This presentation was originally designed to be presented to teachers but has been modified for students of grades 4-12. This presentation can be used as an introduction to a unit on Washington habitats and wildlife or as a supplement to a social studies unit on Washington state. You may wish to modify the text or format of the presentation to adapt the presentation for your students.

**WASHINGTON WILDLIFE**

POWERPOINT SCRIPT

Prepared by Woodland Park Zoo Education Department

*Developed 2001, updated 2017*

Using this script, you can present this PowerPoint for your students, or have students work together to present the PowerPoint to the rest of the class. The entire presentation will take approximately one hour (between 10 and 15 minutes for each habitat section).

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# Slide 1

**Woodland Park Zoo – Washington Wildlife**

This presentation was originally developed in 2001, updated in 2017.

# Slide 2

**Washington Wildlife**

## **Steppe**

## **Montane**

## **Temperate Forest**

## **Wetlands**

## **Urban**

This presentation is going to focus on five important habitats found in Washington state. There are many other vital habitats however, due to time limits, today we will focus on steppe, montane, temperate forest, wetlands and urban.

# Slide 3

**Find your way around the teacher packet:**

This presentation accompanies a teacher packet with further background and information – the teacher packet can be downloaded at [www.zoo.org/resources](http://www.zoo.org/resources).

# Slide 4

**Cross-section of Washington showing the effect of topography on climate variations**

One of the key factors influencing habitats is topography. This slide illustrates a cross-section of Washington state topography and can help us understand resulting climate factors that have contributed to the formation of Washington’s diverse habitats. The Olympic and Cascade mountains, lying to the west of the Columbia Basin, work together to form an effective barrier to moisture-laden marine air. When the marine air reaches the mountains, the air rises and cools, dropping its moisture on the west side slopes, before descending into the Columbia Basin. The annual amount of precipitation falling east of the Cascades is drastically lower than that of western Washington. Also, the contrast between winter and summer temperatures is greater east of the Cascades.

# Slide 5

**Steppe**

## **Columbia Basin region of eastern Washington**

## **“Steppe” derived from Russian word for “vast, treeless plain”**

## **Often referred to as “shrub-steppe” or “sagebrush steppe”**

## **Abundance of shrubs (primarily sagebrush)**

## **Climate:**

## **low annual precipitation (avg. 10-15 inches)**

## **hot, dry summers**

## **cold, windy winters**

## **most precipitation during winter**

Steppes are most similar to savannas (tropical grasslands) but occur in temperate regions and tend to have fewer trees than do savannas. Steppe regions are often referred to as “shrub-steppe” or “sagebrush steppe” because they are characterized by an abundance of shrubs (primarily sagebrush).

# Slide 6

**Map showing the range of steppe habitat in Washington state**

Steppe habitats occur in the region of Washington state known as the Columbia Basin. The Columbia Basin is higher in elevation than the lowlands of western Washington, but is still topographically a basin in that mountains surround it on all sides.

# Slide 7

## **Steppe vegetation**

## **Canopy of shrubs (this layer absent in “true steppe”)**

## **mainly sagebrush, approx. 3 feet high**

## **Second layer of tall grasses**

## **mainly bluebunch wheatgrass**

## **Third layer of low grasses and herbaceous plants**

## **such as Sandberg’s bluegrass and arrowleaf balsamroot**

## **Ground layer of “cryptogamic crust”**

## **symbiotic relationship of fungi, algae, cyanobacteria, mosses and lichens**

“True steppe” occurs mainly in the region of the Palouse Hills (southeastern Washington) where the climate is slightly wetter and the soils are deeper than in other parts of the Columbia Basin. Sagebrush shrubs are few and far between in the true steppe because grasses can outcompete shrub seedlings for moisture on the fertile soils of this region. This results in an abundance of grasses and an absence of shrubs. The true steppe is dominated by bluebunch wheatgrass and Idaho fescue.

# Slide 8

**Illustration of layers of steppe vegetation**

# Slide 9

**Adaptations of steppe plants**

## **Must be able to survive temperature fluctuations and lack of water during the growing season**

## **Hairs on leaves (results in gray appearance)**

## **prevent moisture loss by creating layer of still air over pores on underside of leaf**

## **reflect sunlight**

## **Waxy cuticle on leaves**

## **prevents moisture loss**

# Slide 10

**Adaptations of steppe plants**

## **Specialized roots**

## **big sagebrush has far-reaching shallow roots to catch water from rainstorms and very deep roots to reach groundwater**

## **More perennials than annuals**

## **perennials use permanent root systems to take advantage of spring rains**

# Slide 11

**Steppe vegetation**

**Photos:** big sagebrush, larkspur and Indian paintbrush

# Slide 12

**Steppe vegetation**

**Photo:** bitterroot

# Slide 13

**Steppe vegetation**

**Photos:** Carey’s balsamroot, bluebunch wheatgrass

# Slide 14

**Steppe vegetation**

**Photos:** hedgehog cactus, bitterroot and darkling beetle, wolf lichen on sagebrush

# Slide 15

**Agriculture in the steppe**

Taking advantage of the fertile soils, much of the western part of the Columbia Basin has been farmed with the aid of heavy irrigation since the 1950s, provided with the help of dams. Field corn, fruits, nuts, hops, mint, wheat and grapes are grown, particularly in the Yakima Valley. Irrigation and cultivation have both had significant effects on native vegetation. Native vegetation has been removed for agriculture and much of the land has been grazed, allowing introduced plant species to invade and take over, resulting in land that is less suitable for native wildlife. One interesting effect of the many years of heavy irrigation is that the water table has risen in parts of the Columbia Basin. This has created permanent wetlands in some areas, providing additional habitat for wildlife, such as migratory waterfowl.

**Photo:** Wanapum Dam

# Slide 16

**Steppe animals**

### **MAMMALS**

## **coyote**

## **badger**

## **mule deer**

## **kangaroo rat**

## **jackrabbits**

### **INSECTS**

## **Many insects, including butterflies, grasshoppers and darkling beetles**

### **REPTILES**

## **northern Pacific rattlesnake**

## **short-horned lizard**

### **AMPHIBIANS**

## **Great Basin spadefoot toad**

### **BIRDS**

## **sage grouse**

## **burrowing owl**

## **golden eagle**

## **ferruginous hawk**

Great basin spadefoot toads are very well adapted to the climatic conditions of the steppe. These toads will remain buried in mud to survive the dry times of year and will emerge with spring rains to mate. Once the eggs are laid and fertilized in temporary ponds and puddles, development proceeds very rapidly. The eggs hatch and the tadpoles grow and complete metamorphosis within a matter of weeks.

# Slide 17

**Steppe animals**

**Photo:** short-horned lizard

With their tough skin and leathery eggs, both acting to conserve moisture, reptiles are better adapted to the steppe than are amphibians. All reptiles of the Columbia Basin region hibernate during winter. Most lizards in eastern Washington are either diurnal (active during the day) or crepuscular (active during the early morning and evening). Many reptiles prefer rocky areas in the western part of the basin. The short-horned lizard, which eats primarily ants, digs burrows to escape midday heat, while the sagebrush lizard, which eats a variety of small arthropods, finds cover under shrubs and buries its eggs under them.

# Slide 18

**Steppe animals**

**Photos:** ferruginous hawk, darkling beetle, badger

Darkling beetles serve as important decomposers in the steppe, feeding on decaying organic matter. The wings of darkling beetles, unlike many other beetles, are fused together, one adaptation that helps them to conserve moisture.

Although many steppe animals burrow to escape their predators, there’s no escaping the voracious badger. Badgers can burrow to find food and will eat small mammals, reptiles, amphibians, insects and earthworms hiding underneath the soil surface. Badgers are omnivores, however, so they also consume seeds, fruits and roots of plants. Badgers exploit a wide variety of food sources and are very adaptable animals, as are coyotes. Both animals have been successful at adjusting to changes in their habitat. Ferruginous hawks, on the other hand, have suffered declining numbers due to the loss of their grassland habitat and the small mammals that they depend on for food. Ferruginous hawks nest on elevated sites, such as cliffs, outcroppings of rock, trees or telephone poles. The steppe region of Washington hosts a number of breeding pairs of ferruginous hawks. These hawks migrate to more productive feeding grounds for the winter.

