Key Concepts – Lessons 1-4

Intro to Refuge System

Willapa National Wildlife Refuge (NWR) is one of over 550 national wildlife refuges in the U.S. That's a lot of places – some are big and some are small – but all these refuges are homes for plants and animals. You are really lucky to have Willapa NWR nearby. It was established in 1937 to protect migratory birds – ducks, geese and shorebirds. It is unique among many refuges because it has so many different plants and animals. So many plants and animals live there because of the diversity of habitats…

What is a habitat?

- Each plant or animal requires food, water, shelter, space.
- Non-living (abiotic) elements determine what food, water, shelter and space are available for those plants and animals. An easy way to remember what abiotic elements are is to remember the LAWS.

L = Light

Energy from the sun drives most ecosystems through the process of photosynthesis (plants make food from carbon dioxide, water, nutrients and sunlight). The amount of light determines what plants will live in a specific habitat.

A = Air

Temperature and wind shape life. Each organism's body is tuned to a certain temperature. Too hot or cold and the organism will struggle to eat, breathe and move. Wind increases the loss of an organism's heat and water. High winds can shape an organism – think of the trees along a windy coastline!

W = Water

All life needs water to survive. The amount of water an organism varies from a lot to a little – compare a garter snake to a salmon.

S = Soil

It's more than dirt! The amount of sand, silt and clay particles, air space, water, minerals (like nitrogen) and organic material (dead plants and animals) affect what lives there.

In addition - Catastrophic Events like fire, floods, tsunamis and wind storms can change a habitat quickly.

Willapa NWR has lots of Habitats

Because there are so many parts of Willapa NWR, the different amounts of L.A.W.S. create over 10 different habitats at the Refuge. The students have learned about the 5 most common:

- Bay
- Mudflats and Salt Marsh
- Freshwater Wetlands, Streams & Ponds
- Dunes & Grasslands
- Forest

Intro to Adaptations

Adaptations – how an organism's structure or behavior allows it to survive in a particular ecological niche/habitat include behaviors and structures. Remember the various amounts of L.A.W.S. create different habitats. Adaptations help an organism find and get food, water, shelter and space from a habitat.

Behaviors include how an organism gets food, water, and shelter. What time of a day an organism is most active and seasonal movements (migration) are behavioral adaptations.

Examples: Feeding and traveling at night (nocturnal) or dawn & dusk (crepuscular) helps animals hide. Much of Willapa's wildlife is either nocturnal or crepuscular, including: bats, beaver, porcupine, flying squirrels, owls, cougar, deer and elk. **Migration** (yearly or twice yearly animal movements) maximizes food and minimizes competition with other organisms. Shorebirds, such as the Red knot, travel through Willapa Bay each spring on their way to the artic from Mexico and Central America. Some Red knots travel from the southernmost tip of South America to the artic and back each year - a distance of 9,300miles (15,000km).

Structures are how the organism is shaped or how parts of an organism function.

Examples: Kinnickinnick grows low and long with leathery leathers to help it cope with strong winds and sun of dunes. Many adaptations can be seen. They can help us identify the organism. For example, birds have different shaped bills, legs and feet that help us know a Great blue heron (long legs and toes, and slender, long bill) from a Green-winged teal (short legs, webbed feet, and a wide flat bill).

Bird ID based on adaptations

We can use structural and behavioral adaptation to get to know the birds that nest, rest and winter on the refuge.

Bird Parts: Nape, Chin, Crown, Breast, Shoulder, Belly, Legs, Back, Throat, Wings, Rump, Bill (Mandibles)

Field Marks are stripes and spots, caps, crowns, rump patches and wing, tail, bill markings that are unique to a specific species.

Shape Look at its silhouette. Is it tall and thin, or compact and plump? Long legs or short? Is its body longer than it is tall? What shape is the bill? the feet? the tail?
Behaviors can help us, too – Does it climb trees, wade, swim, fly, perch? How? Does it twitch or bob? How does it feed?

