PART 2 – Wetland: Functions and Values

- The following slides show examples of wetland functions and values.

FUNCTION: Properties that a wetland naturally provides.

VALUES: Properties that are valuable to humans.
Wetland: Physical/Hydrological Functions

a. Flood Control
b. Coastal Protection
c. Ground Water Recharge
d. Sediment Traps
e. Atmospheric Equilibrium
Flood Control

- Wetlands act as protective natural sponges by capturing, storing and slowly releasing water over a long period of time, thereby reducing the impact of floods.

- A good example of this is the Mississippi River's bottomland hardwood-riparian wetlands, which once stored at least 60 days of floodwater and represented significant fish and wildlife habitat. They now store only 12 days of floodwater because most have been filled, levied, or drained, with substantial loss of fish and wildlife habitat. Another good example is Minnesota, where the cost of replacing the natural flood control function of 5000 acres of drained wetlands was found to be $1.5 million annually.
Coastal Protection

- Coastal marshes, mangrove swamps and other estuarine wetlands act as effective storm buffers. Studies have concluded that more than half of normal wave energy is dissipated within the first 3 meters of encountering marsh vegetation such as cordgrass. The erosive nature of tides is also dampened by wetland plants because their roots hold soil in place and their stalks reduce the destructive energy of waves and wind.

Unstable shoreline with a large amount of erosion

Stable wetland, preventing erosion.
Groundwater Recharge

- Wetlands’ role in recharging groundwater varies widely, but it is clear that wetlands often contribute to groundwater and can be important in recharging aquifers.

- The Floridian aquifer system, for instance, is one of the more productive groundwater sources in the United States. It occurs across the entire state of Florida, into southern Georgia, and portions of South Carolina and Alabama. This huge subsurface reservoir produces some of the cleanest water in the nation. Its primary source is rainwater that filters through hundreds of feet of sand and rock. For example, one calculation shows that if a 5-acre Florida cypress swamp was 80% drained, available groundwater would be reduced by an estimated 45%.
Sediment Traps

- Wetlands improve water quality by acting as sediment sinks or basins. They are especially effective at trapping sediments in slow moving water. Wetland vegetation slows water velocity and particles settle out.
Atmospheric Equilibrium

- Scientists also point out that atmospheric maintenance is an additional wetland function. Wetlands store carbon within live and preserved (peat) plant biomass instead of releasing it to the atmosphere as carbon dioxide, a greenhouse gas affecting global climates. Therefore, wetlands world-wide help to moderate global climatic conditions.

- On the other hand, filling, clearing and draining wetlands releases carbon dioxide.
Self - Quiz 2

Using the knowledge gained from previous slides, answer the following questions. Answers can be found on the next slide.

1) How does the presence of wetlands help protect property (slide 34)?
2) True or False? Can the loss of wetlands affect groundwater supplies (Slide 36)?
3) How do wetlands physically clean water (Slide 37)?
4) Within the first 3 meters of coastal marshlands, wave energy is dissipated by how much (slide 35)?
Self Quiz 2 - Answers

1) Wetlands act as protective natural sponges by capturing, storing and slowly releasing water over a long period of time, thereby reducing the impact of floods.

2) True. Wetlands’ role in recharging ground water varies widely, but it is clear that wetlands often contribute to groundwater and can be important in recharging aquifers.

3) Wetlands improve water quality by acting as sediment sinks or basins. They are especially effective at trapping sediments in slow moving water. Wetland vegetation slows water velocity and particles settle out.

4) Studies have concluded that more than half of normal wave energy is dissipated within the first 3 meters of encountering marsh vegetation such as cordgrass.
Wetland: Chemical Functions

Chemical Functions

a) Waste Treatment/Pollution Interception

b) Biogeochemical Cycling
Waste Treatment

- Wetlands act as filters and sponges. Water that enters a wetland is filtered through the substrate and wetland plants, removing nutrients, i.e. nitrogen and phosphorus, and toxins.

Stormwater Wetland

Wastewater Wetland
Wetlands provide the conditions needed for the removal of both nitrogen and phosphorus from surface water.

- **Biogeochmneical cycling**, involves the biologic, physical, and chemical transformations of various nutrients within the biota, soils, water, and air.

- Wetlands are very important in this regard, particularly relating to nitrogen, sulfur, and phosphorous. A good example of this occurs in anaerobic (non-oxygenated) and chemically reduced wetland soils and the muddy sediments of aquatic habitats like estuaries, lakes, and streams, which support microbes that function in nitrogen and sulfur cycling. Upon death and decay, the nitrogen and sulfur in plant and animal biomass is released through mineralization. Much of this is eventually transformed into gaseous forms and released into the atmosphere, where it once again becomes available to certain plants and their associated nitrogen-fixing bacteria in the soil.

