Wetland Classification: A First Step

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Why classify?

Photos courtesy of USDA NRCS
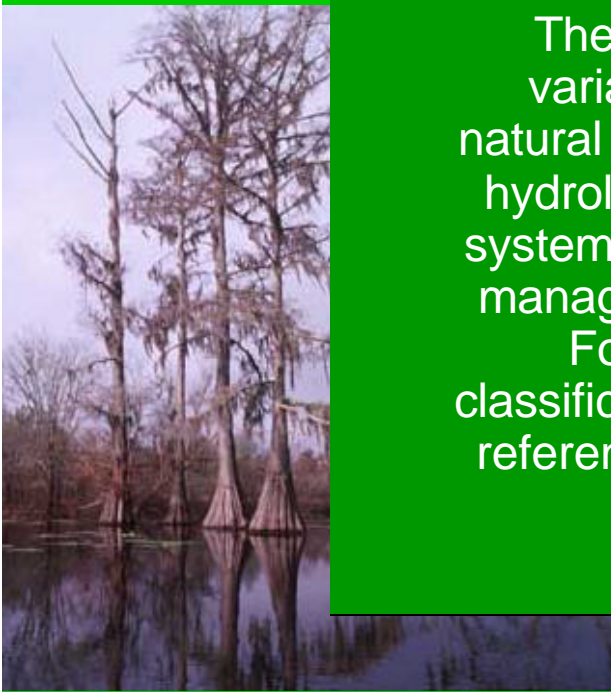
Why classify?

The overall goal of classification is to reduce variability within classes due to differences in natural condition related to factors such as geology, hydrology, and climate. The type of classification system chosen depends on the particular scientific, management, or regulatory application of interest. For the purposes of criteria development, classification is important in refining expectations for reference condition, or the state of wetlands in the absence of anthropogenic impacts.

Photos courtesy of USDA NRCS

R e f e r e n c e   C o n c e p t

site - specific

vs.

vs.
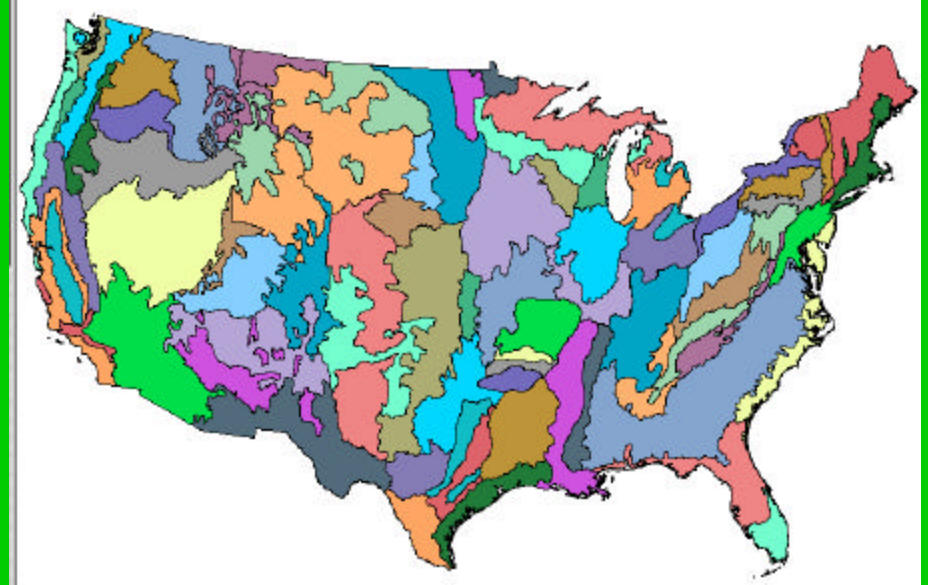
regional approach

HGM approach: "(r)eference wetlands are actual wetland sites that represent the range of variability exhibited by a regional wetland subclass as a result of natural processes and anthropogenic disturbance"

Reference standard = "conditions exhibited by a group of reference wetlands that correspond to the highest level of functioning (highest, sustainable level of functioning) across the suite of functions performed by the regional subclass"

