Refuge Explorer Program Key Concepts

The Willapa National Wildlife Refuge Explorer Program offers a relevant and hands-on opportunity for fourth grade students to discover local wildlife, science and stewardship. Below is a brief overview, including the key concepts, of each classroom lesson and Refuge Expedition.

Lesson 1 – A Wildlife Refuge in Your Backyard

Willapa National Wildlife Refuge offers an opportunity for students to build on what they already know and begin to explore the scientific process. In this lesson students will put their understanding of Washington State's natural and cultural history to the test through hands-on discovery of local habitats and wildlife.

This lesson's activities will help students to understand:

- The **National Wildlife Refuge System** protects habitats and that the local refuge is highly diverse.
- A **habitat** contains and is defined by the availability of food, water, shelter, and space.
- All habitats consist of varying levels of **non-living, or abiotic, elements**. These elements are light, air, water and soil. An easy way to remember these elements is that they are the L.A.W.S. of an ecosystem.

Intro to Refuge System

Willapa NWR is one of over 550 national wildlife refuges (NWRs) in the U.S. That's a lot of places – some are big and some are small, but all National Wildlife Refuges protect habitats for wildlife (plants and animals) for future generations. NWRs conserve America's wildlife heritage – a living museum of sorts! Willapa National Wildlife Refuge was established in 1937 to protect migratory birds – ducks, geese and shorebirds. It is unique among many refuges because it has so many different habitats, plants and animals.

What is a habitat?

- Every plant and animal requires food, water, shelter, and space. When combined these things are called "habitat".
- Non-living (abiotic) elements determine what food, water, shelter and space is available for the plants and animals in a specific location. An easy way to remember what abiotic (non-living) elements are is to remember the L.A.W.S.

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. Think about the amount of light you find in a forest compared to what you find in a meadow or pasture.

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 needs varies from a lot to a little – compare a garter snake to a salmon. There are different amounts and types of water; deserts compared to estuaries and fresh water to salty.

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. Humans and invasive species can also change a habitat.

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. Students learn about 3 (or 4) of the most common:

- Forest
- Estuary
- Freshwater Wetlands, Streams & Ponds
- *Grasslands & Dunes (optional)*

Lesson 2 – Everything is Connected in the Web of Life

Willapa National Wildlife Refuge offers an opportunity for students to build on what they already know and begin to explore the scientific process. In this lesson students expand their knowledge of local habitats and wildlife by making educated guesses about the interrelatedness of Refuge wildlife through focused observations.

This lesson's activities will help students to understand:

- All life is **interrelated**.
- **Adaptations** are behavioral and structural characteristics that allow a plant or animal to survive.
- Plants and animals have roles within an ecosystem, including **producers**, **herbivores**, **carnivores**, **omnivores**, **detritivores/decomposers/scavengers**, as well as **predators** and **prey**.
- Animals and plants can be labeled as either **generalists** or **specialists** depending on the number of habitat elements they can utilize as food, water, shelter or space.

Intro to Adaptations

Adaptations can be defined as how an organism's structure or behavior allows it to survive in a particular ecological niche/habitat. 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.

Behavioral Adaptations 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) help animals hide. Much of Willapa's wildlife is either nocturnal or crepuscular, including: bats, beaver, porcupine, flying squirrels, owls, cougar, deer and elk. **Migration** (twice yearly animal movements) maximizes access to food and minimizes competition with other organisms.

Shorebirds, such as the Red knot, travel through Willapa Bay each spring on their way to the arctic from Mexico and Central America. Some Red knots travel from the southernmost tip of South America to the arctic and back each year - a distance of 9,300miles (15,000km).

Structural Adaptations include how the organism is shaped or how parts of an organism function to utilize its habitat.

Examples: Plants that live in the water (like Eel grass or Different-leaved water starwort) don't have or don't need a rigid structure because the water supports the stems and leaves.

Many adaptations can be observed. They can help us learn about the organism and help us make an educated guess about their lives. For example, birds with webbed feet, such as the Green-winged teal, most likely are adapted to live in a wet habitat (like an estuary or freshwater wetland).

Adaptations determine the role an organism plays in the ecosystem

- **PRODUCER:** makes food from non-living elements like sunlight or minerals in the soil. Plants do this through photosynthesis.
  Adaptations: leaf shape and size, evergreen or deciduous
- **HERBIVORE:** eats plants
  Adaptations: Clipping teeth in front, grinding teeth in back for eating plants
- **CARNIVORE:** catches and eats animals
  Adaptations: Sharp teeth for catching, holding, tearing and eating animals. Most have large, strong feet and claws for catching animals.
- **OMNIVORE:** eats both plant matter and animal flesh
  Adaptations: Mix of all teeth; sharp teeth for cutting, grinding teeth for chewing.
- **DETRITIVORE/DECOMPOSER:** Eats dead plants or animals, or waste
  Adaptations: could have a slimy or hard cover to protect from decomposing material.
- **SCAVENGER:** an organism that eats animals killed by other organisms
  Adaptations: good sense of smell, strong jaws, minimal fur or feathers near mouth. Many omnivores and carnivores are also scavengers.
- **PREY:** An organism that is eaten by another
  Adaptations: Eyes on sides of head to see danger.
- **PREDATOR:** An organism that catches and kills another organism to eat
  Adaptations: Eyes facing forward for binocular vision which helps to pinpoint and catch prey.