- Phosphorous does not have a gaseous form, but vascular plants in wetlands transform inorganic forms of phosphorus (that might otherwise be shunted into undesirable algal blooms) into organic forms in their biomass as they grow.
Pollution Interception

*In performing this filtering function, wetlands save us a great deal of money.* A 1990 study showed that, the Congaree Bottomland Hardwood Swamp in South Carolina, removes a quantity of pollutants that would be equivalent to that removed annually by a $5 million wastewater treatment plant. Another study at a 2,500 acre wetland in Georgia, indicated that it saves $1 million in water pollution abatement costs annually.
Because they produce so much plant biomass and invertebrate life, estuaries and their coastal marshes serve as important nursery areas for the young of many game (recreational) and commercial fish and shellfish. Menhaden, flounder, sea trout, spot, croaker, and striped bass are among the more familiar fish that depend on coastal wetlands. Such areas are also critical nursery habitat for young commercial shrimp along the Southeast and Gulf Coasts. Freshwater fish, such as the chain pickerel and northern pike use well-flooded or ponded wetlands as breeding and nursery areas. Some fish, like the brown bullhead and mud minnow, even subsist in wetlands that have natural low dissolved oxygen concentrations that other species cannot endure. In the Pacific Northwest, some wetlands release cooler water to salmon-bearing streams and rivers; in places this is critical to the health of coldwater fish populations.
Wetland Function - Habitat

- Wetlands provide habitat for upland mammals such as deer and raccoons.
Wetland Function - Habitat

- Wetlands provide habitat for wetland dependent species such as the salamander.
The U.S. Fish and Wildlife Service estimates that up to 43% of the federally threatened and endangered species rely directly or indirectly on wetlands for their survival (e.g., the wood stork, Florida panther, whooping crane, swamp pink, and Canby's dropwort). Many other species use wetlands at some point in their lives.
Wetlands provide valuable stop-over sites for migratory birds. Wetlands are also necessary habitat for all waterfowl.

Migratory waterfowl, including ducks, geese, and swans, use coastal and inland wetlands as resting, feeding, breeding, or nesting grounds for at least part of the year. For example, in the Chesapeake Bay Region (a major wintering area for waterfowl), coastal wetlands supported an annual average of nearly 79,000 wintering black ducks over a 45-year period (1950-1994); over the same period, it supported an annual average of about 14,000 wintering pintails. Most of these ducks rely on the prairie potholes (depressional wetlands) in upper mid-western United States and adjacent Canada and interior wetlands in northeastern North America for nesting.
Self - Quiz 4

Using the knowledge gained from previous slides, answer the following questions. Answers can be found on the next slide.

1) What is the difference between a wetland function and a wetland value?
2) What is the estimated percentage of endangered species dependant upon wetlands?
3) True or False – Wetlands are important to upland animals.
4) Why would the loss of wetlands result in a lower fish and shellfish yields?
5) What part of a wetland facilitates the cycling of nitrogen and phosphorus?
Self Quiz 4 - Answers

1) The difference between a wetland function and a wetland value is that functions are properties that a wetland naturally provides. Values are wetland properties that are valuable to humans.

2) 43%

3) True. Wetlands provide habitat for upland mammals such as deer and raccoons.

4) Wetlands are the nursery grounds for aquatic life.

5) Microbes living in the anaerobic (no oxygen) wetland soils.
Wetlands: Value

- The following slides show examples of wetlands values. Values are properties of a wetland that are beneficial to humans.

**Socioeconomic Functions/Benefits**
- Food
- Commercial Animal Populations
- Fuel
- Timber/Fiber Production
- Recreation, Aesthetics, Education
Food

- Wetlands produce food that is beneficial to humans. Examples are rice and cranberries.
Wetlands are habitats for commercial fur-bearers like muskrat, beaver, otter, and mink, as well as reptiles such as alligators. The nation's harvest of muskrat pelts alone valued at over $70 million annually, while the alligator industry is valued at $16 million.
Fuel

- Peatlands are still used as production areas.
Timber/Fiber Production

- Wetlands are used as timber/fiber production areas.
- **Wetlands supporting timber totals about 55 million acres**, two-thirds of which occurs east of the Rocky Mountains.
Commercial Animal Populations

- Many of the nation's **fishing and shellfishing industries harvest wetland-dependent species (e.g., striped bass and brown shrimp)**. In fact, the fish and shellfish that depend on wetlands for food or habitat constitute more than 75% of the commercial and 90% of the recreational harvest. In the Southeast, fish and shellfish species dependent upon coastal and estuarine wetlands comprise almost all of the commercial catch. The coastal marshes of Louisiana alone produce a commercial fish and shellfish harvest amounting to 1.2 billion pounds annually, which was worth $244 million in 1991. In this region, 96% of the commercial harvest and more than 50% of the recreational catch are estuary-coastal wetland-dependent fish and shellfish. The United States commercial fisheries harvest is worth more than $2 billion annually. This harvest is the basis for a $26.8 billion fishery processing and sales industry. Overall, including commercial and recreational endeavors, seafood is a $50 billion industry.
Wetlands are used as recreation sites all over the world.
In the United States, more than half of all the adults (98 million) **hunt, fish, birdwatch, or photograph wildlife** annually spending a total of $59.5 billion in the process. Coastal areas themselves attract at least 100 million Americans each year. At least $18 billion in economic activity is generated annually from coastal wetland-dependent recreational fishing by 17 million Americans.

