

What is an ecosystem?

An **ecosystem** consists of all living things (animals, plants, fungi, bacteria, and other microorganisms) that interact with each other and the environment in which they live (air, water, and soil).

- Ecosystems can range from tiny to large: a drop of pond water, rotting log, river, patch of old growth forest, and a range of mountains can all be considered ecosystems. Small ones can fit inside larger ones, and boundaries tend to overlap with neighbouring ecosystems. e.g.- a rotting log can be found in a cottonwood forest which is growing there because there is a river next to it.
- Resource managers are moving away from managing landscapes for only one or two species (e.g.- creating lots of browse for deer and moose after logging), to addressing the needs of the broader ecosystem (e.g.- making sure there is habitat available for most wild creatures in an area).
- To aid in research, management and communication of ecosystems in B.C. a biogeoclimatic (BGC) ecosystem classification system has been developed. The system uses climate, soil, vegetation to group ecosystems at regional and local levels. Fourteen large ecological zones are recognized in B.C. In the Columbia Basin the following BGC's are represented: Interior Cedar Hemlock, Interior Douglas-fir, Ponderosa Pine, Montane Spruce, Engelmann Spruce-Subalpine Fir and Alpine Tundra.
- Ecosystems are constantly changing affected by natural disturbances such as fire, insect attack, windstorms, landslides or logging. Disturbance can return an ecosystem to its beginning. Succession involves changes in plants, animals and conditions as the new ecosystem develops from infancy to mature and old age.

Forest Ecosystem

a.k.a. coniferous or deciduous forest, mature forest

A **forest** is a common type of vegetation community dominated by trees and other woody shrubs that are growing close enough together that the tree tops touch or overlap creating various degrees of shade on the forest floor. Forests are sometimes defined as natural communities of standing trees that are being managed or maintained for the public need in terms of their value (e.g. timber, recreation or wildlife habitat). Forests are complex webs of interconnectedness held together by strands of soil, sun, water, and air; sustaining a variety of animals and plants.

- Forests cover almost two-thirds of B.C. and provide a wide range of habitats for plants and animals. B.C. contains 15% of the forested land in Canada yet it produces 50% of the country's softwood volume. 93% of the forests in BC are administered by the provincial government.
- A significant portion of species in B.C. are forest-dependent including 82% of freshwater fish, 72% of amphibians, 60% of mammals, 50% of breeding birds and 31% of reptiles.



- Second growth forests in the interior are classified as an early forest if it is less than 40 years old, immature 40-80 years, mature if between 80-120 years and old growth if over 120-250 years (depending on the species).
- The extensive forests in B.C. are of significant economic importance. However forests provide more than just timber. Non-timber values include recreation, range, clean water, and food, a steady supply of clean oxygen, pharmaceuticals, and places for spiritual renewal. If you think about it all of our water in B.C. comes directly or indirectly from forests.

Where to find forests in the Columbia Basin?

There are five forest zones in the Columbia Basin: Ponderosa Pine (lowland to 350 m), Interior Douglas-Fir (from 350-600 m), Interior Cedar-Hemlock (from 400-1500 m), Montane Spruce (from 1250-1700 m), and Engelmann Spruce-Subalpine Fir (from 1500-2300 m). Climate is the most important determination of the nature of land-based ecosystems. Elevation, landscape and climate together determine the evolution of specific forest zones.

Indicators of Healthy Forests

- Biodiversity is a measurement of forest health. Forests in BC support many threatened and endangered forest dwelling species including 15% of listed vertebrates and 12% of the vascular plants. Of special concern are forest dependent freshwater fish and amphibians.
- Across Canada the forest industry is working to achieve a balance between conserving forest ecosystems and sustainable harvesting levels. To do this forest managers must consider: conservation of biological diversity, the condition and productivity of the forest ecosystem, soil and water conservation, global ecological cycles, multiple benefits to a variety of stakeholders and overall responsibility to Canadian society.
- Forest health is the ability of the forest to resist or recover from natural or human caused disturbances. When organisms in the forest interfere with forest management practices they are labeled pest. Major risks to timber values in the Columbia Basin are disease and insects. Root diseases like *Armillaria ostoyae* are common in many forests. Insects including mountain pine beetle kill thousands of mature trees each year. Disease and insects can degrade the value of a forest including timber, wildlife, recreational and visual quality (e.g. tourism). Insects may be increasing in the region due to fire suppression and exclusion in many forests.
- Ponderosa pine forests are one of the most threatened forest zones in the Columbia Basin.
- Forest riparian ecosystems are transitional zones between aquatic and upland forests. They are especially important for stabilizing streambanks, regulating stream temperature, and filtering out potentially harmful debris and pollutants. Riparian forests cover 12% of the forest land area in B.C. and have a wide variety of plant species providing many opportunities for wildlife to nest, feed, hide, roost or use as migration corridors.