Everything 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 other plants – 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, scat, cough pellets and urine) is not wasted - it is recycled into nutrients and soil by fungi, bacteria, worms and other invertebrates, and/or scavenged by other 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.

Refuge Staff and Explorers use all of their senses and their great minds to 'read' clues in nature and unravel the Web of Life: Students can use observations of adaptations to determine what an organism's role is and they don't even need to see the whole animal to make a good guess. Since most wildlife can move, and doesn't like to be around humans (we are predators after all!), – anyone can use what wildlife leave behind to make an educated guess about their connections in the Web of Life. Scat, tracks and bones all provide valuable insights to the lives of the animals that left them behind. (Remember that owl pellet? What about a hair-filled coyote poop, or berry-filled bear scat?)

Nature is complicated, doesn't follow our rules, and is all connected
Some organisms from one habitat are connected to organisms in another, or they use more than one habitat (like elk, coyote and bear). These organisms are called **Generalists** because they can use a broad range of habitat. **Specialists** can only live in specific places, like the Marbled murrelet, or only eat a few things, like the Oregon silverspot butterfly.

Lesson 3 – Change Happens

Willapa National Wildlife Refuge offers an opportunity for students to build on what they already know and begin to explore the scientific process. In this lesson students put their knowledge of local habitats and wildlife to the test by making and testing their educated guesses about the effects of habitat change. Refuge staff go through a similar process to drive real-life conservation efforts.

This lesson's activities will help students to understand:

- **Environmental change** happens. It can be caused by natural processes and human enhancement, alterations or interactions. Nature is not static.
- Organisms react to environmental change. Specialist species can be an **indicator** of habitat change.
- National Wildlife Refuges are good places for **scientific experimentation**.
- People can use **facts** to make educated guesses, or **inferences**. **Experiments** allow people to test the inferences the make through the collection of more facts, i.e. data.

Change happens in and to the Web of Life
Animal and plant populations rise and fall (snowy owls irrupt every 6 years, invasive species infiltrate a habitat), storms and natural events (floods, fires, and windstorms) alter habitats, and humans can change habitats for better or worse. Change can happen on a local, regional, national, or global scale (e.g. 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. For example, the decrease in the Western snowy plover population can be an indication of habitat change in the coastal dune habitat.

Willapa is all about change

Life at Willapa NWR is adapted to daily tides, and seasonal winds and floods. These processes create rapid changes to the L.A.W.S. on habitat edges as sediments move, trees and plants change (death or growth), and salinity and temperatures fluctuate. Students have been learning about how organisms adapt to use habitat and how things are connected in the Web of Life. In this lesson they explore what happens to organisms when their habitat changes using a simplified process like the one Refuge scientists use to model the effects of change and to help wildlife. There are basically three steps in this process:

1. use your understanding of Willapa NWR's habitats and the adaptations of organisms (**facts** that you have gained in previous lessons);
2. make an **inference** (educated guess) as to what may happen due to a human-influenced change to the habitat;
3. test your inference by conducting a simple **experiment**. Make observations before, during and after the experiment to collect data – more facts!"

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 **repeat** 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. For example: the number of Western snowy plovers counted, the specific location/habitat in which they were found, and the behavior observed in each location.

Inference: An educated guess based on information you know to be true. For example: Because the Western snowy plover populations were decreasing dramatically in the area, Refuge scientists made an educated guess that the invasive beach grass was crowding out the plover's nesting habitat.

Experiment: A test with the purpose of discovering something unknown or to support an idea. Experiments are often repeated several times to compare results. For example: In 2001, Refuge staff removed several acres of beach grass. The following spring, plovers were observed nesting in the newly restored habitat. The Refuge continued to remove new areas of beach grass each winter, and more and more plovers were found nesting.

Variable: Something that may or does change. It is important to note things that may change the results of an experiment. For example: there are many factors that affect the numbers of plovers, such as nesting and feeding habitat, winter habitat, predation, disturbance, etc. Through careful observations, Refuge staff discovered that crows and ravens were using the closure signs as perches from which to find and prey on plover eggs and chicks.

Refuge Expedition

A visit to Willapa National Wildlife Refuge offers an opportunity for students to use their knowledge and observation skills gained from classroom lessons and workbook extensions. During the expedition students test educated guesses about Refuge wildlife, collect data, and report this information to Refuge staff.

This lesson's activities will help students to apply:

- Knowledge of the use of facts, inference and experiments.
- All their senses to make and record detailed field observations.
- Skill in sharing field observations in a concise and thoughtful manner.
- Understanding that everyone is responsible for the success of National Wildlife Refuges and the future of wildlife.
- *Optional: Individual quiet time can support personal observation, reflection and connection with the wild.*