# Slide 19

**Steppe animals**

**Photo:** Pygmy rabbit

Pygmy rabbits are native to the Great Basin region of the western United States, with a small population found in the shrub-steppe region of eastern Washington. Pygmy rabbits are listed as endangered in Washington state and under the federal Endangered Species Act. These rabbits dig burrows underground and rely primarily on sagebrush leaves for food. In Washington state, most of sagebrush-covered, deep soils have been turned over to agriculture, reducing the habitat available for pygmy rabbits. Sagebrush removal and over-grazing by livestock have also contributed to the decline of pygmy rabbits. In the late 1990s, the already small pygmy rabbit population in Washington declined significantly. Genetic studies determined that Washington’s pygmy rabbit population is genetically distinct from other populations in western North America. In light of the declines and the genetic significance of this population, the Washington Department of Fish and Wildlife launched a captive breeding program for pygmy rabbits in May 2001. Captive care and breeding proved to be challenging and the program shifted in 2011 to a new model of breeding pygmy rabbits in enclosures within their native habitat and releasing rabbits from those enclosures into surrounding habitat. The results since 2011 have been encouraging, with several hundred rabbits released back into the wild each year. That effort is ongoing (see [www.wdfw.wa.gov/conservation/pygmy\_rabbit](http://www.wdfw.wa.gov/conservation/pygmy_rabbit) for update information).

# Slide 20

**Montane Habitats**

## **Mountainous regions: Blues, Okanogan Highlands, Cascades, Olympics**

## **Three major zones within montane ecosystems:**

## **Montane forest**

## **Subalpine zone**

## **Alpine zone**

Montane means mountain habitats. Washington state is well known for its mountains, which include the Blue Mountains, Okanogan Highlands, Cascades and the Olympics. Within montane regions there are three major habitat zones: montane forests, the subalpine zone and the alpine zone, which we will discuss in detail later.

# Slide 21

**Map showing locations of Washington’s mountains and the extent of montane/alpine habitat in Washington**

Before we define the montane zones, let’s take a look at where the various mountain ranges are located in Washington state. (*Show first map layer.*) Washington state includes two major mountain ranges and portions of four others. The Olympic mountains, on the Olympic Peninsula, are coastal mountains and receive the highest amount of yearly precipitation. The Cascades, running beyond the length of the state north and south, act as a climatic barrier, resulting in a wet western Washington and an overall dry eastern Washington. In the northeast are the southern arms of the Selkirks, the Kettle Range, and the Okanogan Highlands, all extending south from Canada. These three ranges are often together referred to as the Okanogan Highlands. In the southeast corner of the state lie the northernmost foothills and peaks of the Blue Mountains, extending north from Oregon.

(*Show second map layer.*) All six ranges support montaneforests and subalpine zones, shown here as “montane,” while only the Cascades and Olympics are high enough to support extensive alpine zones.

# Slide 22

**Montane climate**

## **With elevation gain, temperature decreases and precipitation increases**

## **However, montane habitats tend to be drier than habitats at low elevations because most precipitation falls as snow and melting snow quickly drains off of slopes**

Elevation can play a significant role in the formation of habitats. The low temperatures and lack of available water in a useable form help to determine the types of plants that will grow at various elevations and the wildlife that can survive.

# Slide 23

**Montane forest**

## **Colder, drier and more open than low elevation forests**

## **Snow pack: 3 - 10 feet deep on west side (less deep on east side)**

## **Canopy consists of evergreen conifers:**

## **Eastern WA species: lodgepole pine, whitebark pine, ponderosa pine, grand fir, western larch. At higher elevations: Engelmann spruce and subalpine fir.**

## **Western WA species: Pacific silver fir, noble fir, western hemlock, western white pine. At higher elevations: mountain hemlock, Alaska cedar and subalpine fir.**

Now let us take a look at those three zones mentioned earlier: the montane forest, the subalpine zone and the alpine zone. The lowest elevation level is the montane forest. Montane forests grow between approximately 2,000 and 4,000 feet in western Washington and between approximately 3,000 and 6,000 feet east of the Cascades. We will look at why montane zones are found at different elevations west and east of the Cascades a little later. *(Refer to slide for characteristics.)*

# Slide 24

**Subalpine zone**

## **Characterized by tree islands surrounded by meadows**

## **High precipitation and cold temperatures; significant snowpack (up to 25 feet deep on west side**)

## **Few trees able to grow; trees and shrubs are often stunted and misshapen (krummholz)**

## **Eastern WA:**

## **Conifers: subalpine fir, Engelmann spruce, whitebark pine, lodgepole pine, alpine larch**

## **Shrubs: mountain ash, huckleberries, mountain heathers**

## **Western WA:**

## **Conifers: mountain hemlock, Alaska cedar, Pacific silver fir, western white pine, noble fir**

## **Shrubs: same as eastern WA**

Moving up in elevation, the next montane zone is the subalpine zone. The subalpine zone is found between approximately 4,000 and 6,000 feet west of the Cascades and between approximately 6,000 and 7,000 feet east of the Cascades. In the harsh environment of the subalpine zone, many trees take on different growth forms than those exhibited by the same species growing at lower elevations. Wind breaks branches or tree crowns, causes plant tissues to dry out, and scours trees with small, airborne particles of ice. This wind action can damage limbs which face into the wind, resulting in a condition called flagging, where the branches grow only on the lee (out of the wind) side of the tree. Underneath the protective and insulating snowpack, stunted trees may grow wide skirts of branches. In some trees, these low-lying branches take root where they touch the ground. An erect stem grows up from the newly-rooted branch and the part of the branch connecting the parent and young tree dies. This method of regeneration is called layering. Layering often results in trees growing together in small islands within subalpine meadows. These islands provide adequate shelter from the harsh climate for other plants and animals.

Timberline is the transition between the subalpine and alpine zones and is usually a broad band, not a single line as implied by the name, in which trees become increasingly less frequent and eventually absent. Within the band of timberline, trees grow as krummholz. Krummholz, literally “crooked wood,” refers to trees that are excessively stunted and misshapen by wind. The two most drastic krummholz growth forms are trees that grow as cushions and trees that grow entirely prostrate (pressed flat along the ground surface). Growing closer to the ground reduces exposure to high winds and helps plants to retain heat. Understory species may find significant shelter within the cushions created by krummholz trees.

# Slide 25

**Alpine zone**

## **Extreme conditions:**

## **wind**

## **cold**

## **solar radiation and heat in summer**

## **dry, rocky soils**

## **Characteristic vegetation:**

## **no trees**

## **small, slow-growing plants, such as:**

#### sedges

#### grasses

#### mosses

#### lichens

#### mountain heathers

The highest elevation montane habitat is the alpine zone. In Washington, only the Cascade and Olympic ranges have mountains high enough to have alpine zones. This mountain zone is characterized by its lack of trees. The alpine zone is found above approximately 6,000 feet west of the Cascades and above approximately 7,000 east of the Cascades.

High elevation life presents difficult conditions for alpine plants. Fierce winds can damage and dry out vegetation. Temperatures often fluctuate from very cold to very hot, due to a higher degree of solar radiation. Alpine soils are generally rocky and unstable. What precipitation does fall, generally falls in the form of snow and is therefore not in a form that can be used by plants or animals. Snow and ice are present most of the year and little moisture is available during the summer months. Thick layers of snow insulate plants throughout the winter, giving them a chance at survival. Exposed ridges where snow is blown away are generally free of vegetation since no snow is present to insulate plants.

# Slide 26

**Alpine plant adaptations**

## **small size**

## **grow close to the ground to be out of the wind**

## **develop large root systems to capture limited water**

## **cushion shape to protect from wind and retain heat**

## **high concentrations of dissolved nutrients in tissues act as anti-freeze**

## **dark green leaves to absorb heat**

## **waxy leaves to retain moisture**

## **hairy leaves to retain moisture and reflect solar radiation**

Alpine plants have several adaptations to withstand the extreme conditions described in the previous slide. Most alpine plants grow close to the ground where wind speed is lower and they develop large root systems to capture what little moisture is available. Alpine plants often take on a cushion shape, which provides further protection from wind and also helps to retain heat. Some alpine plants have high concentrations of dissolved nutrients in their tissues that act as an anti-freeze. Some plants have dark green leaves that absorb heat or waxy leaves that seal in moisture. Other plants have hairy leaves, which help to retain moisture, prevent heat loss, and filter intense solar radiation. It is interesting that some of these adaptations, such as waxy or hairy leaves, are also found in steppe plants to prevent moisture loss (see “Adaptations of Steppe Plants,” Slide 8.)

