WETLANDS
We know what they are…
Or do we?

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Wetlands are among the most valuable but least understood of all natural resources. They are an important transition zone in our watersheds – the vital link between land and water.

A *very* brief history of wetlands loss in the United States

- In the early 1600's (around the time of European settlement) there were approximately **225 million acres** of wetlands in the area that would become the coterminous United States.
- As of the mid-1980's, about **103 million acres** remained.
- Wetland alteration went hand-in-hand with pioneer settlement, along the east coast and moving westward, particularly in draining wetlands for agriculture. Most pioneers viewed natural resources from wetlands as a never-ending supply.
- During the 1700's, wetlands were considered areas that bred diseases, hampered travel, and impeded food and fiber production. Governments, settlers and commercial interests all agreed that for these reasons, wetlands should be eliminated and the land reclaimed for "better" purposes. (Dahl and Allord 1997)

Besides agriculture and settlement, one of the major events to impact wetlands was the American Civil War (1861-65). Moving heavy equipment through swamps and other wetlands presented major difficulties for both armies. This stimulated the design, engineering, and construction of transportation and communication networks. Focus was placed on the development of routes around, through or over wetlands and waterbodies, and on the creation of accurate maps.

In 1849, Congress passed the first of the Swamp Land Acts, which granted all swamp and overflow lands in Louisiana to the State for reclamation. Other states were added in 1850 and 1860. Even though most states did not immediately begin large-scale reclamation projects, this legislation clearly showed that the Federal Government promoted and supported wetland drainage and reclamation for settlement and development. This support continued for the next century.

For Louisiana, the wetland acreage granted to the state under the authority of the Swamp Land Act totaled 9,493,456.

For the 15 states, the total was 64,895,415 acres

An example from the late 1800's…

The Black Swamp in northwestern Ohio was an elm-ash forested wetland which contained a variety of commercially valuable trees, and was a barrier to travel and settlement. This wetland was estimated to have been 120 miles long and 40 miles wide, covering an area roughly equal in size to Connecticut. By the end of the nineteenth century, nothing was left of the Black Swamp.

…another example from the mid 1900's

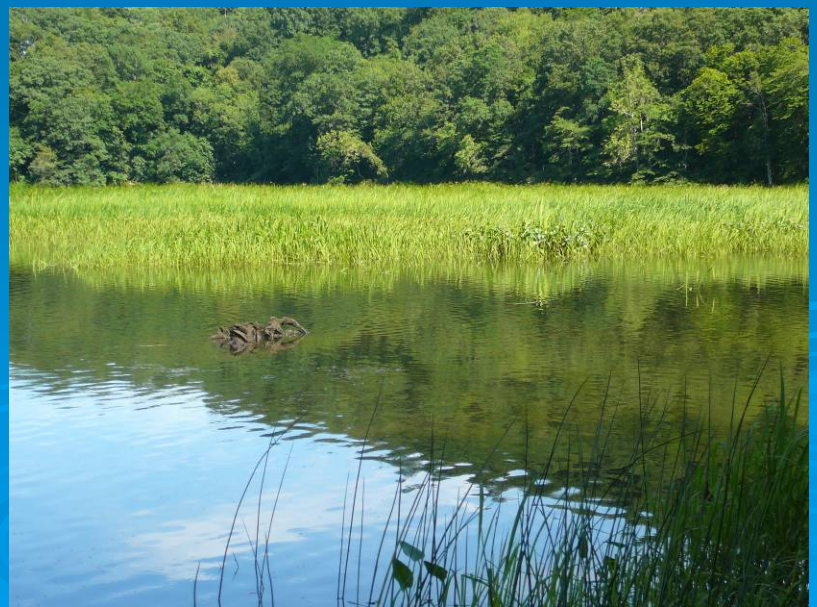
In 1949, Redwood Highway road bed was created by filling wetlands adjacent to Redwood Creek

It wasn't all bad news though…

In 1934, Congress passed the Migratory Bird Hunting Stamp Act. This was one of the first pieces of legislation to initiate the process of acquiring and restoring America's wetlands.

- Since the 1970's, both scientists and the general public have developed an increased awareness of wetlands as valuable places that provide important environmental functions.
- "Swampbuster" and other federal policies have eliminated incentives and other mechanisms that have made the destruction of wetlands technically and economically feasible.
- New laws, such as the Emergency Wetland Resources Act of 1986, also limit wetland losses.

- More recently, in 1988 George Bush endorsed a policy calling for “no net loss of wetlands,”
- In 1990 the U.S. Army Corps of Engineers was required by Congress to achieve a no net loss goal for future water resources projects, and
- Bill Clinton further endorsed the no net loss goal as well as calling for a long term gain of wetlands.



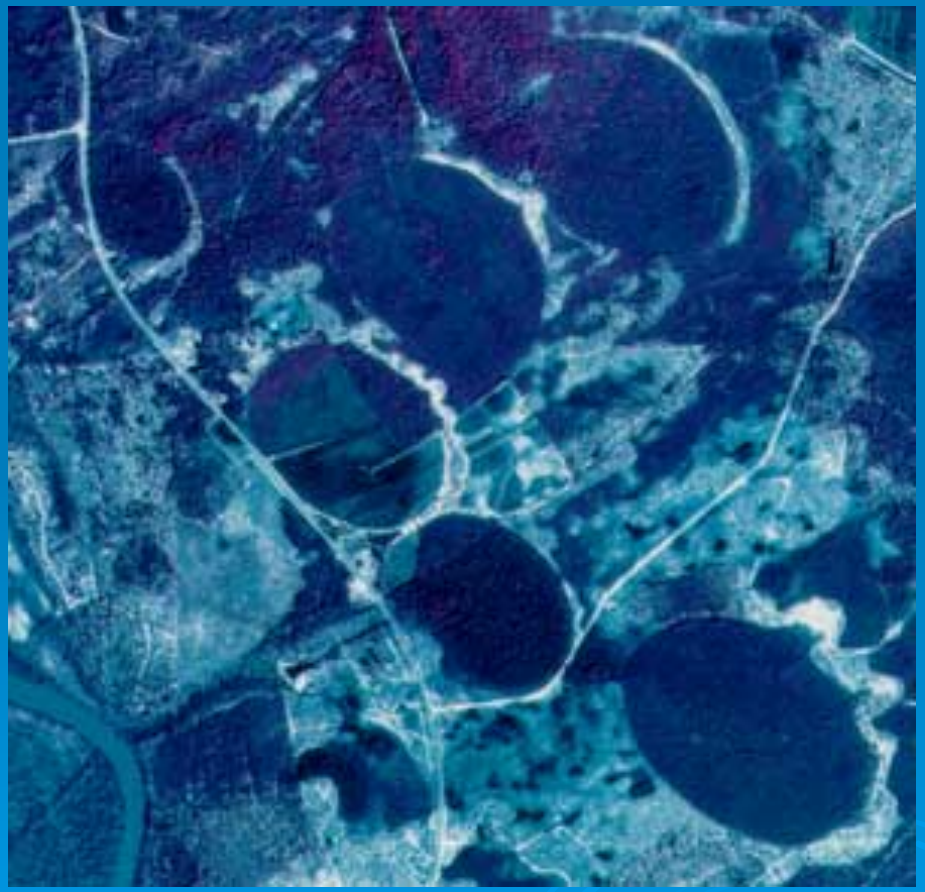
So where are we today?