Photo courtesy of USDA NRCS

Regulatory Goals

- Biocriteria-related issues
   - assess overall condition of aquatic community
    - comparison of community-level indices describing biotic integrity for test sites against index ranges derived for reference sites
    - need to define expected condition
- Chemical (nutrient) criteria-related issues
    - need to define expected (background) condition
    - may need to stratify by sensitivity to nutrie

Approaches to Classification

- Geographically-based
  - Fixed boundaries
  - Examples
    - Omernik ecoregions
    - USFS Ecological Units (Keys et al 1985)
    - Regional systems (Florida)
- Environmentally-based
  - Hydrogeomorphic types
  - Habitat-based systems
    - Circular 39
    - Cowardin

Omernik Ecoregions

- based on overlay of component maps for land use, potential natural vegetation, land-surface form, and soils

- BPJ of congruence of spatial patterns

- widely used for streams but few examples available for wetlands
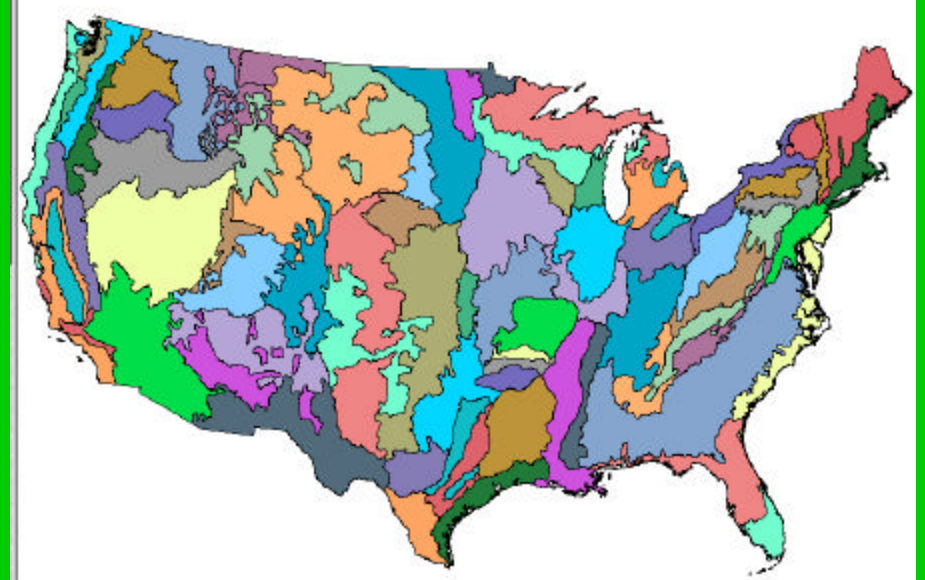
Extension of ecoregion approach to marine coast

