Wetland Classification as per Cowardin et al. 1979

PSS01-e0tg

Ω

PEM01-f0tg

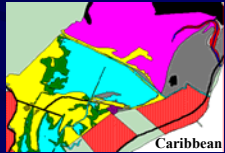PAB03-h0tg

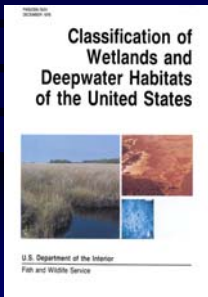**Matthew J. Gray**
University of Tennessee

Why Classify Wetlands?

1) Delineate their edges

2) Estimate their area
- Boundary of development

3) To create maps
- Management, Excavation, Mitigation

Caribbean

Classification of Wetland and Deepwater Habitats of the United States

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

Classification of Wetlands and Deepwater Habitats of the United States

U.S. Department of the Interior
Fish and Wildlife Service

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)

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)

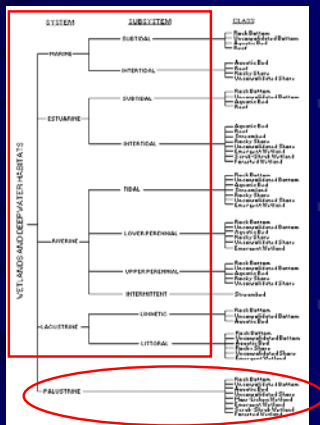**Marine**   **Estuarine**   **Riverine**

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.

OR,

1) **Extreme high water limit of spring tides**

OR,

2) **Wetland emergent vegetation**

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.

OR,

1) **Salinity >0.5 ppt**

2) **Imaginary line closes bay or river mouth**

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

El Fangar Bay

Ebro River

Amposta

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

(if non-persistent)

Lacustrine System

Freshwater deepwater habitats and wetlands with the following characteristics:

>8 ha in Surface Area:
and,

OR,

<8 ha in Surface Area:

1) Positioned in topographic depression or dammed river channel

2) There is <30% coverage of <u>persistent</u> emergent vegetation (**non-persistent OK**)

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

"Ponds, Lakes & Reservoirs"

Lacustrine Subsystems

Size, Depth, Non-persistent

>2 m

Littoral zone   Limnetic zone

Sunlight penetrates and warms the water.

Epilimnion

Metalimnion

Temperature and other physical and chemical factors change rapidly with depth.

Hypolimnion

Water is cold and dark and may lack dissolved oxygen.

See Figure 5

Palustrine System

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

•Non-tidal or tidal

Also, all wetlands lacking above vegetation (or dominated by <u>non-persistent</u> emergents) having <u>all</u> 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
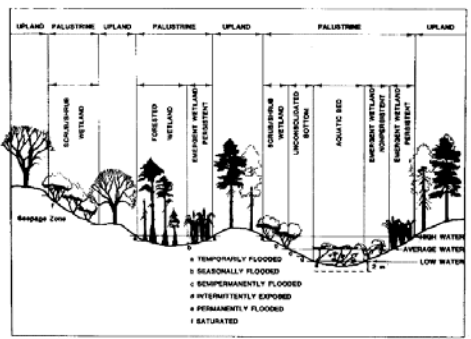
No subsystems!!

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 <u>uppermost</u> layer of vegetation (i.e., tallest) with HVC >30%

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

If Horizontal Vegetative Cover is **<30%:**

Class is distinguished based on the texture and composition of the <u>substrate</u>

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) <u>Bedrock</u>: >75% bedrock substrate
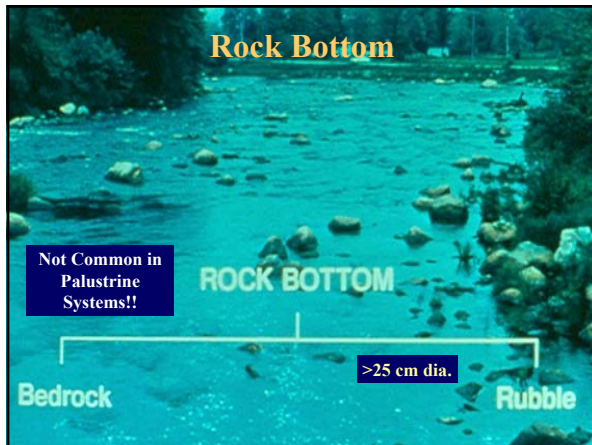
B) <u>Rubble</u>: <75% bedrock; >75% bedrock+bolders+stones

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

Rock Bottom

Not Common in Palustrine Systems!!

ROCK BOTTOM

>25 cm dia.

