarine System

Tidal deepwater systems and wetlands that are usually semi-enclosed by land but have open, partly-obstructed, or sporadic access to the open ocean.

1) Salinity >0.5 ppt

2) Imaginary line closes bay or river mouth

OR,

3) Wetland Vegetation
If, goes beyond #2

4) Offshore Areas
Continuously diluted w/ freshwater

"Low-energy Systems"

Subsystems:

Subtidal: Substrate is continuously submerged (deepwater)

Intertidal: Substrate is exposed and flooded by tides (wetland)

Estuarine System

Riverine System

All deepwater systems and wetlands contained within a channel EXCEPT:

(1) Dominated by PERSISTENT emergent plants, trees, shrubs, mosses, or lichens

OR,

(2) Salinity >0.5 ppt.

Ends at Upland Boundary, Spring, or another System

Subsystems:

Lower Perennial:	Low Gradient/Flow, Substrate is mud or sand.
Upper Perennial:	High Gradient/Flow, Substrate is rock, gravel.
Intermittent:	Water flows only during part of the year.
Tidal:	Flow fluctuates with tide but freshwater.

Riverine Subsystems

Lower Perennial

Upper Perennial

Intermittent

Lacustrine System

<0.5 ppt

Freshwater deepwater habitats and wetlands with the following characteristics:

>8 ha in Surface Area:
1) Positioned in topographic depression or dammed river channel

and,

2) Lacks >30% coverage of persistent emergent vegetation (non-persistent OK)

OR,

<8 ha in Surface Area:
1) #1 and 2 above (and one below)
2) Wave-formed shoreline
3) Deepest part of basin > 2 m depth

Subsystems:

Limnetic: All deepwater zones

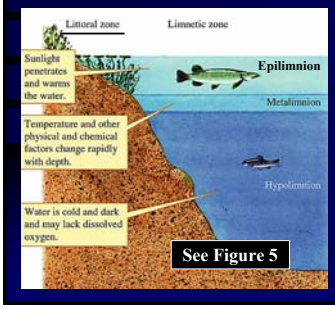
Littoral: All wetlands zones

"Ponds, Lakes & Reservoirs"

(extends from upland or Palustrine System to 2 m depth)

Lacustrine Subsystems

Size, Depth, Non-persistent



See Figure 5

Palustrine System

All freshwater wetlands dominated (>30% coverage) by trees, shrubs, persistent emergents, or emergent mosses and lichens

- Non-tidal or tidal

Also, all wetlands lacking above vegetation (or dominated by non-persistent emergents) having all these 4 characteristics:

1) <8 ha. in size
2) No active wave formed shoreline
3) Depth <2 m
4) Salinity <0.5ppt

No subsystem!!

Palustrine System

No subsystems!!

Palustrine Illustration

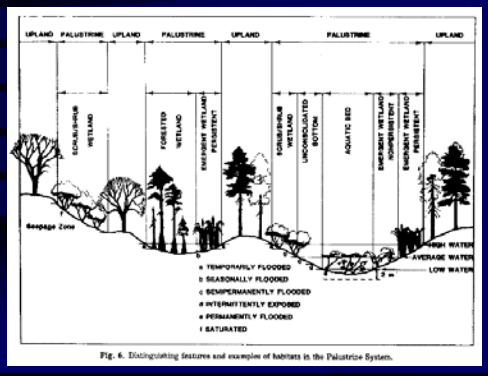


Fig. 6. Distinguishing features and examples of habitats in the Palustrine System.

Classes

For Palustrine System

Describe the *general appearance* of the wetland in terms of either the dominant vegetation or substrate composition

If Horizontal Vegetative Cover (HVC) is >30%:

Class is distinguished based on the uppermost layer of vegetation (i.e., tallest) with HVC >30%

(e.g., 50% HVC of Trees over 60% HVC of Shrubs would be a Forested not Scrub-shrub Wetland)

If Horizontal Vegetative Cover is <30%:

Class is distinguished based on the texture and composition of the substrate

Classes:

How many classes?

HVC >30% (tallest strata)

Subclasses and Dominance Type

Subclass:

Describe *finer* differences in vegetative life forms (often related to life history) or substrate characteristics (i.e., size [gravel vs. sand] or composition [sand vs. organic])

Dominance Type:

The taxonomic category subordinate to subclass.

