UWIN
Utah Wetlands Interpretive Network

Definition of Wetlands and Supplemental Information

The wetland definition and supplemental information described below were created by the Utah Wetlands Interpretive Network (UWIN) Education Committee. It was produced to assist 4th grade teachers, as well as other educators in Utah, in teaching their students about wetlands. If you have more questions about wetlands in Utah, feel free to contact any one of the UWIN partners. A list of UWIN partners can be found at www.utahwetlands.org.

WETLAND DEFINITION

Wetlands are ecosystems identified by the presence of water at some point during the year, which creates a unique environment with hydric soils and specially adapted plants and animals.

SUPPLEMENTAL INFORMATION

1. A Recipe for a Wetland

In order to define an area as a wetland, the following "ingredients" must be present:

a. Hydric Soils - Hydric soils are saturated long enough during the growing season to create an anaerobic state in the soil horizon. This lack of available oxygen limits the number of plant species that can survive there.

b. Hydrophytic Plants - Hydrophytic plants have adapted to thrive in wetlands despite the stresses of an anaerobic and flooded environment.

c. Bacteria and Animals - From bacteria to beavers, wetlands are both home and supermarket for myriad residents. Many animals are adapted to use wetlands for food, shelter, spawning, nesting, or predatory opportunities.

d. Water - Water must be present in a wetland for at least part of the growing season. Wetland plants and animals that have adapted to live in a wet environment require saturated soils or standing water to grow and survive.

2. Examples of Wetlands, Unusual Forms of Wetlands, and Other Aquatic Ecosystems

Wetland Examples

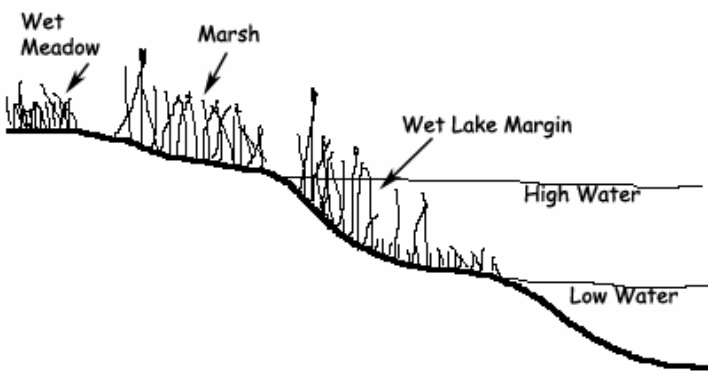
- Ponds
  These wetlands are depressions in the ground where water collects. Ponds are not as deep as lakes – they must be less than 6 feet deep. Ponds can be found at any elevation, although

they can be formed in many different ways. Ponds at high elevations may be glacial potholes (see unusual wetlands).

- Marshes
  Marshes are usually inundated with water – surface water levels generally vary from a few inches to two or three feet. Marshes may be adjacent to lake fringes, pond edges, river edges or they may end by feeding into the groundwater system (subsurface flow).

- Wet Meadows
  Wet meadows sometimes appear dry due to the heavy grassland associated with them. In fact, for most of the year they don't have standing water, but the soil is saturated due to the high water table. Surface water is usually present only during the spring growing season. Wet meadows can either be found on a slope (such as a slope angled toward a river), or on the outside edge of a depression. For example, a pond may have a marshy area associated with its edges, and outside of the marshy area may be a wet meadow.

- Wet Lake Margins/Lacustrine fringe
  These wetlands are along the edges of lakes or man-made reservoirs. The water level in the fringe is maintained by the lake level. When the lake level is high, the fringe would be flooded and as the lake level goes down, the fringe is saturated but has no surface water. In Utah, wet lake margins may include salt grass, bulrushes, and spikerush, in addition to *Phragmites* and cattails.



- Playas
  A playa is a depression with very little vegetation, no outlets to other water bodies, and a high salinity. A playa has distinct wet and dry seasons. The depressions that form playas are thought to be created either by wind or natural sinkholes in the ground. Playas are common around the Great Salt Lake and in the Great Basin.