Photo Credit Texas Parks and Wildlife
Birding

Much of the nature-based tourism involves birds, many of which are wetland-dependent. Each year, about $20 billion dollars are spent on seed, travel, and equipment by birders. Birding has increased more quickly than any other outdoor recreation activities, such as biking, pleasure walking, skiing, and golf. In fact, participation has tripled from 1982-83 (21 million) to 1997 (63 million). The birding public is quite active – 24.7 million people took trips away from home to partake in birding, spending $5.2 billion in goods and services in 1991. This high level of participation by Americans in bird-related recreation is a clear indicator of the societal value of birds. An inordinate amount of this recreational birding is associated with wetlands and aquatic habitats. This undoubtedly relates to the fact that birds, in particular, tend to gravitate towards wetlands and aquatic habitats, which in turn attracts natural history and outdoor enthusiasts.
Self - Quiz 5

Using the knowledge gained from previous slides, answer the following questions. Answers can be found on the next slide.

1) Name two wetland food crops.
2) Can you think of some recreational activities that occur in wetlands?
Self-Quiz 5  Answers

1) Cranberries and rice
2) Canoeing, bird watching, hunting, fishing, hiking, education
Wetland Classification Systems:

Wetlands have been classified since the early 1900’s. Early classifications were driven by the value of the wetlands. Namely peatlands – a valuable source of fuel.

Today, classification methods use a variety of attributes including hydrologic regime, vegetation classes, hydrologic flow and functions and values.

The most commonly used classification method in use in the U.S. is entitled Classification of Wetlands and Deepwater Habitats of the United States, published in 1974 by the U.S. Fish and Wildlife Service written by Cowardin and others.

The Cowardin Classification Method uses water depth, hydroperiod, and dominant vegetation to classify specific sites.

Most wetlands fall within two of Cowardin’s Classifications, Palustrine and Estuarine.
Cowardin - Palustrine: All non-tidal systems dominated by trees, shrubs, emergent vegetation, emergent moss/lichen, and all wetlands occurring in fresh tidal wetlands.

e. Permanently Flooded  f. Intermittently Flooded

  g. Semi-permanently Flooded  h. Seasonally Flooded

  i. Saturated  j. Temporarily Flooded
Cowardin - Estuarine: Deepwater habitats and adjacent wetlands that are semi-enclosed by land but have access to the ocean.

a. Subtidal  
b. Irregularly Exposed  
c. Regularly Flooded  
d. Irregularly Flooded
<table>
<thead>
<tr>
<th>TYPE</th>
<th>HYDROPERIOD</th>
<th>VEGETATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marsh</td>
<td>Regularly Flooded</td>
<td>Emergent Herbaceous</td>
</tr>
<tr>
<td>Swamp</td>
<td>Permanently Flooded</td>
<td>Trees</td>
</tr>
<tr>
<td>Bog</td>
<td>Temporarily Flooded</td>
<td><em>sphagnum spp</em></td>
</tr>
<tr>
<td>Floodplain/Bottomland</td>
<td>Seasonally Flooded</td>
<td>Hardwood Trees</td>
</tr>
<tr>
<td>Playa</td>
<td>Temporarily Flooded</td>
<td>Emergent Herbaceous</td>
</tr>
<tr>
<td>Prairie Pothole</td>
<td>Temporarily Flooded</td>
<td>Emergent Herbaceous</td>
</tr>
<tr>
<td>Vernal Pool</td>
<td>Seasonally Flooded</td>
<td>Emergent Herbaceous</td>
</tr>
<tr>
<td>Wet Meadow</td>
<td>Saturated</td>
<td>Emergent Herbaceous</td>
</tr>
</tbody>
</table>
Major Wetland Types

- Marsh: Coastal, inland, salt or fresh
- Swamp: Dominated by trees
- Bog: Organic soils
- Floodplain/Bottomland: Associated with Rivers
- Playa: Found in Southwestern U.S.; can be dry for long periods of time; resting grounds for migratory birds
- Prairie Pothole: Found in Midwest U.S. and Canada, formed by glacial movements; important migratory bird habitat
- Vernal Pool: Floods during the spring and summer, dry in fall and winter; good habitat for herptiflua
- Wet Meadow: Driven by a high water table
Using the knowledge gained from previous slides, answer the following questions. Answers can be found on the next slide.

- I am a wetland found in the Southwestern part of the U.S. I can be dry for many years at a time. Migrating birds love to rest in me.
- I am a wetland dominated by large trees. Help to protect human life and property by soaking up seasonal floodwaters.
- I am a wetland dominated by grasses. I am the breeding grounds for fish and shellfish, providing a safe, calm and nutrient rich habitat.
Quiz 6 Answers

1) Playa Lake
2) Bottomland Hardwood
3) Coastal Marsh