Adaptations determine the job an organism has:

- Producer = makes food from non-living elements, generally plants
- Herbivore = organisms that eat plants
- Carnivore = organisms that catch and eat the flesh of animals
- Omnivore = organism that eats both plant matter and animal flesh
- Detritivore/Scavenger = an organism that eats decaying matter or animals killed by other organisms

Everybody is connected in a "web of life":
It's easy to see how things are connected by who eats whom: Plants **produce** food using the sun (some steal it from others – saprophytes). Herbivores and omnivores eat plants and are **prey** for **predators**. Sometimes predators are in turn eaten by other predators. Waste (dead plants and animals, poop, cough pellets and urine) is not wasted - it is recycled into nutrients and soil by fungi, bacteria, worms and insects, and/or scavenged by animals. AND there is more to the web of life – think about habitats and where an organism gets its food, water, shelter and space. This may link an organism to something else in the web – not because it eats or is eaten by another organism, but because it needs that organism for shelter. Nature is complicated doesn't always follow our rules

Explorers use all of their senses and their great minds to 'read' clues in nature and unravel the web of life: You can use your observations of adaptations to determine what an organism's job is and you don't even need to see the whole animal to make a good guess. Since most wildlife can move, would rather not be near you (we are predators after all!)– Think about what is left behind: poop, tracks and bones (Remember that owl pellet? What about a hair-filled coyote poop, or berry-filled bear scat?)

PREY: Eyes on sides of head to see danger, eaten by others
PREDATOR: Eyes facing forward for binocular vision; capture & eat other animals
HERBIVORE: Clipping teeth in front, grinding teeth in back for eating plants
CARNIVORE: Sharp teeth for holding and tearing for catching and eating animals
OMNIVORE: Mix of all teeth, eats plants and animals

Generalist species use a broad range of habitat, **specialists** can only live in specific places or eat a few things.

Change happens **in and to the web of life** – animal and plant populations rise and fall (snowy owls irrupt every 6 years, invasive species), storms and natural events (floods, fires, and windstorms) alter habitats, humans can change habitats for better or worse. Change can happen on a local, regional, national,

global scale (climate change…) Changes in populations or behaviors of specialist species can be an indicator of a change in the habitat because they cannot easily move or use another habitat.

Willapa is all about change – life here is adapted to daily tides, and seasonal winds and floods. These processes create rapid changes to L.A.WS. on habitat edges as sediments move, trees and plants change (death or growth), and salinity and temperatures fluctuate. You have been learning about how organisms adapt to use habitat and how things are connected in the web of life. Today you'll be learning about what happens to organisms when their habitat changes. You will do this by using a simplified process like the one Refuge scientists use to help wildlife:

a) use your understanding of Willapa NWR's habitats and the adaptations of organisms (**facts** that you have gained in previous lessons);
b) apply **inference** (educated guess) as to what may happen due to a human-influenced change to the habitat;
c) test your guess using a simple **experiment**. (Use your senses to make **observations**)

When scientists test their inferences, they try to create an experiment to ensure the results accurately reflect what they are testing for. They do this by eliminating or accounting for variables (things that may change the results) that may distract from or confuse the experiment's outcome. They also complete the experiment many times to increase the likelihood that the results did not happen by chance.

Fact: A thing that has actually happened or is actually true; the state of things as they are. An example would be that the measurement of a particular bird's bill that is 4 inches long and ¼ inch around and I observed the bird in the mudflat habitat.

Inference: The act or process of using the information we know to make an educated guess. An example would be observing the structural adaptations of a bird's bill and inferring what it eats. Based on the measurements above and the habitat I found the bird in, I can guess that it probes in the mud to catch prey.

Experiment: A test with the purpose of discovering something unknown or to support an idea. An example of an experiment based on this inference would be to make a series of observations about how the bird feeds (does it stick its bill in the mud or does it catch things out of the air?).

Variable: Something that may or does change. It is important to note things that may change the results of an experiment. For example the bird may have several different behaviors it uses to find food, the bird may use a habitat to rest or nest rather than feed.