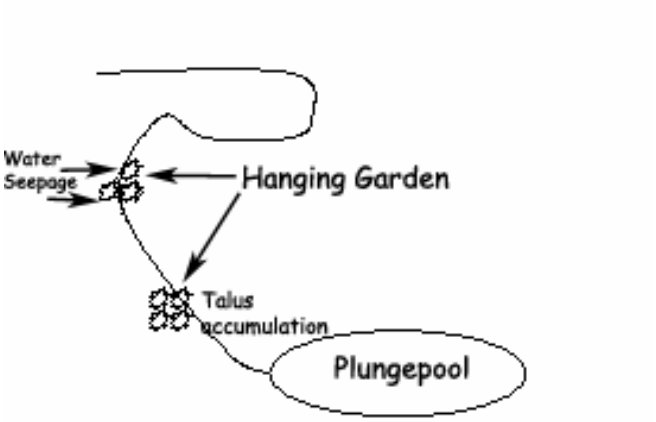
- Mudflats/Saltflats
  These wetlands are "flats" that may have outlets to other water bodies, and often will have no vegetation associated with them. The often occur on large, dry lake bottoms, such as Lake Bonneville. They are only fed by precipitation.

- Riparian wetlands
  Not all riparian areas include wetlands. Those areas found along the edges of rivers or streams that include wetland vegetation and hydric soil are wetlands. Where there is little precipitation, such as in southern Utah, riparian wetlands are an oasis of life. Some riparian

wetlands may be parts of a river that were cut off long ago from the rest of the river (cutoff meander, or old oxbow).

Unusual Wetlands

- Potholes & Plungepools
  These wetlands are found in southern Utah. A pothole is a depression in a rock where water accumulates. They sometimes, but not often, have a soil substrate. They often will have macroinvertebrates. Potholes are formed by rocks that grind a depression in a larger rock when pushed around and around by water. Plungepools are similar to potholes, except that they are found underneath an intermittent waterfall.



- Hanging Gardens
  Found in the rocks of southern Utah, hanging gardens occur where water seeps through cracks in the rocks along cliffs. The water creates an alcove and deposits sediments on or below the wall. Some plants grow there that aren't found anywhere else in Utah, including some species of orchid, lily, monkeyflower and primrose.

- Glacial Potholes
  These wetlands are ponds found in montane areas. They were formed by mountain glaciers that deposited large chunks of ice. Soil then filled in and around the ice chunk. As the ice melted, the deep pothole filled with water.

- Fens
  Fens only occur in the mountains and high plateau areas in Utah (montane/subalpine wetlands). Buffered by the calcium in the air and sometimes the rocks, fens are non-acidic peatlands.

Other Aquatic Ecosystems

- Lakes and Reservoirs
  These ecosystems are not really wetlands, but are classified as "deep-water habitats". They are deeper than 6 feet, and therefore function much differently than wetlands do. However, some lakes and reservoirs contain wetland areas (see wet lake margins above).

- Rivers & Some Riparian Areas
  Rivers are not considered wetlands because they have fast-moving water, creating an ecosystem that is distinctly different than a wetland. Some riparian areas are not wet often enough to be considered wetlands, and therefore function differently than typical wetlands. However, some riparian areas contain wetlands (see riparian wetlands, above).

3. What Lives in a Wetland?

Plants, animals and bacteria live in a wetland. Many have specific adaptations that allow them to live in a wetland environment. (Note: Plants and animals denoted by an asterisk (*) are non-native species).

Plants

Wetland plants, called hydrophytes (hydro=water, phyte=plant), have developed several adaptations that allow them to live in a water-logged environment. Wetland plants create oxygen through the process of photosynthesis, but also need to obtain oxygen from the environment for respiration through their roots. This presents a problem because wetland environments do not have much oxygen in the water or soil. Some of the special adaptations hydrophytes have to help them obtain oxygen via their roots in a low oxygen environment are listed below.