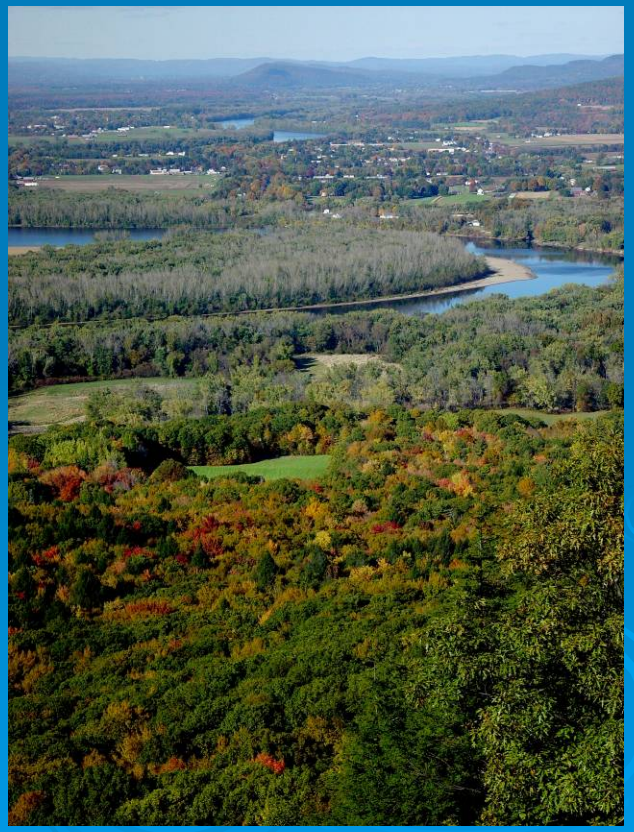
- What is a wetland?
- What kinds of wetlands do we have in Connecticut?
- Why are wetlands important (functions and values)?
- How are wetlands protected (ecologically and legally)?

Wetlands occur in areas where due to topography, surface water collects and/or ground water discharges making the area wet for extended periods.

Examples of wetlands include:

Depressions: swales, sloughs, prairie potholes, Carolina Bays, vernal pools, oxbows, glacial kettleholes





Relatively flat depositional areas that are subject to flooding: shorelines, deltas, flood plains, intertidal flats and marshes

Sloping topography associated with springs, seeps and drainage ways

Open water: floating mats and submersed beds

WETLANDS ARE CHARACTERIZED BY:

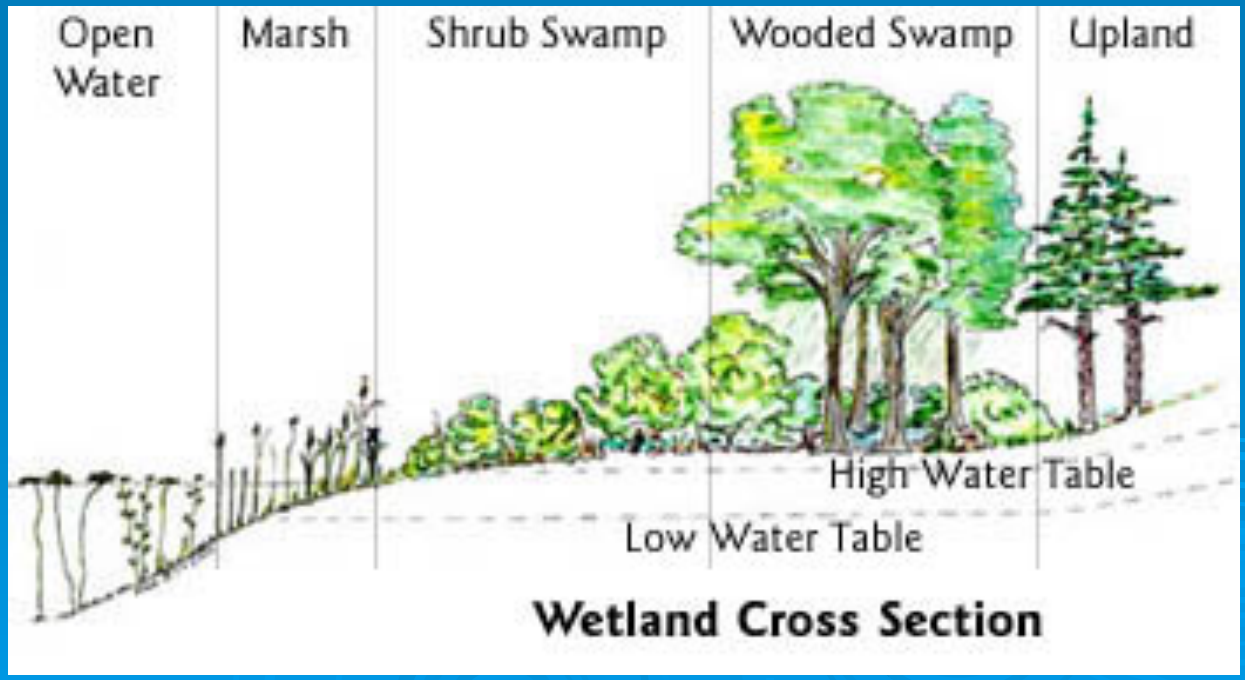
HYDROLOGY

VEGETATION

SOILS

WETLAND HYDROLOGY

Hydrology refers to the presence of water at or above the soil surface for a long enough period to influence the vegetation and soils that occur in that area.



…HYDROLOGY

… VEGETATION

- All vascular plants in the U.S. are classified as to their Wetland Indicator Status, and put into one of five categories (obligate wetland, facultative wetland, facultative, facultative upland, obligate upland)
  USDA Plants Database website: http://plants.usda.gov/

The USFWS had scientists collect data on plants and their locations. They analyzed the data, and for each plant made a determination as to how often it was found in a wetland or upland environment. Based on this analysis:

- Plants that require flooding or saturated conditions (*obligate wetland* plants are found in wetlands at least 99% of the time)
- Plants that tolerate flooded conditions (*facultative wetland* plants are usually associated with wetlands (66 -99% of the time))

Obligate wetland plants

Facultative wetland plants

… SOILS

Wetland soils are soils that are saturated, flooded or have standing water long enough during the growing season to develop conditions in which no free oxygen is present in the upper part (*anaerobic* conditions). These soils are called *hydric* soils and are readily differentiated from upland soils.

Wetland organic soils (derived from living organisms) generally are black colored muck and/or black or dark brown colored peat.

Wetland mineral soils often have a thick dark organic surface layer, and then a grey subsurface color with mottles.

VEGETATION CLASSIFICATION

DATING BACK TO 1907 THE U.S. GOVERNMENT HAS ATTEMPTED TO CLASSIFY WETLANDS FOR A VARIETY OF PURPOSES.

THE CURRENT SYSTEM WAS DEVELOPED IN 1979 AND IS BASED ON HYDROLOGY, VEGETATION AND SOILS.