# Slide 27

**Illustration of elevation ranges of montane forest, subalpine zone and alpine zone on the western and eastern slopes of the Cascade Mountains.**

With high precipitation and cold temperatures, snowpack has a significant influence on the upper limits of vegetation in the alpine, subalpine and montane forest zones. Where snowpack lingers, the growing season becomes too short for trees to establish themselves before the onset of the next frost and snow. Due to higher precipitation on the western side of the Cascades, snowpack is deeper and lingers longer, so alpine, subalpine and montane habitats exist at lower elevations than they do on the eastern slopes.

# Slide 28

**Subalpine habitat**

**Photo:** Salmo-Priest Wilderness - approximately 6,000 feet

The Salmo-Priest Wilderness is located in the northeast corner of Washington state in the Selkirk Mountains. This region is one of the last refuges for several species of large mammals in Washington, such as mountain caribou, moose and grizzly bears (see slide 32). This photo shows an eastern Washington subalpine meadow with trees along the upper edge of the meadow.

# Slide 29

**Subalpine habitat**

**Photo:** beargrass in the Salmo-Priest Wilderness

Despite its name, beargrass is not commonly eaten by bears, but the leaves are sometimes used by grizzly bears to line their winter dens. Elk and deer will eat the flower heads of beargrass.

# Slide 30

**Subalpine habitat**

**Photo:** Subalpine meadow and trees on Hurricane Ridge (Olympic National Park), approximately 5,000 feet, showing misshapen growth of trees (krummholz)

# Slide 31

**Subalpine flowers**

**Photo:** mountain heather, lupine, and Indian paintbrush

# Slide 32

**Impacts on montane habitats**

## **Logging moved up into montane habitats after lowlands were deforested**

## **affects habitats downstream**

## **East of Cascades, grazing and trampling by livestock (sheep) has affected understory forest vegetation**

## **Mining - gold, silver, gravel**

## **many mining projects started in the late 1800s failed**

## **Recreational activities including off-road vehicles, horseback riding, hiking, camping, mountain climbing, hunting**

Trees help to anchor soil and prevent erosion. When montane forests are logged, significant erosion can occur either in the form of landslides or soil being washed into rivers and streams. This can add heavy loads of silt to the waterways, affecting downstream habitats and wildlife as well. Livestock, mining and recreational activities can also have negative impacts on montane ecosystems.

# Slide 33

**Montane animals**

**• Many species migrate elevationally—use montane habitats in milder summer season**

**• Those that don’t migrate may hibernate, store food, or remain active under the snow**

## **butterflies**

## **ptarmigan**

## **Pacific giant salamander**

## **voles**

## **pocket gophers**

## **marmots**

## **badgers**

## **weasels**

## **wolverine**

## **bighorn sheep**

## **elk**

## **mountain goat**

## **moose**

## **mountain caribou**

## **lynx**

## **wolf**

## **grizzly bear**

Several amphibians of Washington are closely associated with montane environments. In mountain streams, larvae of one such animal, the Pacific giant salamanders can be found. These are the largest terrestrial salamanders in North America and they eat a wide variety of invertebrates as well as some small vertebrates such as snakes, shrews, mice and other salamanders.

The Selkirks in Washington’s northeast corner host both moose and mountain caribou, hoofed mammals not commonly found elsewhere in the state. Moose are the largest terrestrial mammals found in Washington. They eat a variety of leaves and aquatic vegetation. Mountain caribou are an endangered species in Washington. Over the past ten years, several successful relocations of caribou from Canada to Washington’s Selkirks have taken place. Lichens, mostly fallen from coniferous trees, are an important food source for caribou, particularly in the winter when little else is available.

# Slide 34

**Elk**

Elk and deer often migrate seasonally between high and low elevations. Western Washington’s subspecies of elk is the Roosevelt elk. Most Roosevelt elk migrate elevationally (spending the summer months high on the mountains and moving to lower elevations for the winter), while some remain at low elevations year-round. Washington’s other subspecies of elk, Rocky Mountain elk, live in the southeastern Cascades and in the state’s northeastern mountain ranges. Rocky Mountain elk seasonally move between subalpine elevations and low elevations. Rocky Mountain elk are descendants of elk reintroduced to the area from Yellowstone in the 1910s. Because elk were extremely popular game animals in the early part of the century, especially when wearing an elk tooth on a watch chain became highly fashionable, they were nearly eliminated from the Cascades prior to 1910. The elk were reintroduced to allow for continued but regulated sport hunting. By the mid-1980s reintroduction efforts had proven successful and there were 57,000 Rocky Mountain elk in Washington. Roosevelt elk, a small herd of females and one male, can be observed in the Northern Trail at Woodland Park Zoo.

**Marmot**

Marmots, which are medium-sized rodents, also make their homes in talus slopes, eating grasses, sedges and other green vegetation growing nearby. Unlike pikas and woodrats however, marmots hibernate through the winter. Yellow-bellied marmots of eastern Washington may begin their hibernation in midsummer when green plants have dried up. In a sense they start out estivating (a state similar to hibernation occurring during hot/dry periods) and continue through the winter hibernating. Marmots are considered to have the most complete hibernation of the animal kingdom. Their body temperatures drop as low as the air temperature in their burrows and their heartbeat slows from four beats per second (240 beats per minute) to only four beats per minute. Hoary marmots, native to subalpine and alpine regions of the Cascades and Okanogan highlands, live in the mountain goat exhibit in the Northern Trail at Woodland Park Zoo but are often difficult to see, especially when they are hibernating!

**Lynx**

The Okanogan Highlands are home to the largest population of Canada lynx in the lower 48 states. Lynx spend most of their time in the subalpine zone or in the upper elevations of montane forests. Lynx are similar in size to bobcats and have very short tails, but lynx generally have longer fur and legs than do bobcats, giving them a larger appearance. Lynx have very large paws in proportion to their body size and long back legs. These physical characteristics help lynx maneuver adeptly through snow in order to hunt their primary prey, snowshoe hares. Lynx are not often seen due to their solitary, nocturnal habits. Their numbers have decreased in the past century largely due to high demand for their fur in the late 1970s and early 1980s. Canada lynx were listed as threatened under the Endangered Species Act in April 2000 and are listed as threatened in Washington state.

# Slide 35

**Bighorn Sheep, Mountain Goat**

Bighorn sheep living in the Blue Mountains, on rocky slopes of the southeastern Cascades, and in the Okanogan Highlands are descended from animals reintroduced in the late 1950s. Mountain goats are native to alpine and subalpine regions of the Cascades but were introduced in the Olympic mountains in the 1920s as game animals for hunting. Mountain goats had never before inhabited the Olympics and their increasing numbers may be causing harm to native plants, some of which grow only in the Olympics and nowhere else in the world. This problem has caused wildlife managers to consider removing the animals from Olympic National Park, though whether to take this action and how this would be accomplished is up for debate. Both bighorn sheep and mountain goats feed primarily on grasses and other herbaceous vegetation, but during winter mountain goats depend heavily on mosses and lichens growing on subalpine firs as well as the trees’ foliage. Both species usually remain at high elevations throughout the winter, though they will migrate to lower elevations if snow becomes excessively deep. Several mountain goats can be seen grazing in a meadow or perching on rocky cliffs in the Northern Trail at Woodland Park Zoo.

**Wolverine**

Wolverines are the largest members of the weasel family and are formidable predators. They prefer timberline habitat with its mosaic of tree islands, open space and rocky areas. Wolverines are opportunistic scavengers, meaning they generally eat what they find. In the winter, wolverines eat carrion but they also dig up hibernating rodents. In summer wolverines eat small mammals, eggs of ground-nesting birds, insects and some berries and nuts. Wolverines have vast home ranges, up to 300 square miles (780 km²), and thus require large amounts of suitable habitat. Due to past persecution by humans in attempts to eliminate predators and to obtain fur, wolverines are now restricted to remote uninhabited areas of Washington. The numbers of wolverines in Washington and other parts of the western United States are considered to be very low and biologists have petitioned to have the wolverine added to the threatened or the endangered species list in the lower 48 states. The petition is still under debate in late 2001.