Bedrock   Rubble

Types of Palustrine Classes, Subclasses, and Dominance Types

2) Unconsolidated Bottom:

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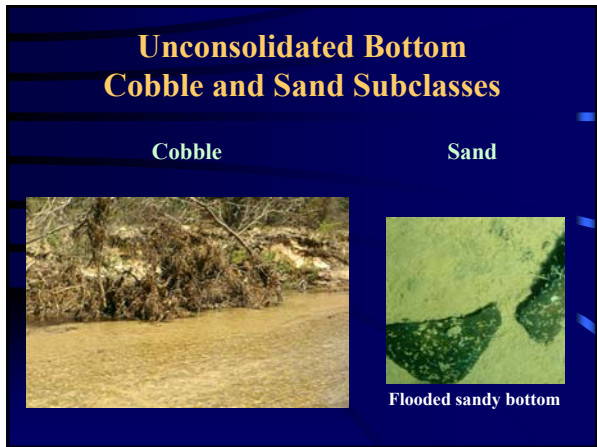- • <30% HVC

Usually low-energy wetlands that are flooded more permanently.

A) <u>Cobble-gravel</u>: >50% c/g   *C) <u>Mud</u>: >50% silt & clay
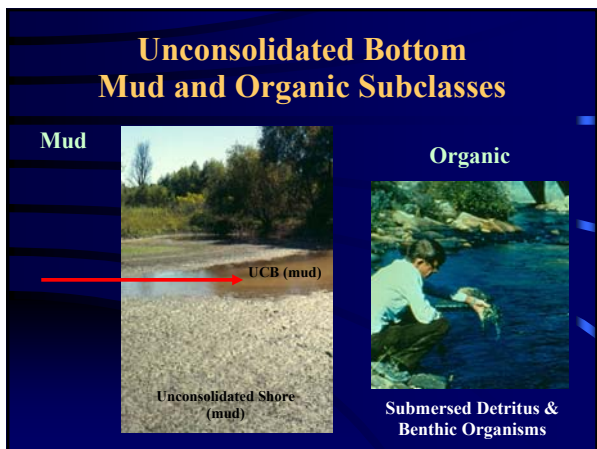
B) <u>Sand</u>: >50% sand   *D) <u>Organic</u>: >50% <u>dead</u> or live organic matter

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

Depends on $\bar{V}^*$

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   Organic

UCB (mud)

Unconsolidated Shore (mud)

Submersed Detritus & Benthic Organisms

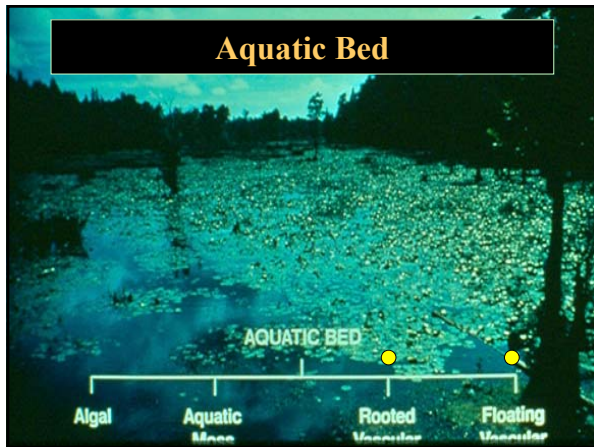## Types of Palustrine Classes, Subclasses, and Dominance Types
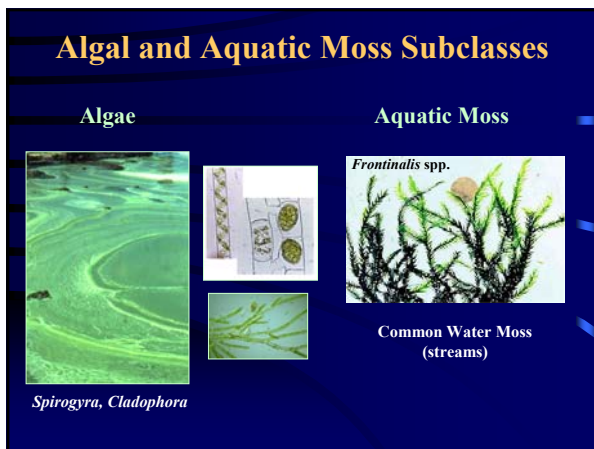
3) Aquatic Bed:

> >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) <u>Algal</u>: >50% algae   *C) <u>Rooted Vascular</u>: >50% RV

B) <u>Aquatic moss</u>: >50% moss   *D) <u>Floating Vascular</u>: >50% FV

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

Aquatic Bed

AQUATIC BED

Algal   Aquatic Moss   Rooted Vascular   Floating Vascular

Algal and Aquatic Moss Subclasses

Algae

Aquatic Moss

Frontinalis spp.