THE FOUR MAJOR OBJECTIVES OF THIS CLASSIFICATION ARE:

- IDENTIFY ECOLOGICALLY SIMILAR HABITAT UNITS
- CLASSIFY THESE UNITS IN A SYSTEMATIC WAY TO FACILITATE RESOURCE-MANAGEMENT DECISIONS
- IDENTIFY UNITS FOR INVENTORY AND MAPPING PURPOSES
- PROVIDE UNIFORMITY WHEN DISCUSSING WETLANDS THROUGHOUT THE COUNTRY (TINER 1997)

MARINE: open ocean and its associated coastline

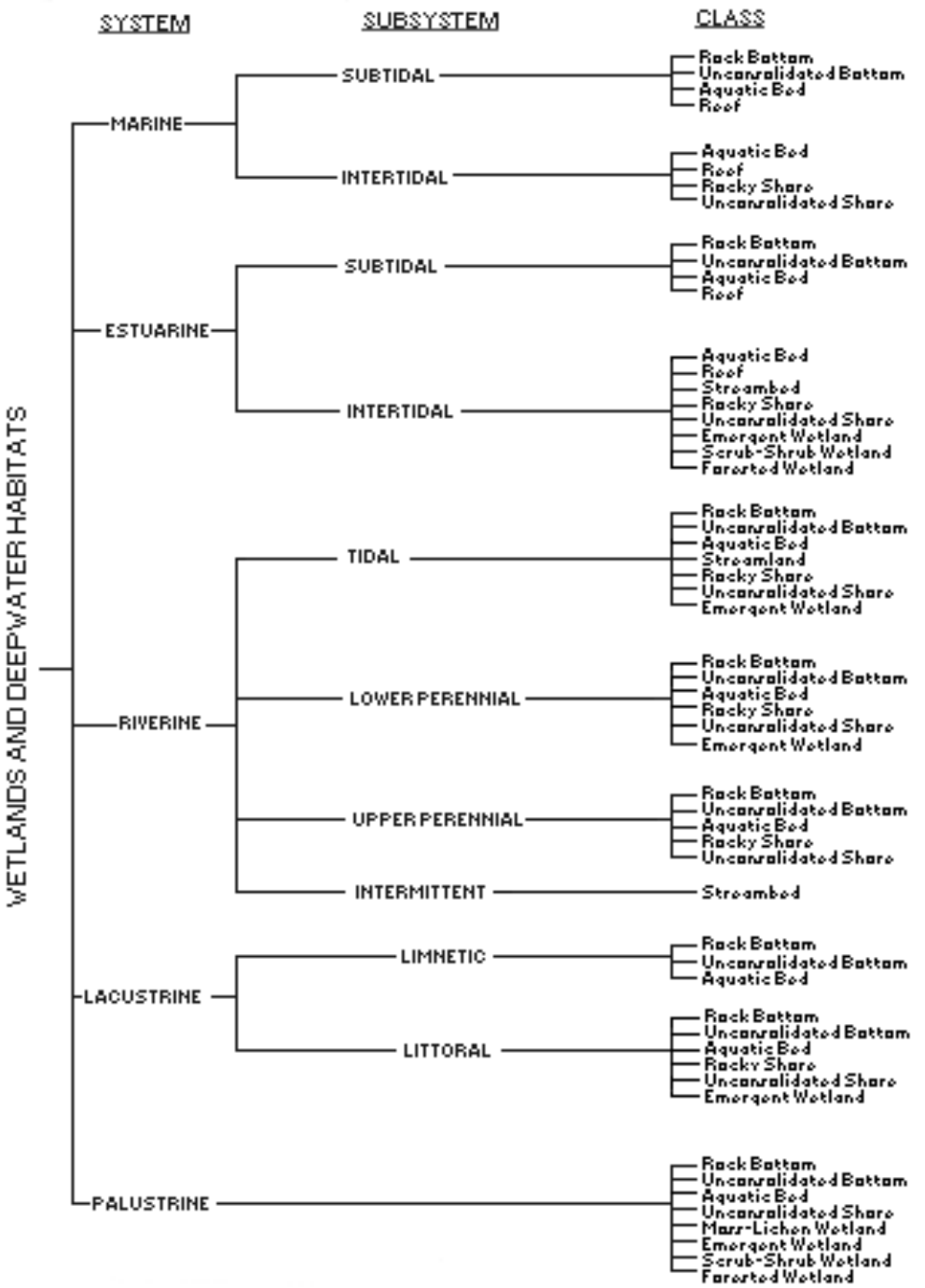
ESTUARINE: tidal waters of coastal rivers and embayments

RIVERINE: wetlands/deep water habitat contained within a channel excluding wetlands with persistent veg, or wetlands with salinity greater than 0.5%

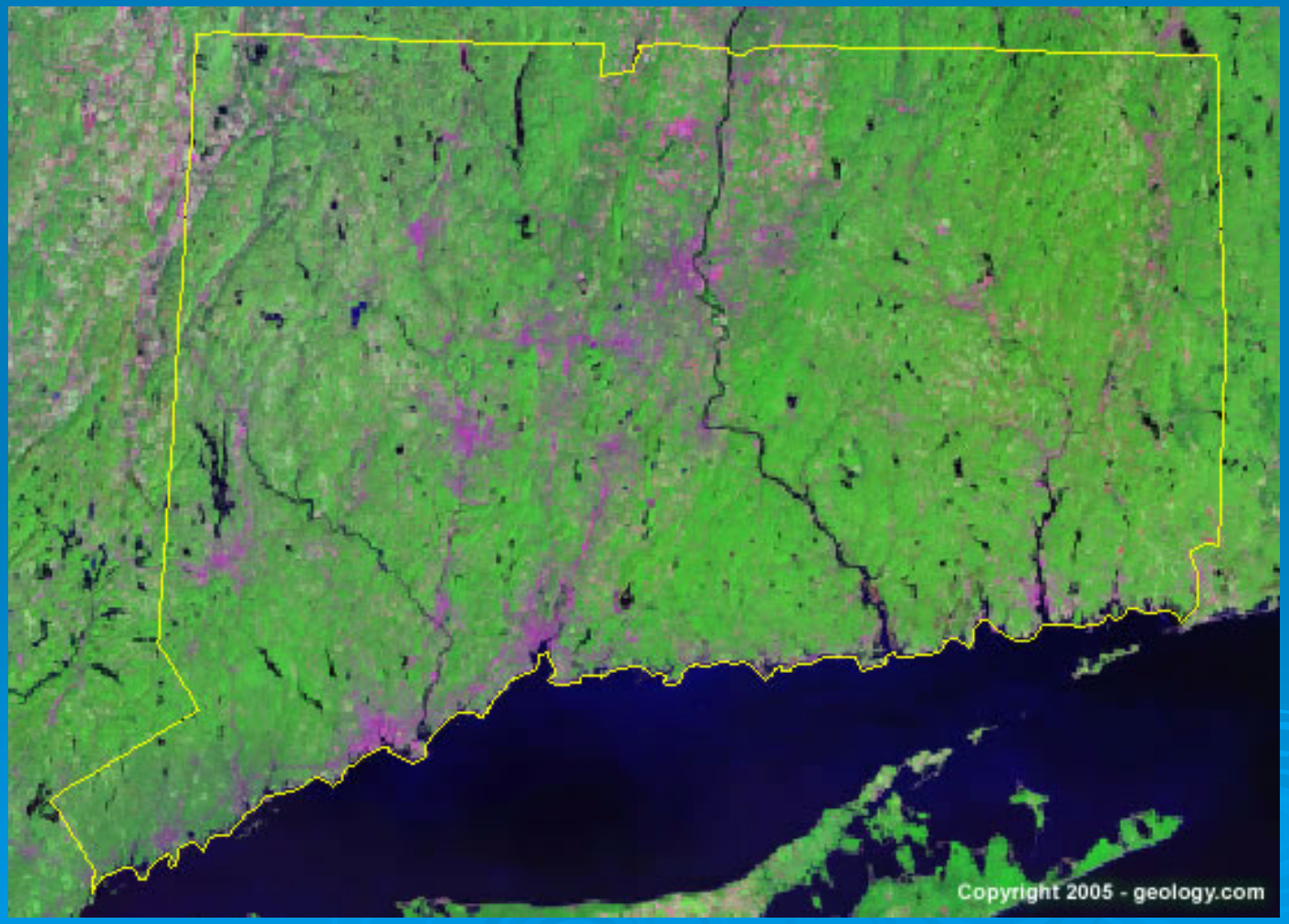
LACUSTRINE: wetlands/deep water habitat situated in a topographical wetland or dammed river channel, having less than 30% persistent veg cover, and total area exceeds 20 acres

PALUSTRINE: all nontidal wetlands dominated by trees, shrubs, persistent emergent veg, and tidal wetlands with salinity less than 0.5%

(Cowardin *et al.* 1979) System used for national assessment and mapping of wetlands



So what kinds of wetlands do we have in Connecticut where approximately 17% of the land area is classified as wetland?