Use 50/20 Rule

- Dominant Plant Species *(if class is vegetation)*
- Dominant Animal Species *(if class is substrate)*

Subclasses and Dominance Type

Sampling Methods FWF 410

Types of Palustrine Classes, Subclasses, and Dominance Types

1) Rock Bottom:

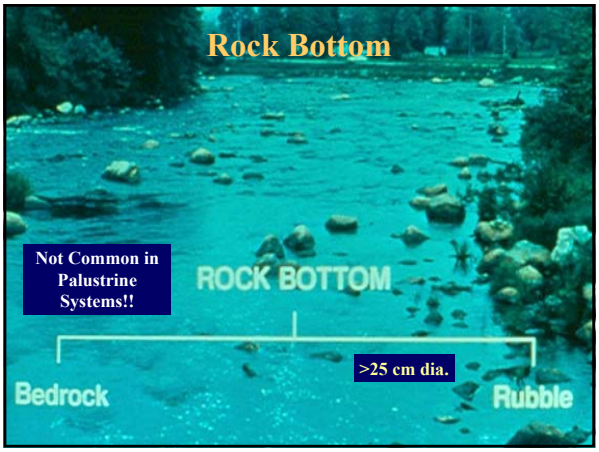
- >75% HC of stones, bolders, or bedrock
- <30% HVC

Usually high-energy wetlands with well-aerated water.

A) Bedrock: >75% bedrock substrate

B) Rubble: <75% bedrock; >75% bedrock+bolders+stones

Dominance Types: *Ephemeralla*, *Procambarus*, *Spongilla*, and *Lymnaea* (pond snail)



Types of Palustrine Classes, Subclasses, and Dominance Types

2) Unconsolidated Bottom:

- >25% HC of soil particles smaller than stones
- <30% HVC

Usually low-energy wetlands that are flooded more permanently.

A) Cobble-gravel: >50% c/g

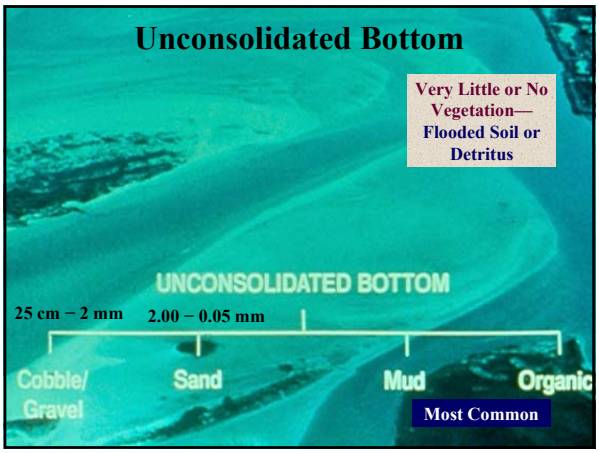
B) Sand: >50% sand

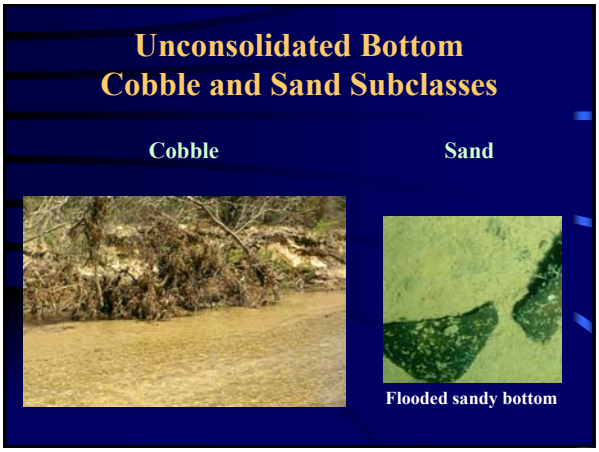
*C) Mud: >50% silt & clay

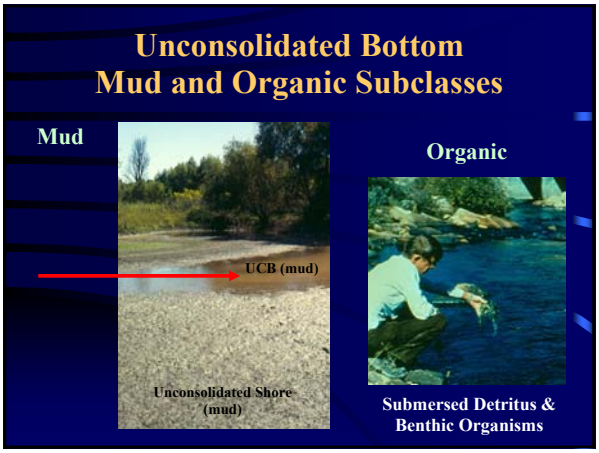
*D) Organic: >50% dead or live organic matter