- Marine and Estuarine Provinces
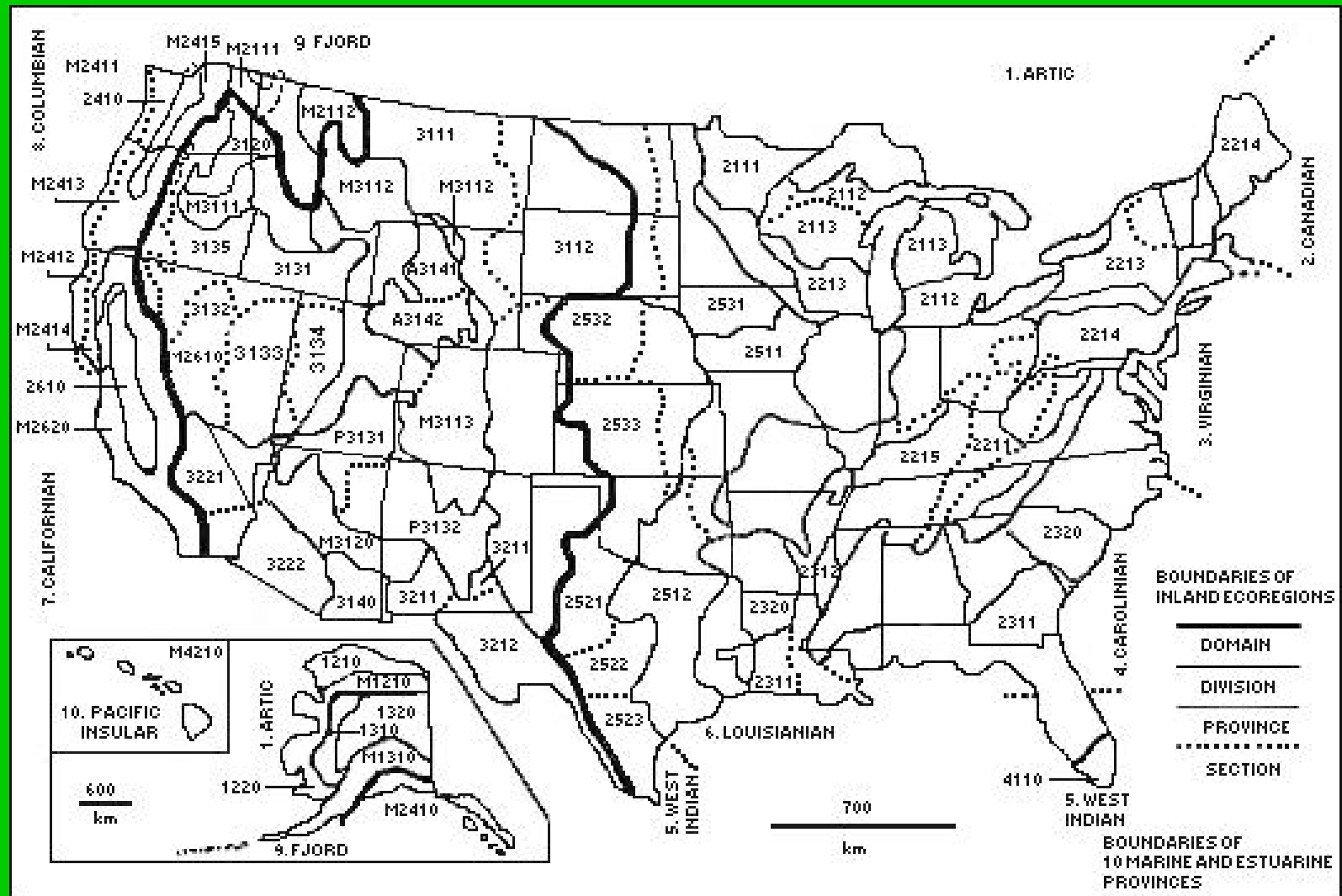
Hierarchical Approach of USFS Ecological Units

200 Humid Temperate

a. Domain

230 Subtropical

b. Division

231 Southeastern Mixed Forest

c. Province

231A Southern Appalachian Piedmont

d. Section

Environmentally-based classification approaches: Hydrogeomorphic approach

- Lacustrine fringe, tidal fringe, slope, mineral flats, organic flats, depressional, riverine
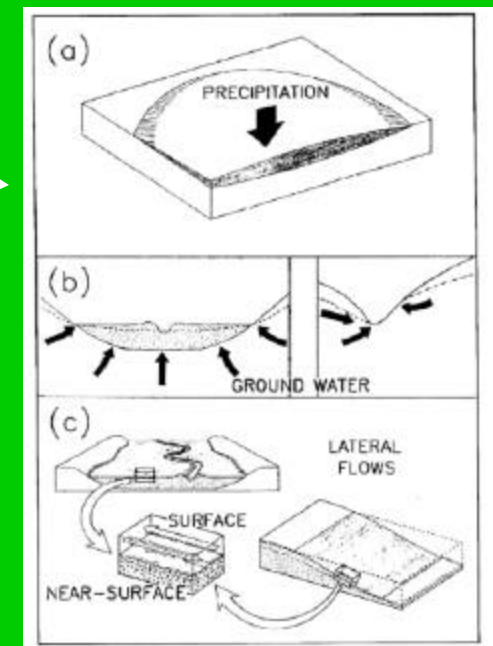- Basis for Hydrogeomorphic Classes
  - Geomorphic setting
  - Dominant water source
  - Dominant hydrodynamics
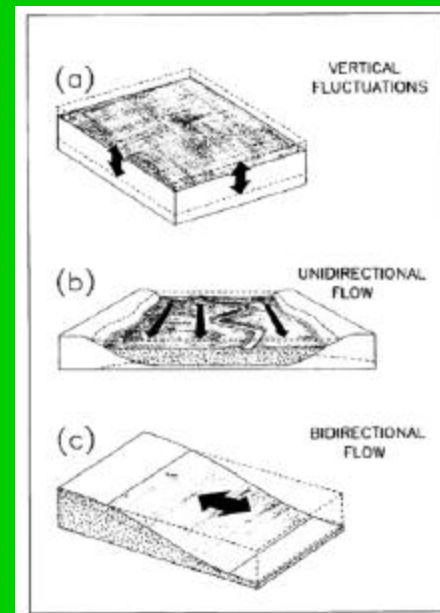
Environmentally-based classification approaches: Hydrogeomorphic approach