- Mainly palustrine and estuarine –

- Palustrine – e.g. aquatic beds, pond and lake shores, riverbank wetlands, basin marshes and swamps, poor fens (bogs), seepage swamps, alluvial swamps

- Estuarine – e.g. aquatic beds, intertidal flats, beaches and shores, tidal marshes

Salt marsh

Brackish tidal marsh

Freshwater tidal marsh

Aquatic plant beds

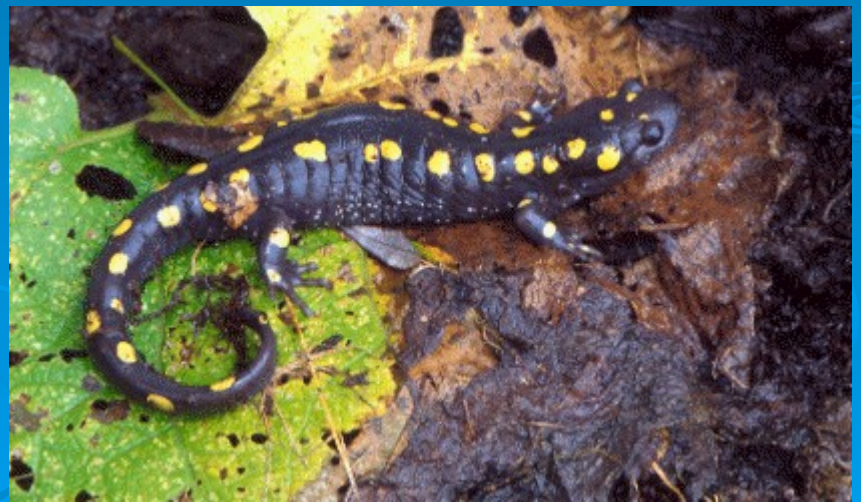
Atlantic White Cedar Swamp

Bog

Floodplain Forest

Cattail Marsh

Vernal Pools



Wetland Functions and Values

- Functions – what wetlands do
- Values – benefits humans derive from wetland functions

So for example, a wetland may perform the biogeochemical function of removing dissolved substances, and the maintenance of water quality is the value.

WETLAND FUNCTIONS:
"Not all wetlands perform all functions, nor do they perform all functions equally well." (Novitzki et al. 1997)

- Habitat Functions
- Hydrologic Functions

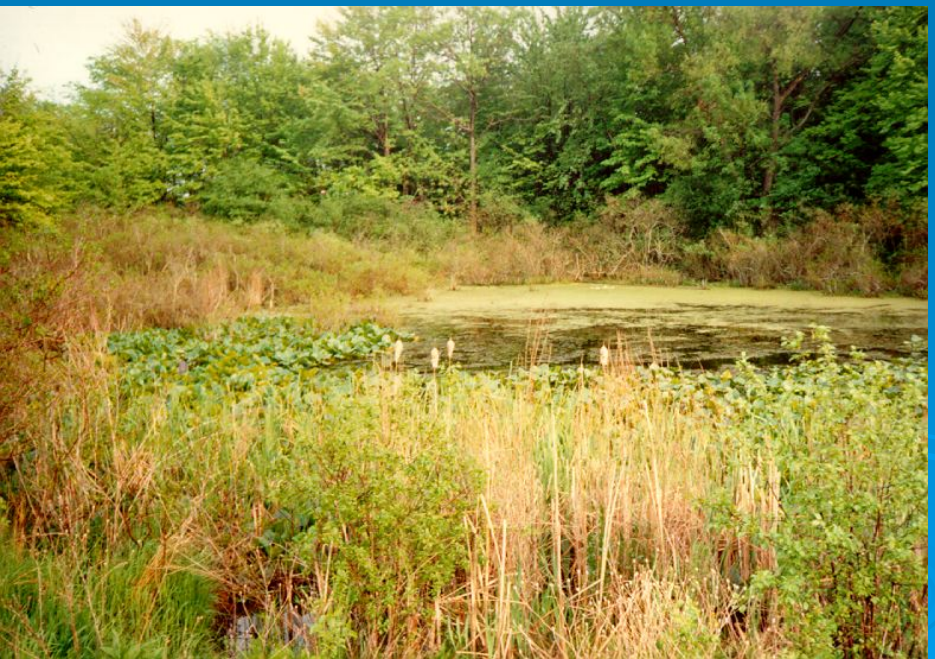
WILDLIFE HABITAT

43% of federally threatened and endangered species rely on wetlands (directly or indirectly) for their survival

HYDROLOGIC FUNCTIONS

Flood control

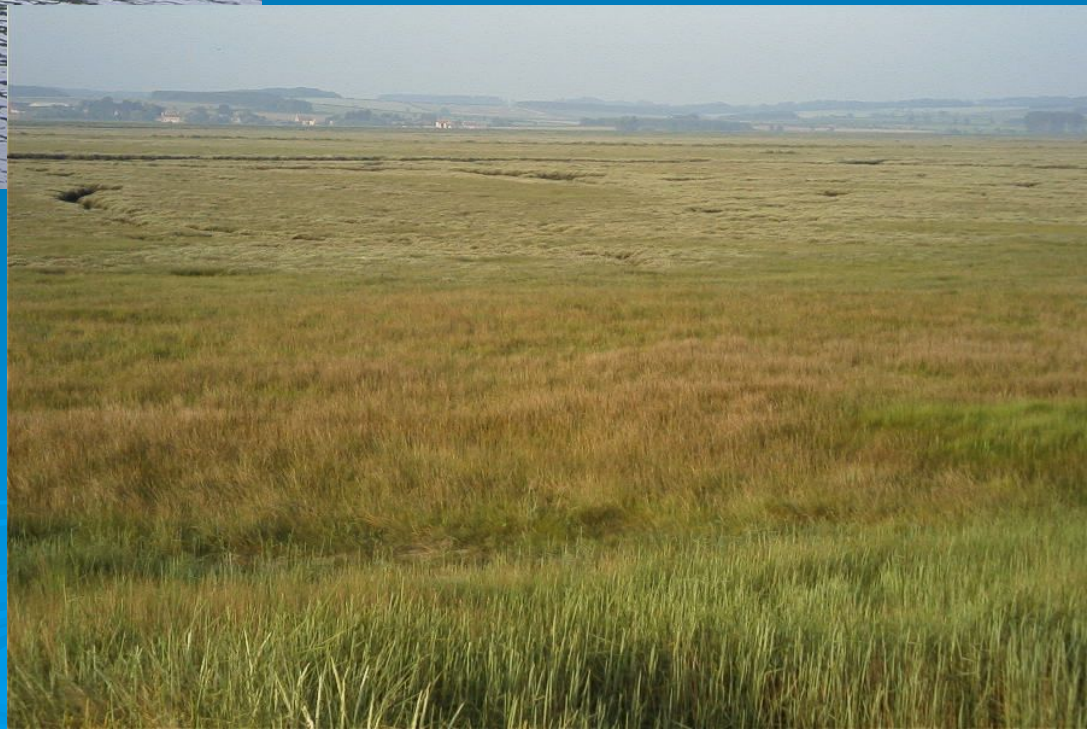
Water supply and groundwater storage



Water quality improvement

Erosion Control

High Primary Productivity



WETLAND VALUES (benefits derived from wetland functions)

Economic benefits

On the Atlantic and Gulf Coasts, 66-90% of the commercially important fish and shellfish species depend on coastal marshes and estuaries for at least part of their life cycle.