# Slide 36

**Gray Wolves**

Gray wolves once roamed throughout Washington state. However, most of Washington’s wolves had been killed by the 1920s because it was believed that wolves preyed heavily on domestic ungulates(hoofed mammals) as well as game animals. We are now beginning to understand the important role played by wolves in their habitat. Wolves primarily prey on elk and deer and are opportunistic hunters, killing the most vulnerable animals in a herd. In this way, wolves help to regulate the health and size of the herd by taking the old and weak as well as some of the young. Generally, if there are enough native prey in an area, wolves will not bother domestic animals. Wolves can inhabit almost any habitat from grassy plains to arctic tundra. Due to human activity throughout North America though, wolves have become restricted to isolated areas, particularly mountainous regions in western North America. There have been sporadic sightings of wolves in unpopulated forested areas of northeastern Washington. These wolves range southward into Washington from Canada. Because gray wolves are listed as an endangered species in Washington, plans to reintroduce them to suitable habitats in the state, such as Olympic National Park, are currently being considered. A small pack of three gray wolves can be observed in the Northern Trail at Woodland Park Zoo.

# Slide 37

**Grizzly Bears**

Grizzly bears, unlike black bears (see “Temperate rain forest animals,” Slide 45), prefer open high country and spend less time in closed forest. Also unlike black bears, grizzlies are not good tree climbers. The grizzly bear is a subspecies of the brown bear. The long claws of grizzlies are not used for defense or fighting, but primarily for digging up nutritious plant roots and for breaking into rotting logs in search of insects. Grizzly bears have limited elevational migrations but their patterns are opposite the migrations of many hoofed mammals; grizzlies den up for the winter at high elevations and range to lower elevations to find food in the spring. Grizzly bears eat a wide diversity of plants, including sedges, the underground bulbs of lilies, a variety of huckleberries and even devil’s club. Plants can make up to 90% of a grizzly bear’s diet. Carrion, fish and occasional deer or elk calves are also eaten. Bears are good swimmers and enjoy wallowing on hot days. In the Northern Trail at Woodland Park Zoo, two grizzly bears can be observed, often swimming and play-fighting in their waterhole.

Grizzly bears are not as widespread and are far fewer in number in Washington than are black bears. Only about 25 grizzly bears are thought to live in the Selkirks and from five to 20 in the North Cascades. These bears most likely move back and forth between British Columbia and Washington, and it is doubtful that these small populations will ever reach great numbers. This is due to the very slow reproduction rate of grizzly bears. A female grizzly, in her lifetime, will only produce from four to seven offspring that will go on to reproduce. This is the second slowest reproductive rate of North American mammals (muskoxen have the slowest). Because grizzly bears are listed as an endangered species in Washington, it is possible that efforts will be made to augment the populations in the North Cascades by introducing more grizzlies, probably from elsewhere in British Columbia. By adding some grizzlies to the existing population, the bears will have a better chance of producing enough individuals to attain what is referred to as a viable population. In order for a population to be viable over a long period of time, there must be enough genetic diversity and enough individuals for the population to survive natural threats, such as diseases and natural disasters. Ecologists have determined that a viable population of grizzlies in the North Cascades ecosystem, which includes Washington and British Columbia, would number from 200 to 400 animals. Find updates about this effort at <http://www.northcascadesgrizzly.org>

# Slide 38

**Temperate Forest**

## **Low elevation forests across the state**

## **Below 3,000 feet in eastern WA**

## **Below 2,000 feet in western WA**

## **Climate:**

## **High precipitation**

#### 15 - 30 inches annually east of the Cascades

#### 35 - 120 inches annually west of the Cascades (but averages up to 140 inches annually in temperate rain forests of Olympic Peninsula)

## **90% of precipitation falls between September and May**

## **Often summer drought**

## **Climate favors coniferous, evergreen trees over broadleaf, deciduous trees**

Low elevation temperate forests are found across Washington state in elevations just below the montane forests. Washington state forests are comprised mainly of coniferous evergreen trees. Why are broadleaf, deciduous trees at a disadvantage in our climate? Deciduous trees have broad leaves and are working at photosynthesis during the spring and summer months—when we get the least amount of precipitation—and are dormant during the fall and winter months—when we got the most precipitation. In addition, broad leaves lose significant amounts of water through the pores (stomata) on the undersides of the leaves. The needle-shaped leaves of conifers conserve water and heat, so evergreen conifers can photosynthesize during the times of year when the most water is present.

# Slide 39

**Map showing the range of temperate forest in Washington**

# Slide 40

**Eastern Washington temperate forest vegetation**

## **Conifers: ponderosa pine, Douglas fir, lodgepole pine, grand fir, western larch**

## **Broadleaf: quaking aspen, Garry oak**

## **Shrubs and herbaceous species typical of steppe in understory and forest floor**

Temperate forests of eastern Washington are much drier than those of western Washington, but have similar structure and share some species in common. The Olympic and Cascade mountains cause air flowing off the Pacific Ocean to rise and drop most of its moisture in western Washington. Thus, eastern Washington lies in the “rainshadow” of the Cascades. Precipitation in the low-elevation forests of eastern Washington ranges from 15 to 30 inches (38 to 75 cm). Fire is an important component of many forest ecosystems. Due to the drier conditions, fire is much more common in eastern Washington forests than in western Washington forests. When fires do occur, many forest floor species are adapted to grow back vigorously, providing an abundance of food for grazing animals. Several conifers, such as ponderosa pine, Douglas fir and western larch, have thick bark and are very fire resistant. Lodgepole pine trees cannot survive a hot fire but their seeds require fire to initiate germination. After a fire, many lodgepole pine seedlings sprout up and these trees dominate the forest until other conifers gradually replace them.

# Slide 41

**Temperate rain forest**

## **Defining characteristics:**

## **several layers of overlapping vegetation (forest floor, understory, canopy)**

## **trees that are long-lived and of great size**

## **thick layer of organic debris on ground**

## **cool, wet, acidic soils**

## **abundance of epiphytes**

## **dominated by coniferous trees**

## **networks of flowing water**

## **negligible disturbance by insect attack or fire**

## **downed logs and old stumps**

## **In Washington, found on the Olympic peninsula**

Thetemperate rain forest of the Olympic Peninsula is one of Washington’s remarkable ecosystems. Temperate rain forests, and the combination of special conditions that help create them, exist only in a few regions of the world. In addition to the Pacific Northwest, temperate rain forests can be found along the coasts of Australia, New Zealand and Chile, as well as small patches along the coasts of Japan, the United Kingdom and Norway. Of the total acreage of temperate rain forests worldwide, two-thirds is found along North America’s northwest coast.

The availability of moisture is an important factor in the growth of temperate forests. Rain forest trees obtain water not only from the wet river valleys they grow along, but also from rain, snow and moisture that condenses from fog. Annual precipitation in the valleys can reach an average of 120 to 140 inches (300 to 350 cm); the amount of precipitation increases with increasing elevation. In other low-elevation forests west of the Cascades, precipitation ranges from 35 to 120 inches (90 to 300 cm) per year. Up to 90% of this precipitation falls between September and May.

Fog is an important contributing factor to moisture in rain forests. Fog that rolls in off the ocean condenses on tree needles and drips down to the forest floor. Trees with thin bark may even absorb this water as it runs down the trunk of the tree. “Fog-drip” can add as much as 30 inches (90 cm) of moisture to the Olympic rain forest annually (Kirk and Franklin, 1992). That’s close to Seattle’s average annual rainfall of 38 inches (95 cm)! Additionally, in the Olympic rain forest twice as many days are cloudy as are clear. This cloudiness insulates the forest, minimizing temperature extremes and preventing loss of moisture.

# Slide 42

**Photo of fog**

Fog drip occurs when water from fog condenses on the needles in the canopy and drips down to the forest floor. Fog drip adds up to 30 inches of precipitation per year to the temperate rain forest of the Olympic Peninsula.

# Slide 43

**Temperate rain forest vegetation**

## **Canopy**

## **Conifers: Sitka spruce and western hemlock. Also Douglas fir, western red cedar, grand fir, silver fir**

## **Broadleaf: Bigleaf maple, black cottonwood, red alder**

## **Epiphytes include mosses, lichens, liverworts, ferns and club mosses**

## **Understory**

## **Small trees: Pacific yew, Pacific dogwood, vine maple**

## **Shrubs: huckleberries, red elderberry, devil’s club, salal**

## **Epiphytes as in canopy**

## **Forest floor**

## **Ferns, redwood sorrel, vanilla leaf, trillium, twinflower**

## **Mosses, lichens, liverworts, club mosses**

In the Olympic rain forest, Sitka spruce and western hemlock dominate the landscape. Other conifers include Douglas fir, western red cedar, grand fir and silver fir. Spruce and other conifers form the canopy of the rain forest, growing to heights of 165 to 280 feet (50 to 80 m). Stands of large bigleaf maples and black cottonwoods are prominent in the rain forest, especially along rivers. Red alders colonize more recently disturbed areas, but will eventually be replaced by conifers.