- Air spaces or aerenchyma: Some wetland plants have extra air spaces in their roots and stems. These air spaces allow oxygen to diffuse from the above-water stems down to their underwater roots.

- Air spaces on leaves: Plants with these air spaces are called floaters because they float on top of the water. The air spaces they have on the surface of their leaves take in oxygen. A special pressure created by temperature and water vapor pushes this oxygen down into the roots of the plant.

Some wetland plants are presented with other challenges as well. Plants found in salt marshes, or even those found in freshwater marshes where there is some salt, must find ways to deal with that salt. Some plants have salt glands that excrete salt out onto the leaves and stems of the plant. Other plants have a special chemical composition that keeps the salt out in the first place.

Native and non-native plants and other producers found in Utah wetlands

- Woody plants - Trees and shrubs such as:

alder	river birch
aspen	Russian olive*
box elder	tamarisk*
cottonwood	willows
dogwood	

- Non-woody plants:

alkali grass	hornwort
arrowgrass	manna grass
bistort	marsh marigold
bluebells	milkweed
blue vervain	mint
bog orchid	monkshood
bulrush	pickleweed
buttercup	pondweed
cattail	reeds
common reed	rushes
duckweed	salt grass
elephanthead lousewort	sea blight

sedges
skunk cabbage
small burreed
tufted hairgrass
twinberry
vetch
watercress*
wild iris (purple – native, yellow – non-native*)

- Other groups:
  Algae and bacteria

Animals
There are both aquatic and semi-aquatic animals, and even terrestrial animals that use wetland ecosystems. Aquatic animals have adaptations that allow them to live in water and a low-oxygen environment. Animals that are on Utah's Sensitive Species list (they are endangered, threatened, or sensitive species) are in *italics*.

Native and non-native animals found in Utah wetlands

- Mammals: Mammals that call wetlands home may have thick, oily fur, and webbed hind feet to allow them to live in a watery environment. Beavers have a broad, flat tail for swimming. Beavers and river otters can close their ears and nose when they swim underwater. They can also stay underwater for long periods of time – river otters can hold their breath 3-4 minutes, and beavers and muskrats can do this for up to 15 minutes!

  beaver
  mink
  moose
  muskrat
  northern raccoon
  northern river otter
  water shrew
  water vole

- Reptiles: Reptiles that are native to Utah wetlands generally do not have any special adaptations that allow them to live in that environment. Turtles are not native to Utah, but have been introduced in some places by humans. Turtles have webbed feet, allowing them to swim in water.

  black-necked gartersnake
  common gartersnake
  cornsnake
  smooth green snake
  snapping turtle*
  spiny softshell turtle*
  painted turtle*

- Amphibians: Although adult amphibians mainly breathe through lungs, amphibians have moist, permeable skin through which they also breathe. Amphibian larvae breathe in the water using gills. Amphibians also have permeable eggs that allow oxygen into the egg from the water. Adult frogs have webbed feet to facilitate swimming.

American bullfrog*
Columbia spotted frog
northern leopard frog
western (boreal) toad
green frog*
canyon tree frog
Great Basin spadefoot toad
tiger salamander
western chorus frog
woodhouse's toad

- Fish: Fish have gills, which they use to breathe in water. These gills have blood close to the surface of the skin to facilitate the diffusion of oxygen from the water into their body. Fish have streamlined bodies and fins that allow them to swim quickly in water.

black bullhead*
black crappie*
bluegill*
brown trout*
carp*
channel catfish*
fathead minnow*
green sunfish*
largemouth bass*
longnose dace
rainwater killifish*
redside shiner
speckled dace
western mosquitofish*
white bass*
yellow perch*