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Forest Ecosystem

I: Forest Characteristics

Are there:

- Many levels to the forest that create different kinds of habitat for forest dwellers. There should be evidence of a variety of animals and living organisms at all levels:
 - **Canopy** – uppermost layer and supports osprey, bald eagle, great blue heron, etc.,
 - **Understory** – grows under the canopy and supports great grey owl, northern flying squirrel, yellow-pine chipmunk,
 - **Forest floor** – which can be broken down into litter, humus and mineral soil supports dusky shrew, long-toed salamander, ruffed grouse, deer, and;
 - **Soil** – underneath the forest floor supporting worms, nematodes and springtails.
- A variety of plants including woody plants (trees and shrubs), non-woody plants, lichen and fungus. Non-woody plants can be:
 - **Perennial** – grow for 3 years or more like trillium, lupines and shooting stars,
 - **Annual** – grow from a seed each year like sweet-clover or yellow monkey flower, or
 - **Biennial** – live over two years, flowering and producing fruit in the second year.
- Different age classes of trees including standing dead ‘wildlife trees’ where there is more biotic life than in live trees.

II: Associated Plants and Animals

Plants		
Western redcedar	Black gooseberry	Clark’s nutcracker
Lodgepole pine	Saskatoon	Gray jay
Ponderosa pine	Thimbleberry	White-breasted nuthatch
Whitebark pine	Falsebox	Mountain chickadee
Western white pine	Twinflower	*Pine grosbeak
Western larch	Bunchberry	Northern flicker
White/Engelmann Spruce	One-sided wintergreen	Mammals
Subalpine fir	Round-leaved violet	Little brown myotis
Western hemlock	Indian paintbrush	Red squirrel
Douglas-fir	Solomon’s seal	Northwestern chipmunk
Western yew	Blue clematis	Yellow-pine chipmunk
Douglas maple	Cow parsnip	Northern flying squirrel
Black hawthorn	Fairy slipper orchid	Red-backed vole
Choke cherry	Western white trillium	*Wolverine
Pin cherry	Small twisted stalk	Porcupine
Mountain alder	Indian hellebore	Mule deer
Paper birch	Fungi and Lichen	*Rocky Mountain bighorn sheep
Black cottonwood	Wolf lichen	Rocky Mountain elk
Trembling aspen	Common witches hair	Moose
		Coyote



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Forest Ecosystem

Devil's club	Bracket fungi	Black bear
Oregon grape	Root rot fungi	*Grizzly bear
Snowberry	Truffles	*Fisher
Wildrose	Birds	Marten
Huckleberry	Stellar's Jay	Reptiles and Amphibians
Honeysuckle	Barred owl	Long-toed salamander
Soapberry	Great grey owl	*Rubber boa

*Rarity ranked as "Blue Listed" in B.C.