A characteristic of temperate forests, particularly rain forests, is the presence of epiphytes. Epiphytes are non-parasitic (not harmful) plants that grow on other plants. In the Olympic rain forest most epiphytes are mosses, liverworts (closely related to mosses), lichens, club mosses and ferns. By growing on trees, epiphytes can take advantage of increased light in the canopy.

The understory of a temperate forest hosts a number of different small trees and shrubs. Plants that grow in the understory must be tolerant of very shady conditions due to the dense canopy overhead. Understory plants often have their leaves spread flat and wide to catch the maximum amount of available light.

The temperate forest floor in many places is a green carpet of herbaceous plants and mosses, which grow vigorously on decaying wood and other organic material, aiding in the decomposition process. Ferns are widespread forest floor dwellers, with sword fern being the most abundant. Redwood sorrel and vanilla leaf are among the other herbaceous plants that form extensive green patches. Numerous tiny tree seedlings can also be found, such as the shade-tolerant western hemlock.

# Slide 44

**Temperate rain forest understory vegetation**

**Photos:** fern and sphagnum mass, calypso orchid, sorrel, trillium, salal flower

# Slide 45

**Temperate rain forest animals**

## **INVERTEBRATES**

## **Canopy: mites, spiders, springtails, barklice**

## **Forest floor: ants, termites, banana slug, millipedes, centipedes, beetles**

## **AMPHIBIANS**

## **Pacific tree frog**

## **red-legged frog**

## **salamanders**

## **REPTILES**

## **garter snakes**

## **northern alligator lizard**

## **BIRDS (species that rely on old growth forests)**

## **winter wren**

## **Vaux’s swift**

## **marbled murrelet**

## **pileated woodpecker**

## **spotted owl**

From the highest needle in the canopy to the soil underneath the forest floor, tiny living things inhabit all parts of the forest. Canopy tree needles, particularly of older forests, are colonized by an assortment of microorganisms. Taken together, these organisms—fungi, algae, yeasts and bacteria—are called “scuzz.” Some scuzz organisms grow on the insides of needles, others cover the outside. Tiny invertebrates, such as mites, springtails and amoebae, feed on the scuzz and are in turn eaten by spiders and predatory insects. Birds, bats and other larger animals feed on the insects and spiders and are thus dependent on this food web.

# Slide 46

**Millipede**

These millipedes are common in Pacific Northwest forests, foraging for decaying organic matter on the forest floor. The yellow spots indicate pores where, when disturbed, these millipedes emit small amounts of cyanide to deter predators. The cyanide gives off an almond-like smell. Millipedes are important decomposers in forest ecosystems.

**Banana slug**

Banana slugs can range in color from bright yellow to olive green to nearly black. Light colored slugs often have dark blotches. Banana slugs are native to the Pacific Northwest, unlike common garden slugs, which are introduced from Europe. On the forest floor, banana slugs forage for mushrooms, carrion (decaying animal matter), and plants.

**Pacific tree frog**

You can tell a Pacific tree frog by the dark stripe that runs from its snout, through its eyes and down its shoulders. These frogs can vary greatly in color, from bright green to dark brown. Male tree frogs chorus loudly from February through June, attracting females to mate.

**Roughskin newt**

Roughskin newts spend a great deal of time on land and move about during daylight hours. For these reasons, these newts are more commonly spotted than other newts or salamanders in the Pacific Northwest. Roughskin newts have bumpy skin and are usually dark brown on their backs and orange on their bellies. These newts secrete a toxin from the bumps (pores) on their skin to defend themselves from predators. If you do touch a roughskin newt, it’s a good idea to wash your hands afterwards!

# Slide 44

**Temperate rain forest animals**

### **SMALL MAMMALS**

## **flying squirrel**

## **deer mice**

## **chipmunks**

## **shrews**

## **bats**

## **mountain beaver**

## **marten**

## **fisher**

## **skunks**

### **LARGE MAMMALS**

## **elk**

## **black-tailed deer**

## **coyote**

## **bobcat**

## **cougar**

## **black bear**

Black bears are the largest predators found in low-elevation forests of Washington, but they have an extremely varied, omnivorous diet. Bears eat lots of plants in spring, berries found in forest edges to fatten up in fall, and insects, fish and small mammals whenever they can be found. Bears often rip open rotting logs to find beetles and other insects, thus aiding in the decomposition process. Though they are mostly ground dwelling, black bears are good climbers. They climb trees to find beehives and to take refuge when in danger. Bears’ markings on trees differ from cats’ in that larger sections of bark are removed as they scrape at the trunk. Using dens in hollow trees, rotting logs, or underground, black bears spend the winter in a state of relative inactivity. Though their heart rate slows and they often go the entire winter without eating, urinating, or defecating, it has been debated whether or not this is a true state of hibernation. Their body heat lowers to only 88 degrees F (31 degrees C) as compared to 40 degrees F (4.5 degrees C) for hibernating squirrels. Bears generally remain in their dens without any activity until spring, but they may stir and leave the den for short periods of time. Female bears give birth to their cubs in the middle of winter while sleeping in their dens.

# Slide 48

**Black-tailed deer**

Black-tailed deer, due to their smaller size, have far less impact on forest vegetation than do elk, but are an important food source for several predators, such as cougars and coyotes. Deer are primarily browsers (eat woody vegetation), whereas elk graze more than they browse.

**Striped skunk**

Spotted and striped skunks are members of the weasel family that inhabit temperate forests. Skunks prefer damp lowland riparian areas with deciduous trees. They also frequent cleared areas. In the winter and spring, skunks prey mainly on small mammals, such as cottontail rabbits and mice, while in summer and fall they primarily eat insects (especially beetles), berries and other parts of plants in addition to mammals. Skunks will also eat carrion when available. Skunks may be preyed on by great horned owls. It has been noted that great horned owls sometimes have a slightly skunky smell about them! Great horned owls, like most other birds, do not have a well-developed sense of smell, so eating skunks is no problem for them. Skunks are fairly sociable animals and will often share their dens in rotting logs or stumps with several other skunks. Skunks will generally not spray unless persistently threatened.

**Raccoon**

Raccoons are good climbers and swimmers and are very adept at obtaining food using the excellent sense of touch in their front paws. Raccoons are omnivorous and eat frogs, fish, small mammals, birds, seeds and fruits of plants as well as food scavenged from humans. Raccoons den in hollows in trees, holes under trees, or in the burrows of other animals. Within it’s territory, a raccoon usually has several dens and will generally use a different den each day.

**Cougar**

Cougars, also known as mountain lions, pumas, or catamounts, are also carnivores of the Olympic rain forest and other forest regions of Washington. By stalking and then pouncing, cougars prey mainly on deer and elk. Cougars occasionally eat other animals from insects to hares to coyotes and will also scavenge. Marks of cougars sharpening their claws can be seen five to eight feet (150 to 240 cm) up on tree trunks. Cougars inhabit regions that are more forested than those inhabited by bobcats. Cougars are very solitary animals. They will tolerate overlapping home ranges of other cougars but will actively avoid contact with one another, except during the breeding season. The winter home range of a male cougar is a minimum of 16 square miles (40 km²). Their home ranges in summer are larger and, in general, females’ home ranges are smaller than those of males. Cougars are beneficial to forest ecosystems because they cause redistribution of elk and deer, preventing damaging overgrazing, overbrowsing, and trampling of any particular region.

# Slide 49

**Barred owl**

Recently, spotted owls have had to compete for habitat with barred owls, which have been expanding their natural range further south and west into Washington’s forests. Barred owls, which are better adapted to second growth forests, have displaced many spotted owls from younger forests to older forests, contributing to spotted owls’ dependence on old growth forests.