3 million migratory bird hunters generated $1.3 billion in retail sales

There are approx 55 million acres of wetlands supporting timber

Reduction of flood damage and shoreline erosion protection

Water quality improvement and reduction in environmental problems (algal blooms, fish kills)

Recreation and aesthetic appreciation

Education

Research

SUMMARY

- How wetlands are characterized (Hydrology, Vegetation, and Soils)
- Types of wetlands
- Wetland functions and values
- Next we'll discuss:
  Wetland Protection – both legal protection and ecological protection

HOW ARE WETLANDS LEGALLY PROTECTED IN CONNECTICUT?

- In 1972, the CT State Legislature enacted the Inland Wetlands and Watercourses Act which recognizes the importance of wetlands within CT, that they are essential to the well being of its citizens, and that we must balance economic growth and land use with the need to protect the environment.
- The Act creates a land use regulatory process which considers the environmental impacts of proposed development activities.

1972 – "Inland Wetlands and Watercourses Act" passed by Connecticut Legislature

Section 22a-42 requires that by 1988 each municipality shall establish An inland-wetlands agency.

May be a new or existing board

WETLANDS IN CONNECTICUT

INLAND

Defined by soil type

REGULATED LOCALLY

TIDAL

Defined by vegetation & tidal inundation

REGULATED BY STATE

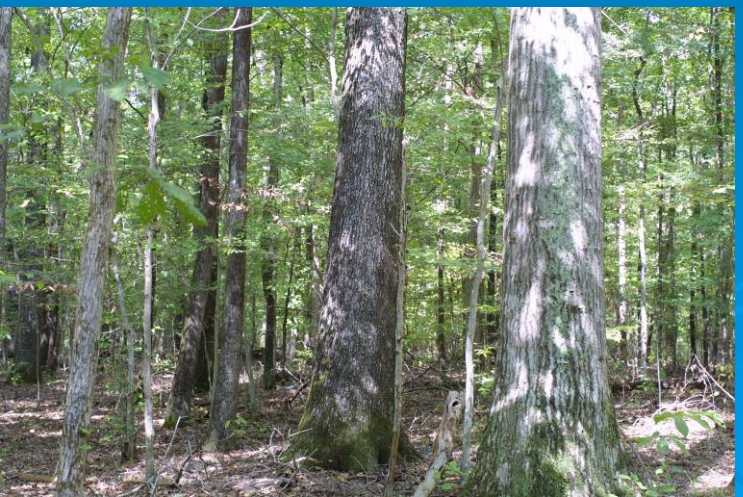
Ultimate regulatory authority for navigable waters and wetlands lies with the U.S. Army Corps of Engineers which uses hydrology, vegetation and soils to define wetlands.

Tidal wetlands in Connecticut

Salt, brackish and freshwater tidal marshes

MAJOR INLAND WETLAND GROUPINGS

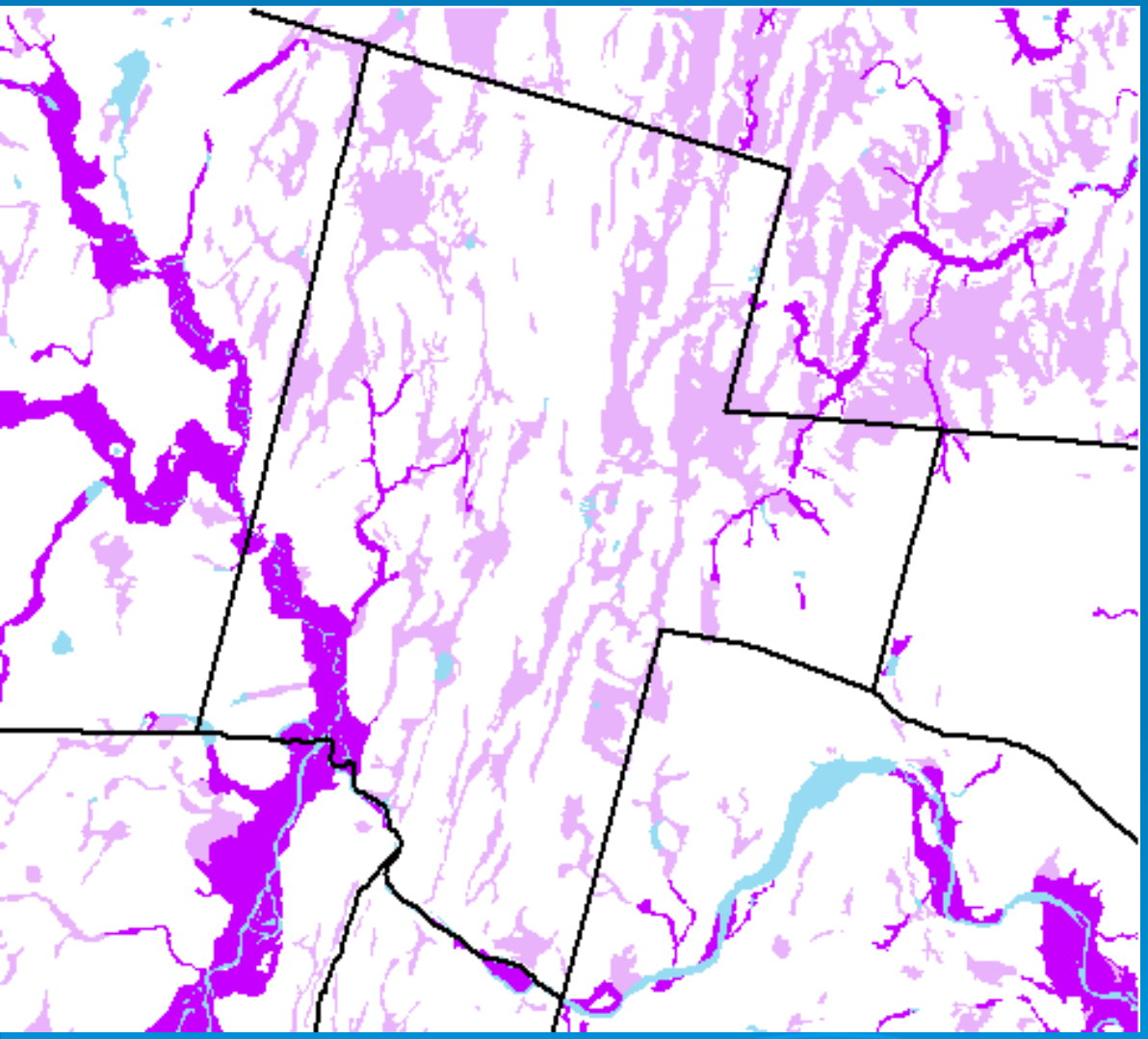
Poorly drained – water table is at or below the ground surface usually from late fall to early spring



Very poorly drained – water level is at or below the surface during most of the growing season

Alluvial or Floodplain - soils formed when material is deposited by flowing water

East Granby Inland Wetland Soils



Municipal Boundary
Alluvial and floodplain soils
Poorly drained/very poorly drained soils
Water
Road

(From CTEco website)

Regulated Areas

Vernal Pools

Unique seasonal microhabitats

Clues for identifying vernal pools include:

- Depression with no permanent outlet and sometimes sparse vegetation
- Holds standing water for at least two months during growing season
- Dries out most years by late summer
- Has no fish population (would eat eggs and larvae)
- Contains the obligate vernal pool species

So how can we protect wetlands?