Dominance Types: *Gammarus* (scuds), *Physa* (snail), *Tubifex*, and *Canthocamptus* (copepod)

Depends on $\vec{V}$


Unconsolidated Bottom
Very Little or No Vegetation—Flooded Soil or Detritus
UNCONSOLIDATED BOTTOM
25 cm – 2 mm
2.00 – 0.05 mm
Cobble/ Gravel
Sand
Mud
Organic
Most Common


Unconsolidated Bottom
Cobble and Sand Subclasses
Cobble
Sand
Flooded sandy bottom


Unconsolidated Bottom
Mud and Organic Subclasses
Mud
UCB (mud)
Unconsolidated Shore (mud)
Organic
Submersed Detritus & Benthic Organisms

Types of Palustrine Classes, Subclasses, and Dominance Types

3) Aquatic Bed:

>30% HVC of plants that grow on or below the surface of the water; <30% HVC "taller" plants.

Usually low-energy habitats that are flooded permanently.

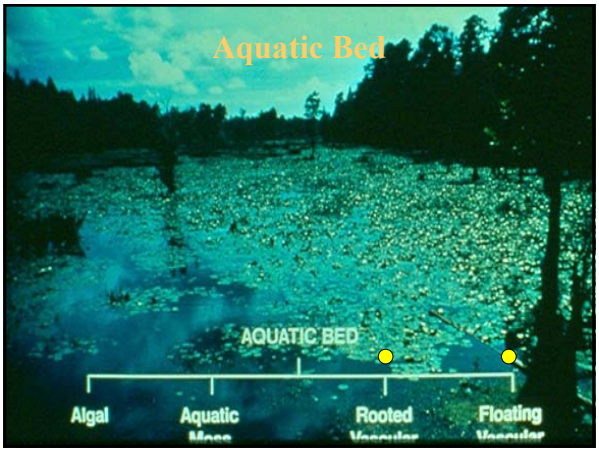
A) Algal: >50% algae

B) Aquatic moss: >50% moss

***C) Rooted Vascular: >50% RV**

***D) Floating Vascular: >50% FV**

Dominance Types: ***Chara, Fontinalis, Vallisneria, Ruppia, Nuphar, Lemna,* and *Eichhornia***



Algal and Aquatic Moss Subclasses

Algae

Spirogyra, Cladophora

Aquatic Moss

Common Water Moss (streams)

Rooted and Floating Vascular Subclasses

Rooted

Floating Vascular

Types of Palustrine Classes, Subclasses, and Dominance Types

4) Unconsolidated Shore:

Shoreline areas with <30% HVC[1] and <75% HC of stone, bolders, or bedrock

Shorelines lacking hydrophytes.

A) Cobble-gravel: >50% c/g *C) Mud: >50% silt & clay

B) Sand: >50% sand D) Organic: >50% dead or live organic matter

[1]E) Vegetated: >50% non-hydrophytic, pioneer plants that die if flooded.

Dominance Types: Snails, worms, clams, *Xanthium* (cocklebur)

Unconsolidated Shore

Cobble and Mud Subclasses

Cobble

Mud

"Mudflats"

Organic and Vegetated Subclasses

Organic

Vegetated

Types of Palustrine Classes, Subclasses, and Dominance Types

5) Moss-lichen Wetland:

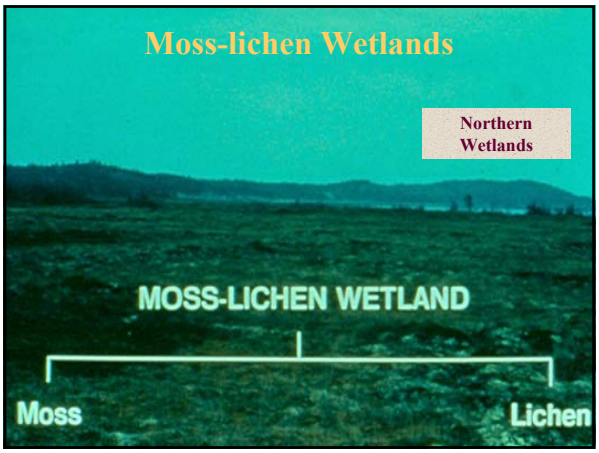
>30% HVC of moss and lichens;
<30% HVC "taller" plants.