**Bald eagle**

Bald eagles are raptors (predatory birds that catch and kill their prey with their feet) that feed mainly on fish. Bald eagles often perch on tall trees near waterways, such as rivers, or bodies of water, such as lakes and bays, to spot fish in the water below. Pairs of bald eagles often return to the same nest each year to raise their young. The eagles may add sticks to the nest each year, eventually resulting in very large and heavy nests. Thus, bald eagles require large, sturdy trees in which to nest.

# Slide 50

**Wetlands**

## **Three defining characteristics:**

## **high water table**

## **hydric soils (saturated, with little oxygen)**

## **hydrophytes (plants specially adapted to survive with conditions 1 and 2)**

## **Washington’s wetlands:**

## **freshwater marsh**

## **swamp**

## **bog**

## **riparian woodland**

## **salt marsh**

Wetlands are generally identified by three defining characteristics that are closely associated with each other. The first, and most significant, of these characteristics is the presence of a high water table. This means that water is continually present either at or near the surface of the land. Because wetlands soils are constantly saturated, they contain very little oxygen. These soils are called hydric soils and are the second defining feature of wetlands. Plants take in carbon dioxide and give off oxygen through their leaves in order to manufacture sugars through photosynthesis. But through their roots, the exchange of gases is opposite: plants take in oxygen andgive offcarbon dioxide through their roots in order to metabolize sugars. Due to the conditions posed by a high water table and hydric soils, namely the low levels of oxygen in the soils, wetlands support unique communities of specially adapted plants. The presence of these types of plants, called hydrophytes,is the third defining characteristic of wetlands.

# Slide 51

**Map showing wetland areas in Washington state**

**Note:** This map, current as of 1991, shows individual wetlands as well as areas with numerous small wetlands (thus, several of the large shaded areas in eastern Washington indicate areas of many small wetlands, not one huge wetland).

# Slide 52

**Freshwater Marsh**

## **water above soil surface with seasonal fluctuations of water level**

## **vegetation consists of herbaceous plants (grasses, sedges, cattails)**

Freshwater marshes are often found at edges of larger bodies of water, such as rivers and lakes. Movement of water in a freshwater marsh is slow in contrast to the fast-moving water in the streams or rivers feeding into the marsh.

**Photo:** Freshwater marsh vegetation at the edge of Quincy Lake in eastern Washington.

# Slide 53

**Swamp**

## **water at or above soil surface with seasonal fluctuations of water level**

## **trees usually dominant vegetation, shrubs present**

In Washington, swamps are found in lowlands of the Puget Sound region and the coast. Coniferous trees are abundant in swamps of the northwest. Western red cedar is the most common of these. The availability of water in swamps also encourages the growth of various deciduous trees, including red alder, black cottonwood, Oregon ash and bigleaf maple. Red alder is the most common, and often dominant, deciduous tree. Willows and skunk cabbage are strong indicators of swamps.

**Photo:** skunk cabbage

**Bog**

## **water above soil surface, water level relatively stable with no inflow or outflow of water**

## **thick layers of peat mosses in the water, with shrubs and trees present**

Bogs, unlike other wetlands covered here, do not have inflow and outflow of water. Rather, all of the moisture comes from precipitation. Bogs are characterized by abundant peat mosses and shrubs, though trees are often present.

# Slide 54

**Riparian Woodland**

## **subject to periodic flooding, soils temporarily saturated**

## **deciduous trees and shrubs along river margins**

Black cottonwood, red alder and other deciduous trees grow to great heights along rivers. These trees provide shade, keeping the water at an ideal temperature for fish, insects and amphibians that live in and around the water. This is important because when water becomes too warm it cannot hold as much oxygen, thus limiting the amount of oxygen available to animals in the water. Black cottonwoods also hold great volumes of water in their trunks and increase the humidity of an area by releasing large amounts of water vapor through their leaves.

Trees that are no longer standing are also important in riparian areas. When trees fall across streams, the logs can trap organic debris, which adds nutrients to the stream. Pools created by logs serve as rest and refuge spots for fish, amphibians and aquatic invertebrates. Fallen logs can also cut the flow rate of the water, allowing coarse sediments, called gravels, to settle out. These gravels collect in streambeds just downstream from the logs, creating ideal places for fish to lay their eggs.

**Photo:** Riparian woodland vegetation along the Hoh River on the Olympic Peninsula.

**Salt Marsh**

## **mixture of fresh and salt water subject to tidal fluctuations**

## **vegetation is largely herbaceous**

In Washington state, salt marshes occur along Puget Sound and the coast. Salt marshes are associated with estuaries, where fresh water from rivers or streams dilutes salt water as a result of tidal action. Salt marshes form on gently sloped land where river mouths are protected from strong waves by bars of sand, gravel or rock. Salt marshes are inhabited by many halophytes, plants that are adapted to live in areas of high salt concentration. Low-growing, perennial herbaceous plants make up the majority of salt marsh vegetation.

Salt marshes are highly productive ecosystems. High productivity in salt marshes is due to a combination of factors:

1. the great amount of nutrients deposited both by runoff from the land and by tidal upwellings
2. the maximum amounts of solar radiation captured due to the openness of the area
3. high oxygen levels in the water, necessary for plant growth, are maintained by incoming tides
4. the abundance of water that aids plant growth

# Slide 55

**Healthy Wetlands = Healthy Ecosystems**

## **Functions of wetlands:**

## **absorb and slowly release large volumes of water (flood prevention)**

## **absorb energy of ocean storms**

## **aquifer recharge**

## **filter pollutants from water**

## **important permanent and temporary habitat (breeding grounds, rest stops, and “nurseries”)**

# Slide 56

**Wetlands animals**

## **INVERTEBRATES**

## **mollusks**

## **crustaceans**

## **dragonflies**

## **mayflies**

## **caddis flies**

## **backswimmers**

## **giant water bugs**

## **FISH**

## **salmon**

## **trout**

## **AMPHIBIANS**

## **northwestern salamander**

## **roughskin newt**

## **Woodhouse’s toad**

## **western toad**

## **Oregon spotted frog**

## **REPTILES**

## **garter snakes**

## **painted turtle**

## **western pond turtle**

## Much of the wildlife inhabiting wetlands may not be easily visible. Tiny fungi and bacteria feed on detritus in wetlands. These organisms help to break down the detritus, providing nutrients for plant growth. Small invertebrates, such as nematodes and annelids, and larvae of larger invertebrates feed on the fungi and bacteria. Larger invertebrates, including mollusks, crustaceans and insects, also feed on detritus as well as eating the smaller invertebrates, fungi and bacteria. All of these creatures form the basis of food webs in wetlands habitats.

# Slide 57

**Wetlands animals**

## **BIRDS**

## **American kestrel**

## **red-winged blackbird**

## **bald eagle**

## **northern harrier**

## **great blue heron**

## **osprey**

## **ruddy duck**

## **bufflehead**

## **MAMMALS**

## **beaver**

## **muskrat**

## **river otter**

## **raccoon**

## **shrews**

## **little brown bat**

## **western pipistrelle**

## **mink**

A great variety of birds rely on wetlands habitats, either as permanent homes or as temporary stopovers along migration routes. Wetlands not only provide water and an abundance of food; wetlands vegetation provides cover for hiding from predators and for nesting.

One of Washington’s most common bats, the little brown bat, is usually seen near water in the late evenings. These bats feed exclusively on insects, catching as many as 500 to 1,200 small insects an hour! Western pipistrelles, the smallest bat of the Northwest at three inches (7.5 cm) long with an eight and one half inch (21 cm) wingspan, frequent riparian woodlands of eastern Washington. Shrews also eat many insects, feeding almost continuously to fuel their high metabolism. Raccoons often visit wetlands habitats, using their front feet to feel around for crayfish, frogs and other tasty wetlands treats.

Beavers, the largest rodents in the Northwest, play an important role in forming and sustaining wetlands. Beavers prefer still ponds where they can harvest small trees growing along the margins. If no pond exists, beavers will create one by felling trees to dam a stream. In this way, beavers provide habitat for themselves as well as other creatures that prefer slow-moving waters, such as muskrats, mink and river otters. Beavers build their lodges in the ponds and stockpile them with food, the inner bark of trees such as alders, aspens and cottonwoods, in preparation for winter when the ponds could freeze and make foraging impossible.

River otters, residents of lakes, rivers and streams, find adequate cover in wetlands vegetation but may use dens, especially for breeding. River otters are carnivorous. Their diet consists mainly of fish but amphibians, crayfish, birds and mammals (mostly muskrats) are also eaten. Well-developed webs on all four feet and a strong tail make river otters excellent swimmers.