depressional

organic flats

Lake Michigan

S Green Bay
CW 264 = Peters Marsh
CW 271 = Long Tail Pt. #1
others = Dead Horse Bay #1-9

lacustrine fringe

riverine

● Wetland Sites
□ Lake MI Shore
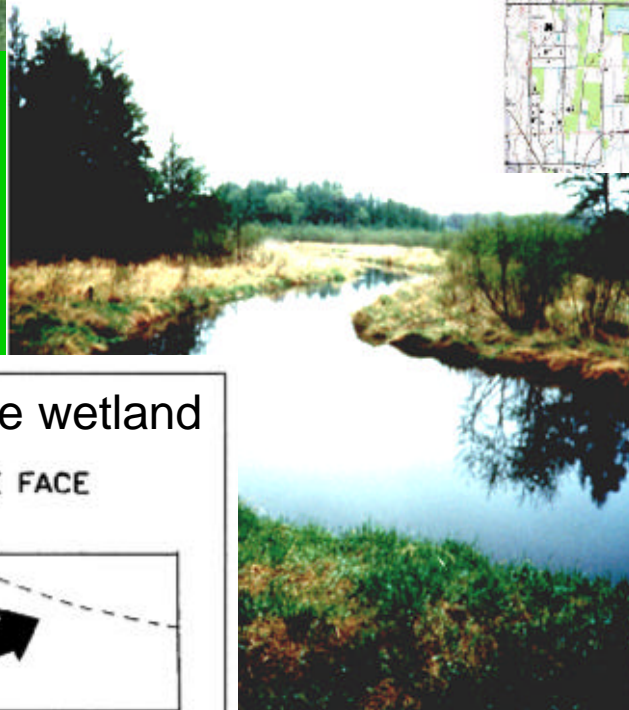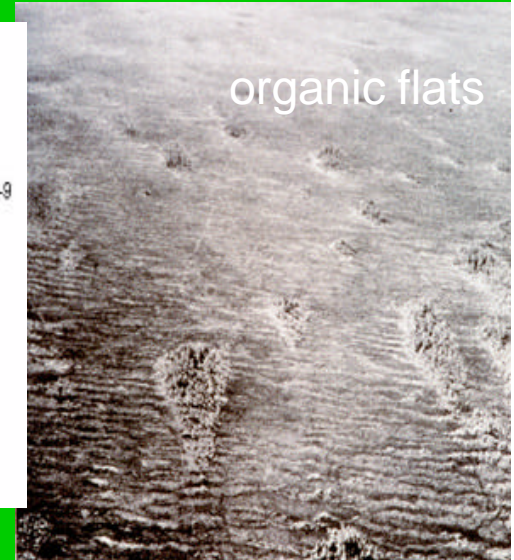
tidal fringe