- Direct development to areas that are capable of supporting it
- Preserve areas that are identified by Natural Resource Inventory and Open Space Plans
- Develop with sensitivity to identified resources including wetlands and water courses – consider location
- Protect sensitive water resources from adverse land uses - not all wetlands are equal – consider quality and function

We need to think about the areas adjacent to the wetlands… BUFFER's

What is a riparian buffer?

- “Riparian” refers to the area by the banks of a river, stream, or other body of water.
- “Buffer” refers to a designated zone or strip of land of a specified width along the border of an area
- So a “Riparian Buffer” is the natural vegetation and soil cover adjacent to a river, stream, or other body of water.

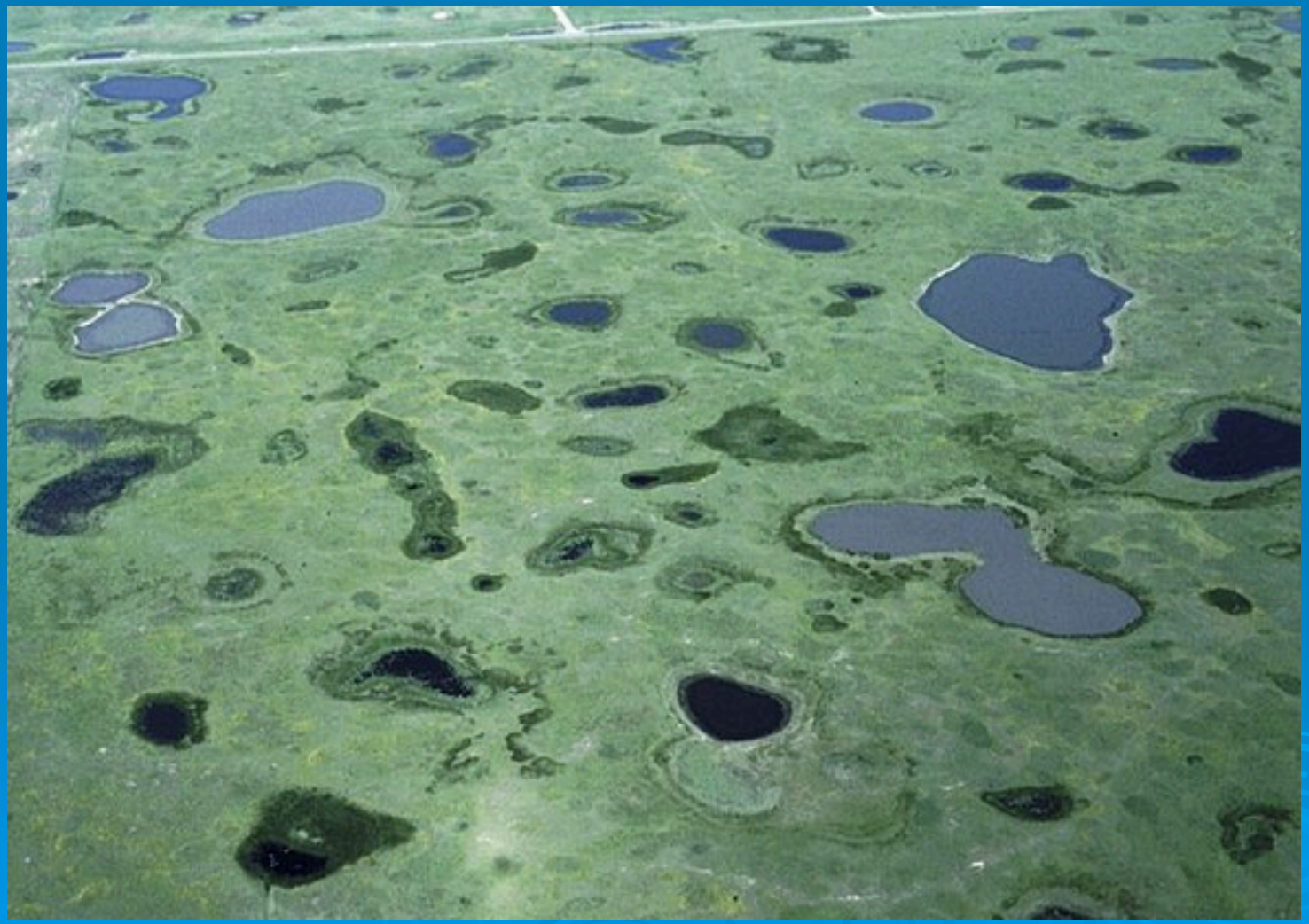
What do buffers do?

- Buffers are the first line of defense against the impacts of impervious surfaces
- Buffers slow runoff, protect shorelines from erosion, aid in flood control and filter or trap pollutants
- Buffers provide habitat and corridors for wildlife
- Buffers shade waters for fisheries enhancement
- Buffers offer scenic value and recreational opportunity

Climate change impacts that will affect wetlands

- Increased mean annual air temperatures
- Changes in precipitation patterns (amount, timing, intensity)
- Increases in average water temperatures
- Sea level rise
- Intense storm events (hurricanes, nor' easters)