Common Water Moss (streams)

Spirogyra, Cladophora

Rooted and Floating Vascular Subclasses

Rooted

Parrotfeather

Pondweeds

Floating Vascular

Duckweed

Water Hyacinth
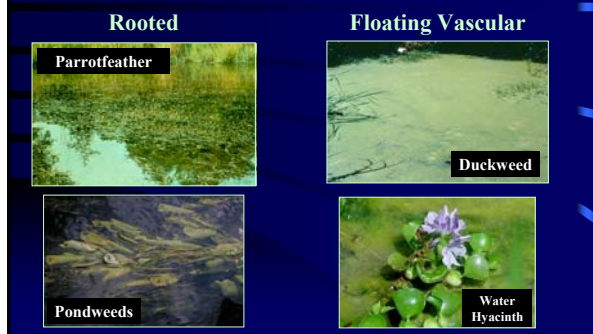
Types of Palustrine Classes, Subclasses, and Dominance Types

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

Not Common in Palustrine Systems!!

Sand Subclass

UNCONSOLIDATED SHORE

Cobble/Gravel   Sand   Mud   Organic   Vegetated

Cobble and Mud Subclasses

Cobble

Mud

"Mudflats"

Organic and Vegetated Subclasses

Organic

Vegetated

Exposed Detritus

FACU and UPL Plants

Cocklebur

Oysters

Types of Palustrine Classes, Subclasses, and Dominance Types

5) Moss-lichen Wetland:

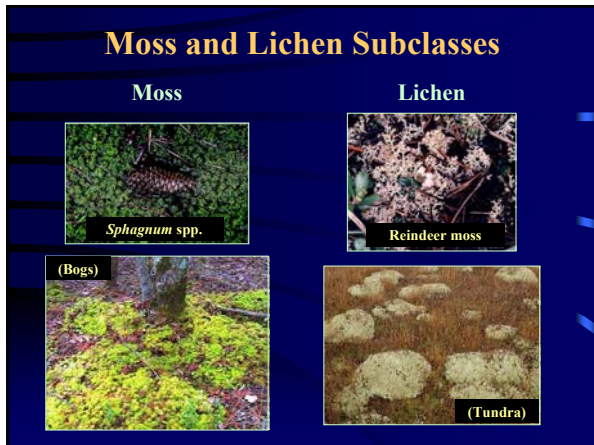>30% HVC of moss and lichens;
<30% HVC "taller" plants.

*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

Northern Wetlands

MOSS-LICHEN WETLAND

Moss   Lichen

Moss and Lichen Subclasses

Moss   Lichen

Sphagnum spp.   Reindeer moss

(Bogs)

(Tundra)

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.

Scirpus spp.

Non-persistent

Echinochloa

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

Buttonbush

BL Evergreen

Mangroves

Needle-leaved Deciduous and Evergreen

NL Deciduous

NL Evergreen

Balsam Fir

White Cedar

Tamarack Bogs

Black Spruce Bog
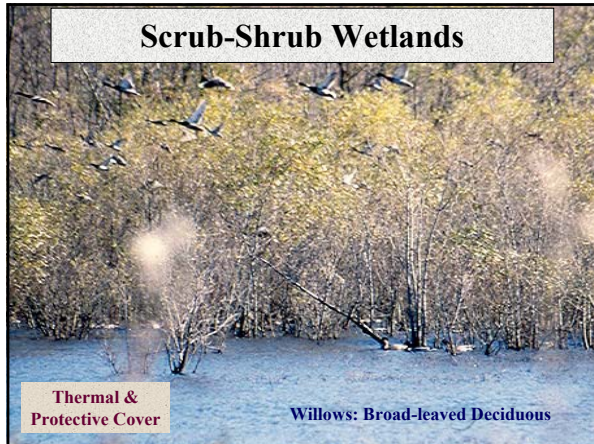
Types of Palustrine Classes, Subclasses, and Dominance Types

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

Forested Wetlands

Broad-leaved Deciduous and Evergreen

BL Deciduous

BL Evergreen

Pneumataphores

Hardwood Bottomlands

Mangrove Forest
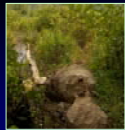
Needle-leaved Deciduous and Evergreen

NL Deciduous

NL Evergreen

Cedar Swamps

Cypress Sloughs

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)

| | |

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)

PSS01-sf04co

PF01-t04cm

Ω

PEM01-sp04co

PAB03-ie04co

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

More Practice

PUB02-p04alo

PSS02-ie04alo

PEM01-sf04alo

PEM02-t04alo

- 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