slope wetland

LAND SURFACE

WATER TABLE
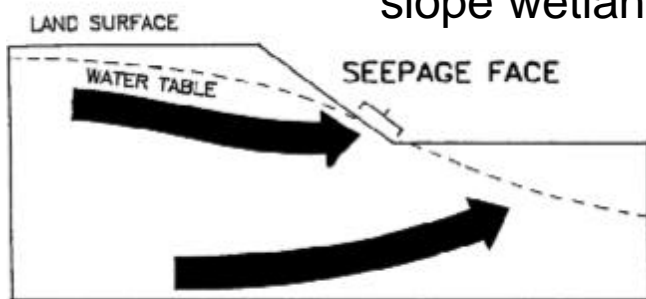
SEEPAGE FACE

a. Seepage face where groundwater flow intersects the land surface

Cowardin Classification Scheme
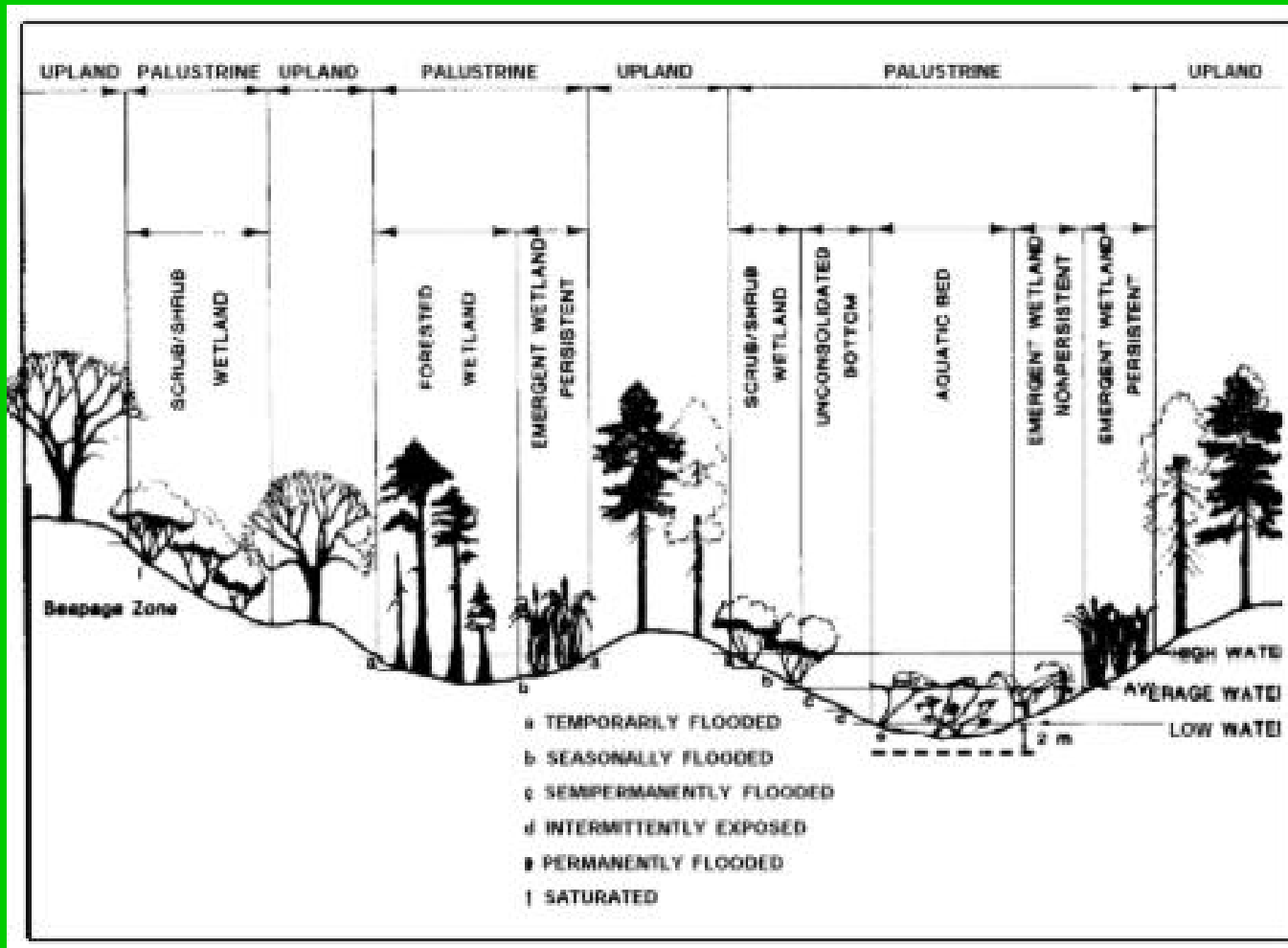
system: landscape position