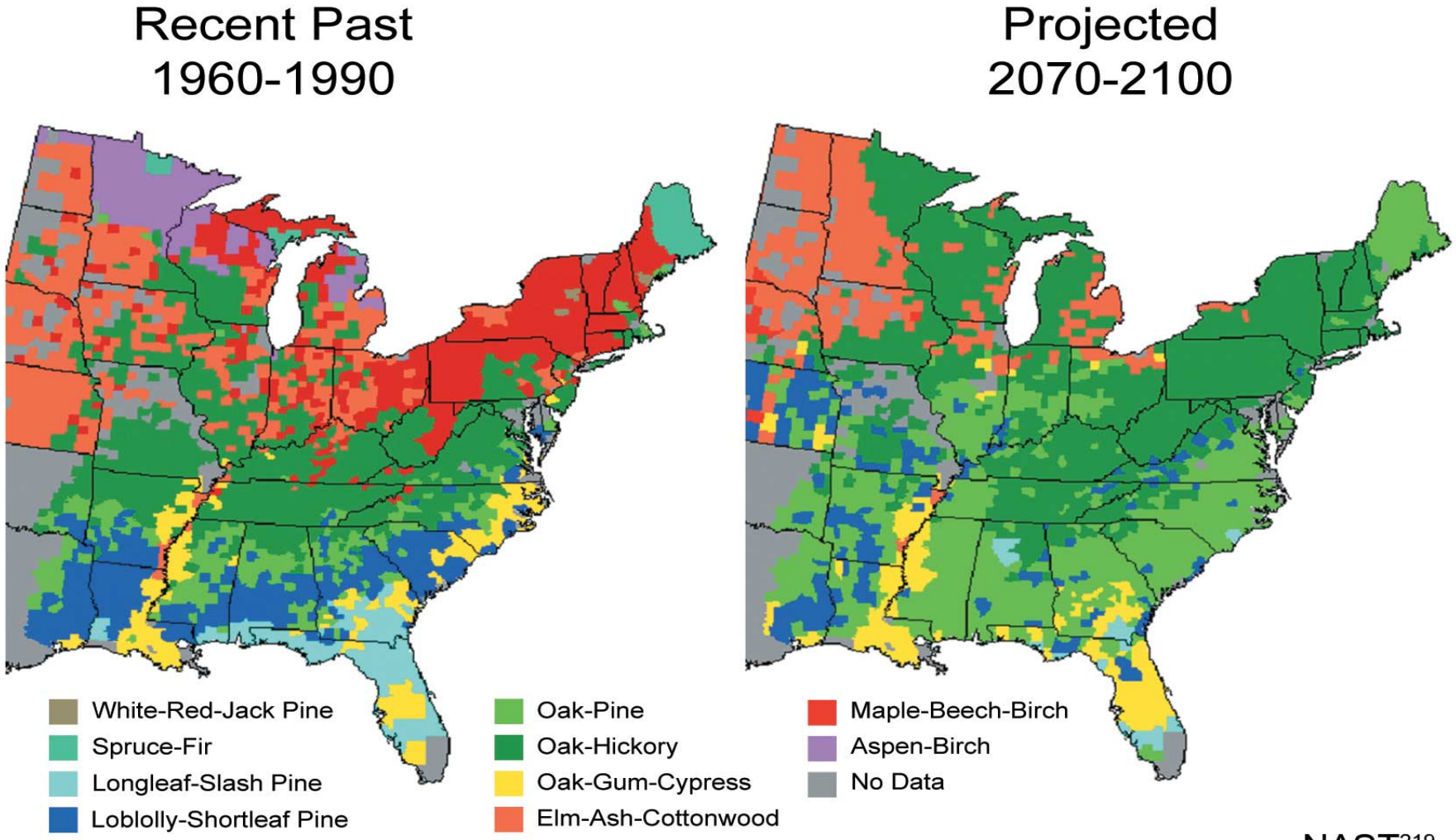
Temperature changes are expected to have a great impact on inland wetlands



Prairie potholes are the most productive habitat for waterfowl in the world.

The melting of permafrost in tundra will result in wetland loss. Changing precipitation patterns in boreal and temperate areas will affect the distribution and composition of wetlands.

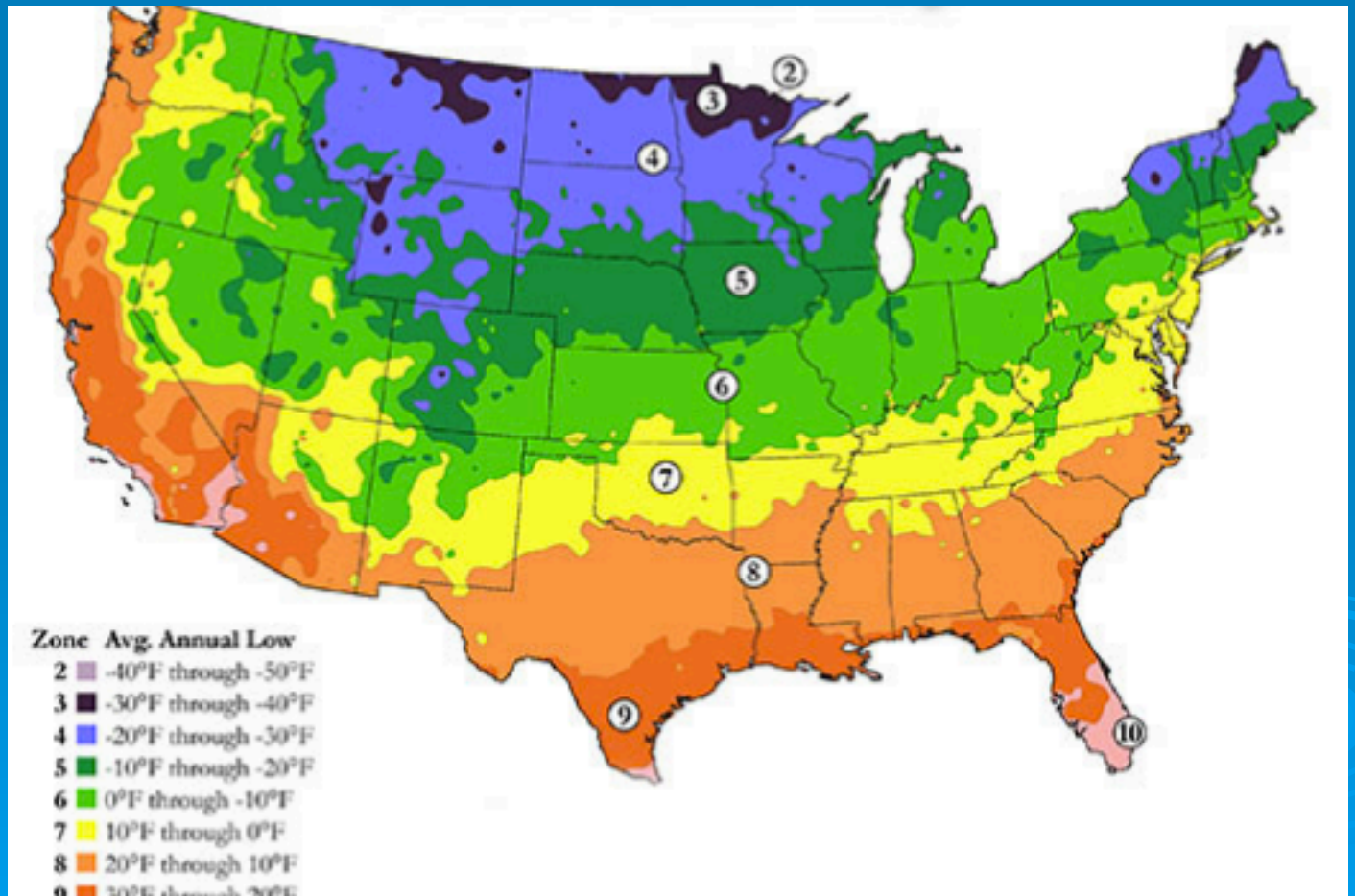
Collapsed permafrost block of coastal tundra on Alaska's Arctic Coast.



The maps show current and projected forest types. Major changes are projected for many regions. For example, in the Northeast, under a mid-range warming scenario, the currently dominant maple-beech-birch forest type is projected to be completely displaced by other forest types in a warmer future.[243]

Increased mean annual air and water temperatures

- Will impact hydrologic regimes
- Changes to plant and animal ranges, migrations (USDA hardiness zones) on land and water systems



In the US, spring now arrives 10 to 14 days earlier than it did 20 years ago.