- Invertebrates: There are many invertebrates that either live in the water their entire lives, or only for the nymph, larval, or pupal stage. Invertebrates that live in the water have a few different adaptations to get oxygen. Some have gills; for example, a mayfly nymph has gills on its abdomen. Other invertebrates, such as diving beetles or water boatmen, carry air bubbles under their wings or trapped in the hair on their abdomens. These organisms often either have a very powerful heart, an increased density of blood vessels, or a very efficient circulatory system to be able to live in a low oxygen environment. They will also sometimes decrease their activity level when oxygen levels are extremely low. Many aquatic invertebrates have flattened, fin-like legs for swimming, while others, such as the water strider, have paddle-like legs that allow the striders to "skate" across the water surface.

back swimmer
brine fly
caddisfly
crayfish*
damselfly
dragonfly
giant water bug
horsefly
isopod
leech
mayfly
midge
mosquito
nematode
phantom midge
predaceous diving beetle
scud
snail *(some mollusks are on Utah's sensitive species list)*
springtail
water boatman
water flea
water mite
water scorpion

water strider
whirligig beetle
worms

- Birds: Some birds have adaptations that allow them to live in a wetland environment. Ducks and geese have webbed feet that allow them to paddle in the water and sometimes even swim underwater. Most ducks and geese have rounded bills, which they use to dabble in the water for plants and small invertebrates to eat. Shorebirds do not have webbed feet, but they do have long legs, allowing them to wade in water. They also have long bills used for probing the mud for invertebrates living there. Some birds, such as the marsh wren and red-winged and yellow-headed blackbirds are adapted to nesting in wetland vegetation, such as cattails. In spring the blackbirds are easily seen and heard in a wetland, as they are singing to try to find mates.

American avocet
American bittern
American coot
American wigeon
American white pelican
bald eagle
belted kingfisher
black-bellied plover
black-crowned night heron
black-necked stilt
blue-winged teal
bufflehead
California gull
Canada goose
canvasback
cattle egret*
cinnamon teal
common goldeneye
common merganser
common yellowthroat
double-crested cormorant
eared grebe
Forster's tern
Franklin's gull
gadwall
great blue heron
greater yellowlegs
green-winged teal
killdeer
least sandpiper
lesser scaup
long-billed curlew
long-billed dowitcher
mallard
marbled godwit
marsh wren
northern harrier
northern pintail
northern shoveler
osprey
pied-billed grebe
redhead duck
red-winged blackbird
ring-billed gull
ruddy duck
sanderling
snowy plover
song sparrow
sora
tundra swan
Virginia rail
western grebe
white-faced ibis
Wilson's phalarope
yellow-headed blackbird
willet

4. What Happens in a Wetland?

Several major processes occur in wetlands at different rates or greater complexity than in many other ecosystems. The presence of water for at least part of the growing season promotes growth and productivity in wetlands. Three major processes- soil formation, life cycles, and food webs- are discussed in detail.

- Soil Formation

  During the growing season, wetland soils are saturated long enough to create an anaerobic (low oxygen) state. These soils are referred to as "hydric". This anaerobic condition limits the type of plants that can grow here.

  In some wetlands that are saturated for most of the year, soils consist primarily of organic material. In these soils, dead plant matter accumulates faster than it can decompose. This causes the soil layer to become thicker year after year. In these areas one would expect to find mosses, cattails, manna grass, and other herbaceous emergent vegetation.

  In areas that are saturated for only part of the growing season, different wetland soils are formed. These soils are composed of sand, silt, and clay and have a high mineral content. They are found in warm, wooded wetlands where decomposition of plant material is as fast as accumulation.

  Some characteristics of hydric soils include:
  1. Green, dark gray, brown, or black in color;
  2. Soil that has a wet feel or oozes between the fingers;
  3. Mottled coloring, red or black concentrations of color resulting from mineral staining;
  4. Sulfurous smell (rotten egg).

- Life Cycles

  While many organisms use wetlands for only part of their lives, many plants and animals depend upon wetlands for their entire life cycle. The abundant habitat that wetlands provide can be important to animals during different stages of their lives. Some examples include:

  1. Dragonfly larvae live in the water and feed on other insects. After a year or two, the larvae climb up a plant stalk and emerge from their exoskeleton with wings and begin to fly as adults. Eventually, the adults lay eggs underwater on wetland plants. The eggs hatch into larvae and the cycle repeats itself. Some dragonflies may occupy the same wetland for several generations.