Wetlands (bogs and lichen swamps) of northern latitude.

A) Moss: >50% moss B) Lichen: >50% lichen

Dominance Types: Peat moss (*Sphagnum*), liverwort (*Chiloscyphus fragilis*), reindeer moss (*Cladina rangiferina*)

Moss-lichen Wetlands



Moss and Lichen Subclasses

Moss

Lichen

Types of Palustrine Classes, Subclasses, and Dominance Types

6) Emergent Wetland:

>30% HVC of erect, rooted hydrophytes, excluding mosses and lichens; <30% HVC "taller" plants.

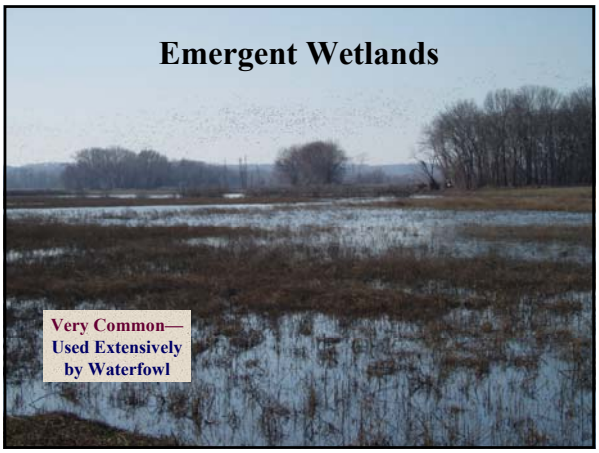
Low energy wetlands (marshes, playas, prairie potholes)

A) Persistent: >50% HC of plants that remain standing at least until the beginning of the next growing season.

B) Nonpersistent: >50% HC of plants which fall to the surface of the substrate or water at the end of the growing season.

Dominance Types: Cattail (*Typha*), bulrush (*Scirpus*), wild millet (*Echinochloa*), wild rice (*Zizania*), *Panicums*

Emergent Wetlands



Very Common—
Used Extensively
by Waterfowl

Persistent and Non-Persistent Subclasses

Persistent

Typha spp.

Non-persistent

Echinochloa

Scirpus spp.

No Standing Vegetation after Winter

Types of Palustrine Classes, Subclasses, and Dominance Types

7) Scrub-shrub Wetland:

>30% HVC of shrubs (<6m [20 ft.] in height);
<30% HVC of trees

Low energy wooded wetlands (shrub swamps, pocosin)

*A) Broad-leaved Deciduous: >50% BLD shrubs

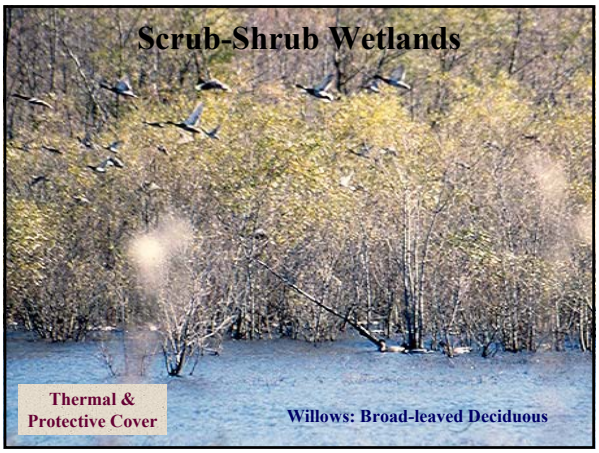
*C) Needle-leaved Deciduous: >50% NLD shrubs