↓

class: habitat/vegetative form

↓

hydrologic modifier

↓

water quality modifiers

Combined Approaches: Lacustrine and Associated Palustrine Systems

- Landscape position
  - Size=> lacustrine fringe vs. depressional
    - Water quality differences
      - Geography (climate/bedrock, Gorham et al 1983)
      - Hydrologic setting (Winter 1977, Eilers et al 1983)

Combined Approaches: Regional Lacustrine Deepwater and Lacustrine Fringe System for Great Lakes (McKee et al 1983)

- Landscape position (system)
  - Depth zone (littoral vs limnetic)
    - Vegetative or substrate class/subclass
      - Modifiers
        - Ecoregions
        - Water level regimes (Gr Lake?)
        - {Fish community structure}
        - Geomorphic structure
        - {Human modification}

Combined Approaches: Riverine Systems

- Landscape position
  - Tidal, upper perennial, lower perennial, nonperennial subclass
    - Channel gradient (Rosgen channel type?)
    - Scaling factor (watershed area, floodplain width)
      - Vegetative or substrate class/subclass

Combined Approaches: Maxwell et al 1985

- Ecological provinces => Climate (soil temperature, moisture regime)
- Ecological sections => Landforms => Predominant hydrogeomorphic types
  - Riverine
    - Valley segments
    - Stream reaches/channel units
  - Lacustrine
    - Depth zones
      - Habitat types

Sources of mapped data

- Digital ecoregion, ecological unit boundaries
- Digital NWI coverages
- Derivation of hydrogeomorphic types via terrain analysis techniques
  - digital elevation models
  - slope, curvature
  - adjacency to deepwater riverine, lacustrine, marine habitats

Empirical classification

- Option 1:
  - Choose classes => randomly sample => test data to confirm groupings

- Option 2:
  - Randomly sample full population => Derive classes empirically from Subset 1 => Test validity of classification with Subset 2
    - Vegetation associations reflect climate, hydrologic regime, water chemistry, and provide physical structure => prediction of other taxa

Combined ecological unit - hydrogeomorphic - habitat - water quality approach
Galatowitsch et al

Forest Glacial Marshes
Prairie Glacial Marshes
Wet Prairies & Sedge Meadows
Non-calcareous Littoral Wetlands
Calcareous Littoral Wetlands
Medium River Floodplain Wetlands
Small River Floodplain Wetlands
Large River Floodplain Wetlands
County Boundaries