  2. After hatching from eggs, tiger salamander larvae live in wetlands as they begin to grow. In order to survive underwater, the tiger salamander larvae have external gills and a fin-shaped tail for swimming. After a year or two, the larvae transform into adults, at which point they leave the wetland. Adult tiger salamanders live mostly in upland habitats, such as grasslands, meadows,

and forests, and return to the wetlands each spring to lay eggs on underwater vegetation.

3. Many species of waterfowl and shorebirds migrate south to spend their winter feeding in wetlands. Once the winter is over, the birds fly north, where they build nests and lay eggs in other wetlands. When the young birds hatch, they feed and take cover among the wetland plants. Even though the birds may travel thousands of miles, they depend upon wetlands for all stages of their life. For example, the American avocet winters on coastal wetlands in Mexico, but nests on the shores of the Great Salt Lake in summer.

4. Beavers live in wetlands along the edges of streams and rivers. They feed on the bark and twigs of trees such as aspen, birch, and alder and build dams from trees that they cut down with their teeth. As a dam is constructed, the beavers build a lodge to live in, where they raise their young. As a result of building dams, beavers often flood upland areas and create more wetlands.

- Food Webs

  Food webs are made up of the organisms that live in a wetland and their interactions with each other. Each organism that lives in a wetland is a producer, consumer, or decomposer. A food web is often made up of several food chains. An example of a food chain is: the sun provides energy to plants (producers), which are eaten by aquatic insects (primary consumers), which may then be eaten by a shorebird such as a killdeer (secondary consumer). Once the killdeer dies, bacteria and fungi (decomposers) feed on the killdeer and make nutrients available to other organisms. Food webs often have a very complex set of interactions between all of the food chains in an ecosystem.

5. Benefits of Wetlands

- Habitat
  Wetlands are among the most productive ecosystems in the world. Nationwide over 5,000 species of plants, 190 species of amphibians and 270 species of birds depend on wetlands for food, shelter and space. Wetlands are important spawning and nursery areas for commercial and recreational fish and shellfish industries, as well as feeding, nesting and shelter zones for fish and migrant birds.

- Climate Control
  Many wetlands return over two-thirds of their annual water input to the atmosphere through evapotranspiration, which act to moderate temperatures and humidity in adjacent uplands. Also, wetlands store carbon within dead plant matter and soil, reducing the release of carbon dioxide into the atmosphere. Carbon dioxide is a greenhouse gas that may contribute to global warming.

- Decontamination
  Wetland soils remove harmful phosphates, metals and agricultural runoff from surface and ground water. Wetland plants take up and use the nutrients and chemicals carried in collected sediments, which would otherwise contaminate rivers, lakes and groundwater supplies.

- Flood Control and Water Storage
  Wetlands control flooding by slowing down and spreading out fast moving water. They also absorb water like giant sponges and slowly release it into downstream habitats and groundwater.

- Nutrient Cycling
  An abundance of decomposers in wetlands continuously break down materials into nutrients and make them available to plants, fish and invertebrates. Wetland processes play an important role in the cycling of carbon, nitrogen, phosphorus and sulfur, constantly transforming and releasing them into the atmosphere. The abundance of aquatic and terrestrial plants in the world's wetlands contributes significantly to oxygen in the atmosphere.

- Soil Conservation
  Water flowing into wetlands loses speed, causing material eroded from upstream to accumulate for use by plants and animals. Plants bind soil to help it stay in place. Wetlands capture sediments and debris that could otherwise threaten life downstream by filling in deep areas, covering eggs or clogging animals' gills. Some wetlands remove up to 90% of sediments passing through them.

- Human Enrichment
  Wetlands provide beauty, recreation and solitude to many.