Obvious changes related to the timing of the seasons: when plants bud in spring; when birds and other animals migrate

Shifts in tree species on mountains in New England (largely in the transition zones)

Sea Level Rise

- Sea level has been rising; the rate of SLR is increasing due to climate change leading to:

  Loss of tidal wetlands where sedimentation rates not keeping up with SLR or no room for marsh migration
- Even a 2 ft rise in relative sea level over a century would result in the loss of a large amount of the US coastal wetlands as many are not able to build new soil at a fast enough rate.

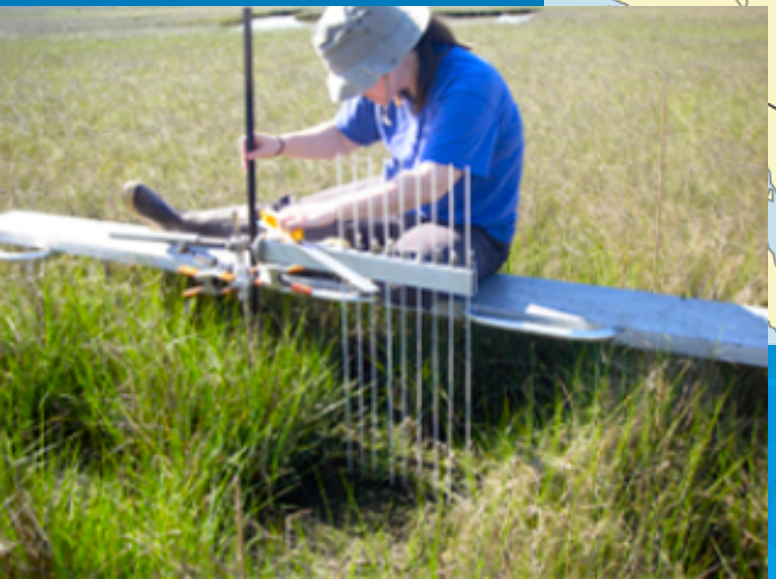
Long Island Sound Marshes

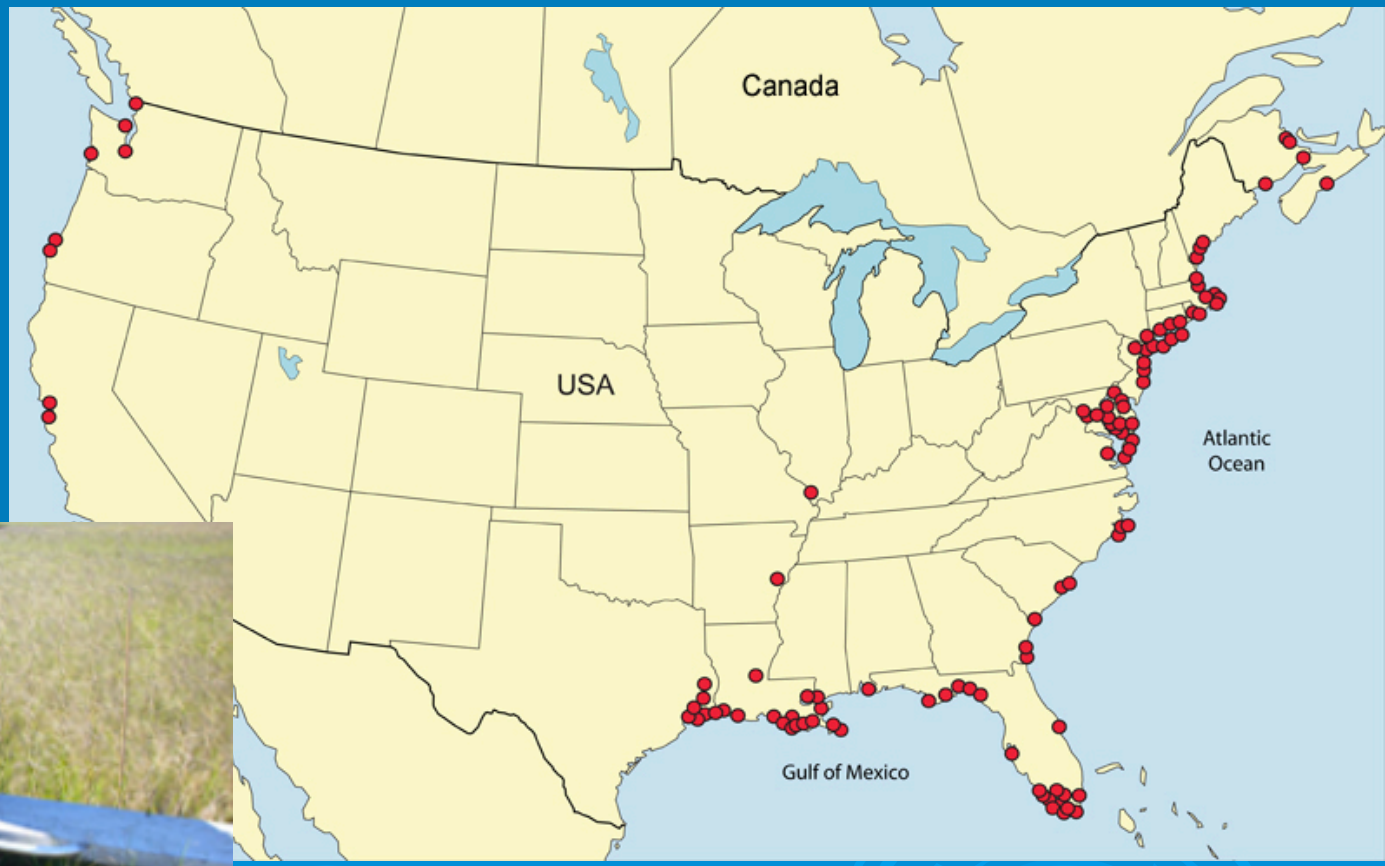
Researchers have developed a salt marsh migration tool and have applied it to the tidal wetlands of LIS.

- Changes in high marsh to low marsh
- Marsh migration scenarios/management scenarios (constraints on landward side)

Surface Elevation Tables (SET's) numerous locations along CT's coast

The Surface Elevation Table (SET) is a portable mechanical leveling device for measuring the relative elevation change of wetland sediments.





Changes at Barn Island Stonington, CT

Connecticut River

Salt wedge may move further upriver with sea level rise. Some of the freshwater tidal wetlands may transition to brackish, and brackish wetlands to salt marshes.

Changes in the timing of the spring freshet will also impact wetlands.

Climate Change Impacts to Inland Wetlands

Increased precipitation, intensity of storm events, increased air temperatures

Where precipitation increases, size and number of inland freshwater wetlands could increase.

Where precipitation decreases or air temperatures increase without increases in precipitation, some wetland could become smaller and/or dry out.

Vernal pools may decrease in size or dry up

Wetland types may change such as from marsh to forest

Associated flora and fauna may change as wetlands change

Potential human threats to wetlands associated with climate change

- Coastal wetlands: coastal hardening to protect infrastructure from SLR
- Dams to prevent flooding, provide water to drought stricken areas
- Drainage of wetlands to reduce risk of disease

"Of all aquatic systems, wetlands will likely be the most susceptible to climate change. Shallow wetlands that are dependent on precipitation will be the most vulnerable to drying, warming and changes in water quality. Intermittent and perennial streams, vernal pools, and coastal wetlands and marshes will also be particularly vulnerable to projected changes in temperature, precipitation and sea level rise."

Lawler, J.J., et al. 2008

Wetlands

the backbone of our natural resource systems…
…key components of our communities.