Section
Lake Agassiz, Aspen Parklands
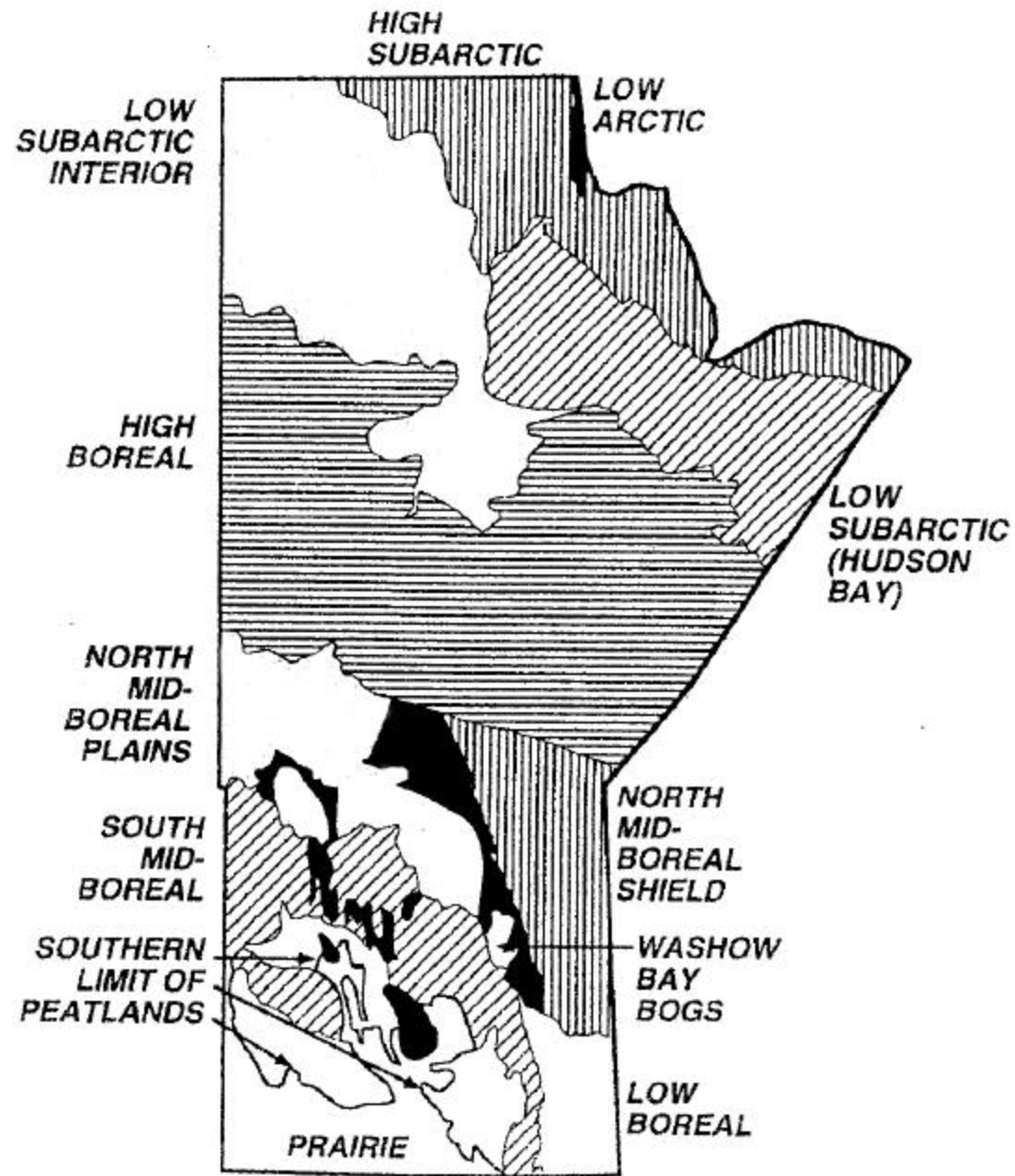Minnesota & NE Iowa Morainal
N. Minnesota & Ontario Peatlands
N. Minnesota Drift & Lake Plains
North Central Glaciated Plains
Northern Superior Uplands
Paleozoic Plateau
Red River Valley
Southern Superior Uplands
Western Superior Uplands

Subsection
AGASSIZ LOWLANDS
ANOKA SAND PLAIN
ASPEN PARKLANDS
BIG WOODS
BORDER LAKES
CHIPPEWA PLAINS
GLACIAL LAKE SUPERIOR PLAIN
HARDWOOD HILLS
Inner Coteau
LAURENTIAN HIGHLANDS
LITTLEFORK-VERMILLION UPLANDS
MILLE LACS UPLANDS
MINNESOTA RIVER PRAIRIE
NASHWAUK UPLANDS
NORTH SHORE HIGHLANDS
OAK SAVANNA
PALEOZOIC PLATEAU
PINE MORAINES & OUTWASH PLAINS
PRAIRIE COTEAU
RED RIVER PRAIRIE
ST. CROIX MORAINES-OUTWASH PLAINS
ST. LOUIS MORAINES
TAMARACK LOWLANDS
THE BLUFFLANDS

Regionalization of wetland classes

From Halsey et al. 1997

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