Great blue herons are very common in Washington, especially near wetlands. These tall herons, up to four feet tall with a six-foot wingspan, use their long beaks to grab their prey, usually while wading in shallow waters. Herons prey mainly on fish, but also eat aquatic invertebrates, reptiles, amphibians and small mammals. When resting and when in flight, herons hold their necks in an “S”-shaped curve. Herons nest communally in large trees. These communal nesting groups are called “heronries” and are located in the same trees year after year.

**Photos:** great blue heron, river otter

# Slide 58

**Urban/Suburban Habitats**

## **Strongly human-influenced habitats**

## **I-5 corridor, Tri-Cities, Spokane, Yakima, Wenatchee**

## **Moderate climate, proximity to transportation (water, road, or rail)**

## **Some native species have adapted, many non-native species survive well in urban habitats**

## **Segments of habitat; may be connected by corridors**

Some areas of Washington with high human concentration, such as Seattle, Spokane or the Tri-Cities, are urbanregionsand are surrounded by suburban areas. Even in places away from cities and suburbs, such as rural farms, humans control many aspects of the environment. Wild plants and animals inhabited Washington state long before humans ever did. However, plants and animals have had to adapt to share the environment with humans. If species are unable to survive in proximity to human habitation, their ranges are restricted to places where human influence is not as great. Other plants and animals that did not originally live in Washington were brought here by people coming from Europe or from other parts of the United States. Some of these introduced species have adapted very well to living in Washington’s urban and suburban areas. In some cases, introduced species have out-competed native species.

# Slide 59

**Map showing urban/suburban centers and transportation corridors in Washington**

# Slide 60

**Urban Plant Adaptations**

## **Hearty**

## **Adaptable**

## **Aggressive**

## **Prolific—spread out or produce a lot of seeds**

Herb-robert is an invasive, introduced weed that can quickly spread in urban and suburban habitats, particularly forested or partially forested areas. Dandelions are a good example of introduced urban plants that produce many seeds and distribute them widely.

**Photos:** herb-robert, dandelion seedhead

# Slide 61

**Urban vegetation**

## **Native species:**

## **pineapple weed**

## **fireweed**

## **Douglas fir, western hemlock, ponderosa pine**

## **Introduced species:**

## **English ivy**

## **Canada thistle**

## **Himalayan blackberry**

## **foxglove**

## **dandelion**

Although some native plants survive in urban landscapes, the vast majority of urban plant life consists of introduced species. Pineapple weed, a member of the sunflower family with pineapple-scented flowers, is native to the west coast of the United States, but may or may not have been native to Washington state. Pineapple weed grows very commonly in playfields and cracks in sidewalks.

Some plants were intentionally brought to the United States by European settlers as garden ornamentals or to provide flowers or fruits that were familiar to them from their native lands. Other plants established themselves when seeds were accidentally transported from one place to another. Introduced species generally take over roadsides, playfields, pastures, cracks in the sidewalk and other areas that are highly and/or regularly disturbed. Some urban plants have adaptations well-suited to their arid native lands. These adaptations also aid their survival in urban habitats where higher temperatures, compacted soil and concrete result in less water available for their roots. For example, great mullein, an introduced plant now common along roadsides, has long taproots and hairy leaves. Urban plants face threats not generally found in more natural habitats such as herbicides and intense pollution. Because species introduced from other parts of the world, particularly Eurasia, have existed together with large populations of people longer than any plants native to Washington state, introduced species are often better adapted to cope with challenges posed by human activity. Many of our native plants succumb more easily to pressures placed on them by human populations.

**Photos:** fireweed flower, Himalayan blackberry

# Slide 62

**Adaptations of Urban Animals**

## **highly adaptable**

## **omnivorous**

## **opportunistic/scavengers**

## **nocturnal**

Many animals native to Washington have been able to adapt to life in proximity to people. Introduced animals, like introduced plants, are also successful in urban habitats because they are highly adaptable. Urban wildlife can be defined as native and non-native, non-domesticated animals that live in or spend time in urban habitats.

Most often, animals that successfully inhabit urban environments are able to eat a greatly varied diet. Many of them are scavengers, consuming almost any food item they can find. Although constant change is a basic characteristic of all habitats, change can happen more often and very quickly in human-influenced habitats. Thus, the most successful urban animals are those that can adapt to change quickly and find new alternatives to fulfill their basic needs in urban environments. Many urban animals are nocturnal which helps them avoid disturbance by the daytime activities of most humans.

**Photos:** raccoon, eastern gray squirrel

# Slide 63

**Urban animals**

## **INVERTEBRATES**

## **earthworms**

## **millipedes and centipedes**

## **sowbugs and pillbugs**

## **earwigs**

## **slugs**

## **snails**

## **ants**

## **butterflies**

## **beetles**

## **BIRDS**

## **European starling**

## **Canada goose**

## **chickadees**

## **barn swallows**

## **sparrows**

## **peregrine falcon**

## **bald eagle**

## **red-tailed hawk**

## **ducks and other waterfowl**

Some of the more familiar urban animals are the smaller residents of backyards, parks and vacant lots. These include earthworms, terrestrial mollusks (slugs and snails), and a variety of arthropods (animals, including insects and spiders, that have hard exoskeletons and jointed appendages). Many of these animals are scavengers, feeding on dead plant and animal material. These scavengers are the decomposers in urban environments. Earthworms digest plant detritus in the soil. This helps to loosen the soil, which they also enrich with their droppings, called castings. Earthworms are an important food source for many animals including moles and birds. Millipedes, sowbugs and pillbugs are all common arthropod scavengers. All these tiny decomposers form the base of the food chain, providing energy for other animals.

Birds are probably the most easily observed of all urban animals. In Seattle’s parks alone, 225 species of birds have been recorded. Because they are able to move between fragments of habitat, birds can satisfy all their habitat needs by flying to many different areas within urban environments. Birds can also fly between urban and natural habitats, making use of the best of both environments. European starlings, an introduced species, nest during spring and summer in urban areas, where natural predators are few, but travel to rural agricultural areas to feed on seeds in crop fields in fall and winter. Cooper’s and sharp-shinned hawks may be attracted to the concentration of prey (small birds) at backyard bird feeders. Red-tailed hawks use forests edge that are common in urban areas, such as along freeways, as hunting grounds.

Peregrine falcons were one of the many species that suffered from the abundance of DDT, a pesticide used on crops, from the early 1940s to the early 1970s. Peregrine numbers had declined drastically due to eggshell thinning caused by eating DDT-contaminated prey. Use of DDT was banned in the United States by 1972, and a program for breeding peregrines in captivity was successfully developed. Since then, approximately 4,500 peregrines have been released across the United States in both developed and natural areas. In natural habitats, peregrines nest on rocky ledges. In cities, window ledges of skyscrapers make good substitutes and prey species, particularly pigeons, are abundant. Urban areas provide an advantage for the survival of young peregrines due to the absence of their natural predators, especially great-horned owls. One pair of peregrines has nested on a building in Seattle for the past several years.

**Photo:** peregrine falcon

# Slide 64

**Urban animals**

## **MAMMALS**

## **moles**

## **shrews**

## **deer mouse**

## **house mouse**

## **Norway rat**

## **Virginia opossum**

## **raccoon**

## **squirrels**

## **skunks**

## **mountain beaver**

## **coyote**

## **deer**

## **cougar**

## **black bear**

Many small mammals are able to satisfy all of their basic needs within the confines of urban habitats. Decomposers, such as earthworms and arthropods, are important food sources for small mammals such as moles and shrews. Moles have extremely poor eyesight and depend more on their hearing for hunting earthworms. Moles sometimes store live earthworms for later use by giving them a disabling bite, which does not kill the earthworms but keeps them from leaving the burrow. Shrews are constantly active in their search for insects to fuel their high metabolism. Some shrews have concentrations of poisonous compounds in their salivary glands and are among the very few mammals that can deliver a poisonous (but not fatal) bite! Shrews are not eaten by many animals except owls and Steller’s jays, though shrews are often caught but not eaten, perhaps due to the poisons in their glands, by domestic cats.

Squirrels are abundant in urban areas and provide interesting subjects for amateur animal behaviorists. The most common squirrel that shares habitats with people in Washington is the eastern gray squirrel, a species introduced from the eastern United States.