B) Broad-leaved Evergreen: >50% BLE shrubs

D) Needle-leaved Evergreen: >50% NLE shrubs

E) Dead: >50% dead shrubs

Dominance Types: *Salix*, mangrove, tamarack, black spruce


Scrub-Shrub Wetlands
Thermal & Protective Cover
Willows: Broad-leaved Deciduous


Broad-leaved Deciduous and Evergreen
BL Deciduous
BL Evergreen
Buttonbush
Mangroves


Needle-leaved Deciduous and Evergreen
NL Deciduous
NL Evergreen
Balsam Fir
White Cedar
Tamarack Bogs
Black Spruce Bog

Types of Palustrine Classes, Subclasses, and Dominance Types

8) Forested Wetland:

Note: Scrub-shrub wetlands can become forested wetlands

>30% HVC of trees (>6m [20 ft.] in height)

Low energy wooded wetlands (swamps, bottoms, hammocks)

*A) Broad-leaved Deciduous: >50% BLD trees

*C) Needle-leaved Deciduous: >50% NLD trees

B) Broad-leaved Evergreen: >50% BLE trees

D) Needle-leaved Evergreen: >50% NLE trees

E) Dead: >50% dead trees

Dominance Types: Red maple, green ash, overcup oak, mangroves, baldcypress, tamaracks, white cedar

Broad-leaved Deciduous and Evergreen

BL Deciduous

BL Evergreen

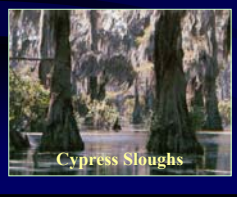
Hardwood Bottomlands

Mangrove Forest

Needle-leaved Deciduous and Evergreen

NL Deciduous

NL Evergreen



Dead Subclass

Scrub-Shrub

Forested

Water Regime Modifiers

(8 Nontidal)

Criteria not as quantitative as USACE zones.

1) **Permanently Flooded**
   Water covers substrate in all years.
2) **Intermittently Exposed**
   Water covers substrate in all years, except during drought.
3) **Semi-permanently Flooded**
   Water covers substrate throughout the growing season in most years.
4) **Seasonally Flooded**
   Water covers substrate for extended periods, especially early in the growing season, but it is absent by the end of the growing season.

Water Regime Modifiers

(8 Nontidal)

Indirect Indicators

drift & inundation lines, vegetation, etc.

5) Saturated

Substrate is saturated, but surface water is seldom present.

6) Temporarily Flooded

Surface water is present for brief periods during the growing season, but water table is far below the surface for most of the year.

7) Intermittently Flooded

Substrate is usually exposed, but surface water can be present for variable durations but w/o predictable seasonal periodicity.

8) Artificially Flooded

Hydroperiod is controlled by pumps, water control structures, and/or levees.

Water Chemistry Modifiers

Salinity:

	PPT
1) Hyperhaline	>40
2) Euhaline	30.0-40
3) Mixohaline	0.5-30
*4) Fresh	<0.5

pH:

	pH
1) Acid	<5.5
2) Circumneutral	5.5-7.4
3) Alkaline	>7.4

Soil Modifiers

Soil Core Depth = 40 cm [16 in] COE

1) Mineral:

Criteria same as before.

A) Saturated Infrequently:

- <20% dry-weight organic carbon

B) Saturated Frequently/Long Durations:

- <18% dry-weight organic carbon if >60% of mineral portion is clay
- <12% dry-weight organic carbon if no clay
- 12-20% dry-weight organic carbon if 0-59% clay

2) Organic:

<0.002 mm dia.

All substrates that have more organic carbon than above percentages.

Special Modifiers

1) Excavated	Excavated basin or channel.
2) Impounded	Structure (dam) prevents outflow.
3) Diked	Structure (levee) prevents inflow.
4) Partly Drained	Water level has been artificially lowered, but hydrophytes and/or hydric soils present.
5) Farmed	Soil is mechanically disturbed, but hydrophytes will reestablish if farming ceases.
6) Artificial	Non-natural substrate. e.g., dredge spoil, automobiles, concrete

Alphanumeric Code

(Handout)

- 1.5 m deep (Sept.)
- <0.5 ppt; pH = 6.0
- 50% Organic C; 10% Carbon C [trees]

More Practice

- 0.1-1.9 m deep
- <0.5 ppt; pH = 8.5
- Shortly after spring rains
- 0.1 mm; 30% organic carbon
- Annuals, perennials, mangrove