Raccoons, opossums and skunks successfully inhabit urban environments. These animals, with their widely varied diets and nocturnal habits, exemplify the advantageous adaptations of many urban animals. Raccoons are good climbers and swimmers and are very adept at obtaining food using the excellent sense of touch in their front paws. Raccoons are omnivorous and eat frogs, fish, small mammals, birds, seeds and fruits of plants as well as food scavenged from humans. If people are not careful with their garbage, raccoons and other urban animals can come to depend on garbage as a food source, leading to undesirable interactions with humans or their pets. Opossums eat fruits, nuts, berries, cat and dog food and other foods discarded by humans. Opossums are marsupials (mammals that carry their young in abdominal pouches) that have been introduced from the eastern United States. A high reproductive rate has helped opossums to populate urban environments, even though they often fall victim to cars at night. Skunks are omnivores and travel through urban areas relatively undisturbed due to their stinky defense, which is rarely used but serves its purpose by keeping people and other animals at a respectable distance. Skunks cannot climb so they take shelter in dens on the ground, either in burrows of other animals or under buildings.

Occasionally large mammals, like the cougar mentioned previously, come into urban and suburban areas. This happens more frequently as human development encroaches further into wildlife habitat. Cougars and bears may be encountered by humans who live in or visit forests near cities and towns. In these situations, it is important to be aware that we share habitats with predators and to take necessary precautions to protect yourself without disturbing them. Most often bears will leave on their own. Occasionally, however, if they begin to rely on urban areas as an easy source of food, they may come to be considered a problem.

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**Making It Work**

Wildlife can also be adaptable in where they raise their young. Many manmade structures emulate natural habitats. For example, in natural habitats, peregrines nest on rocky ledges. In cities, window ledges of skyscrapers make good substitutes and prey species, particularly pigeons, are abundant. Urban areas provide an advantage for the survival of young peregrines due to the absence of their natural predators, especially great-horned owls. One pair of peregrines has nested on a building in Seattle for the past several years.

Snowy owls generally nest in the open areas of the tundra and grasslands during the summer. In the winter, they migrate south to find food. Often, these owls will forage for food at airports, which have wide, open areas reminiscent of the tundra, and also have plentiful rodent populations.

**Photos:** peregrine falcon nest; snowy owl

# Slide 66

**How you and your students can help urban wildlife**

**Create schoolyard and backyard habitats**

* **Food: native plants, feeders (clean weekly!)**
* **Water: birdbaths, water features, ponds**
* **Cover: existing tall trees and dense shrubs, log piles, rock gardens**
* **Places to raise young: nestboxes for birds, bats and bees; provide nesting material (no dryer lint, please!)**
* **Invite other schools to experience your schoolyard habitat**

You and your students can help urban wildlife by creating habitat in your backyard and schoolyard. Manmade habitats can help urban wildlife meet their basic needs during migration season, or can provide more permanent homes for animals to raise young.

In order to be a successful habitat, your backyard or schoolyard needs to meet all the basic needs of wildlife: food, water, cover and places to raise young. Native plants are a great way to provide food in the form of flowers, fruits, seeds, nuts and berries. Choosing native is important because by choosing plants already suited to the site conditions, little maintenance, chemical fertilizers, herbicides, or additional watering will be necessary for the plants to thrive. Also, according to the National Wildlife Federation, native plants may support 10 to 50 times as many species of native wildlife as non-native plants. Supplemental bird feeding can also benefit birds and provides great bird watching from your own backyard. The obvious time to feed birds is in winter when natural food supplies are scarce; however, additional species visit feeders during the spring and fall migrations, and also during summer while nesting. Remember to provide a variety of quality seed and fresh water for drinking and bathing. It’s also important to choose the right feeder and a proper location for the feeder.

Established trees and dense shrubs provide protection from predators and cover during winter months, as do log piles and rock gardens. Nestboxes and nesting material can help birds, bats and bees find the shelter they need to raise young. Dryer lint is not a good choice for nesting material, however, due to its high percentage of cotton, which is a poor insulator for baby birds.

Finally, inviting other schools to experience your schoolyard habitat is a great way to spread the word about the challenges urban wildlife face and how teachers and students can become involved in making their school a more beautiful place while providing habitat for plants and animals.

**Photo:** schoolyard habitat at Lewis and Clark Middle School in Yakima, WA

# Slide 67

**How you and your students can help urban wildlife**

**Maintaining a healthy urban environment**

**• Sustainable garden practices**

* + **Use mulch instead of fertilizer and weed killer**
  + **Accept minor plant damage instead of using pesticides**
* **Always dispose of pet waste in garbage cans; flushing sends pet waste into marine systems**
* **Don’t release pets or classroom animals into the wild or bring wild animals into your home or classroom**
* **Keep cats and dogs indoors as often as possible**

Remember that due to western Washington’s proximity to lakes, rivers and Puget Sound, your schoolyard and backyard habitat can affect local marine habitats. Mulch is both a great fertilizer and weed deterrent. If you keep your plants healthy, they can survive minor plant damage from insects. Fertilizer, herbicides and pesticides can create huge problems for fish and the animals that eat fish, such as whales, seals, otters and eagles. Huge amounts of these toxins are found in whales, indicating that these toxins are accumulating through the food chain. The effects are increased risk of mortality, poor survivorship of young and cancer.

Pet waste can be extremely harmful to marine wildlife. Cat feces often contain a parasite that reaches waterways by storm runoff or through the sewer system. These parasites are ingested by filter feeders such as shellfish, which are in turn eaten by marine animals. This parasite causes toxoplasmosis, a disease fatal to many marine animals such as sea otters.

Another way that well-meaning people can inadvertently harm wildlife is by releasing pets into the wild. These animals are usually reliant on humans to meet their basic needs and may die once released. Released non-native animals can also cause huge problems on a larger scale as introduced species, as stated previously. Many people often bring injured or ill animals into their home for rehabilitation. While acting with the best intentions, these people may be doing more harm to these animals. Often, these animals are fed improper diets and aren’t given proper medical treatment. Usually, these animals become imprinted on humans, meaning they rely on humans for their basic needs, and are not releasable into the wild. Diseases can be spread between wild animals, pets and humans, and the caregiver often risks injury from scared animals that have sharp teeth and claws. Finally, it’s illegal for private individuals to attempt to treat wildlife without a permit. If you or your students find injured or ill wild animals, it’s best to call your local wildlife rehabilitation center.

Also, healthy wild animals do not make good pets. The stress of the capture can weaken or kill them. Many animals in the pet trade were illegally captured and imported, which can decimate the population of these animals in the wild. And finally, wild animals will remain wild, even in captivity. They can injure themselves, other pets and their caretakers.

It’s important to keep pets indoors. Wild animals frequently come into contact with pets allowed to run free. Many deer are killed by packs of dogs, and millions of birds and small mammals are killed by cats. Pets can cause indirect and direct harm to wildlife, and can themselves be injured by wild animals.

**Photos:** orca in Puget Sound

# Slide 68

**How you and your students can help Washington wildlife**

**Wise use of resources:**

* **Buy organic products**
* **Conserve energy**
* **Reduce / reuse / recycle**
* **Buy unbleached, recycled paper products**
* **Use phosphate-free laundry and dishwasher detergents**

The following points are oft-repeated mantras that can actually benefit Washington wildlife. Buying organic products helps keep fertilizers, pesticides and herbicides out of the water cycle. Conserving energy helps reduce the need for hydroelectric dams on Washington’s rivers, which provide the majority of energy for Washington state. Reducing, reusing and recycling products not only conserves energy and raw materials, but also reduces the need for landfills. Landfills attract foraging urban wildlife, but the food available in landfills is of poor quality and the water that pools there is polluted with toxins. Buying unbleached paper and using phosphate-free detergents are also important for improving water quality in urban areas. The manufacturing of bleached paper often results in the release of toxic chemicals into the waste stream. Phosphates encourage algal growth, which can suffocate aquatic life.

**Photos:** black-capped chickadee at bird feeder; western tiger swallowtail butterfly

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**Ecological Concepts**

The topic of Washington’s wildlife can be used as a lens for students to explore a variety of important ecological concepts, including interconnections in ecosystems, plant and animal adaptations, the importance of biodiversity, how matter and energy move through food webs and human impacts on ecosystems.

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## Habitat maps adapted from *Atlas of the Pacific Northwest*

* Slide 67: orca photo, Jeff Hogan, Killer Whale Tales