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Classroom with Outdoors

Engaging Ecosystem Experience

III: Some Examples of Animal Adaptations

- **Grizzly Bear** – Grizzly bears roam throughout the forested mountain terrain of the Columbia Basin. The Latin name *Ursus arctos horribilis* alludes to its reputation as ferocious and dangerous. In fact, grizzlies are shy creatures that usually flee at any sign of human activity. Grizzly bear populations have declined drastically over the last 150 years as humans settled their historic range, which went east into Southern Saskatchewan and south to Mexico. Grizzlies are considered key indicator species for wildlife conservation because its habitat requirements are so extensive. If land is managed for grizzly bears, this will help to ensure the survival of most mammal species that share their habitat.
- **Mule deer** – They are often seen in lower elevation forests and brushy meadows throughout the region. Mule deer closely resemble the stereotypical deer from ‘Bambi’ with large ears, big, beautiful eyes and a tail that is narrow and white with a black tip at the end. In spring and summer they graze on grasses and flowers but in winter can be seen browsing on twigs and winter buds of shrubs, aspens, poplars and evergreens. Cougar, wolves, coyotes, bears, lynx and bobcats heavily prey upon mule deer. High mortality is often caused from collision with motor vehicles particularly in winter months.
- **Wolverine** – If you are traveling in the Columbia Basin wilderness and you see a large two toned brown furry creature about the size of a black lab with a small head, it is likely a wolverine. Blue listed in B.C. this fierce member of the weasel family is vulnerable and sensitive to human activity. Male wolverines living outside of the National Parks use a home territory of 1200-2000 square kilometers. Females stay closer to their home range about 300 square kilometers. Wolverines have a low tolerance for human activity and prefer undeveloped areas that are roadless. For food they scavenge from dead animals killed by other top predators like wolves. Since wolves are rare in the Columbia Mountains, wolverines depend on winter to weaken prey making them easy kills.
- **Clark’s Nutcracker** – Often seen scavenging campsites, this bold member of the crow family is common in forested areas throughout the Columbia Basin. When first observed by explorers to the West in the early 1800’s it was classified as a woodpecker due to its large, straight, black bill. Instead this bird uses its crowbar-like bill to tear apart conifer cones and crack the hard-coated seeds inside. A Clark’s Nutcracker can hold about 90 seeds in a special pouch in its throat, which it uses, to carry seeds to winter storage caches. These places have been recorded with over 30,000 seeds and sometimes require the bird to dig through a meter of snow to find them. Luckily they have amazing memories to find these food **caches**.
- **Downy Woodpecker** – The smallest and most familiar woodpecker in North America, ‘downies’ can be seen in all wooded environments but prefer deciduous forests. A breeding pair work together to excavate a cavity in a dead or decaying tree which can take up to two weeks to build. They can be seen foraging on tree trunks and branches chipping and probing for insect eggs, cocoons, larvae and adults, while also feeding on nuts and seeds.



Threats to Forests

- Agriculture, urban development and logging pose the greatest threats to forest species at risk.
- Clear cut logging for wood fiber to make pulp to produce paper and logs for building materials. This type of logging affects soil, increases erosion, negatively impacts water quality and provides human access via an extensive road network. According to 1989 B.C. Forest liquidation statistics from the Ministry of Forest Annual Report every minute 5.3 logging trucks are loaded, 200 trees are cut and more than 1 acre (16 city lots) of forest are cut.
- Natural disturbances create change in the landscape from a microscopic to a grand scale. The largest yet infrequent disturbances are wildfires and landslides. These disturbances reduce the commercial value of timber. From a natural perspective, disturbances result in a mosaic of habitats creating diversity while maintaining and enhancing future forests.
- Presence of disease impacts the timber value of forests. Root diseases (most commonly *Armillaria ostoyae*) are widespread in many forests especially on Douglas-fir trees. To observe signs of disease look for sickly looking trees that are lighter green with spindly tops. Notice the white pitch running 5-6 feet from the bottom of the tree. There may be dead trees in the stand creating wildlife trees and openings with some regeneration. Younger trees are more at risk of getting root rot.
- Increased number of pests in managed forests can also seriously impact timber values. Most common insects are mountain pine beetle, Western spruce budworm and Western hemlock looper. Mountain pine beetle is one of the most important threats to BC forests. They thrive in monoculture lodgepole pine forests. First they bore through the thin outer bark into the cambium layer underneath. Immediately the tree fights back by exuding pitch tubes. An infested tree shows pitchy holes by late summer and reddening foliage by spring. Epidemics usually start when trees are under stress from periods of drought and warm summer temperatures when conditions are ideal for larval growth.
- Plant infestations particularly dwarf mistletoe, needle cast fungi, black stain root disease and Western gall rust also seriously harm timber values. Western dwarf mistletoe is a tiny, yellow-green leafless plant growing on pine branches (lodgepole, ponderosa, etc.) The mistletoe burrows into the tree and steals sugars, water and essential nutrients from the host reducing its vigor but usually not killing the tree. It spreads easily in young, dense stands of pine.



References for Further Research:

A Field Guide for Site Identification and Interpretation for the Nelson Forest Region

Compiled and edited by T.F. Braumandl and M.P. Curran. Published by the B.C. Ministry of Forests. Land Management Handbook Number 20. May 1992

Available from your local library.

An excellent resource providing detailed information on forests and management prescriptions in our region.

British Columbia: A Natural History

By Richard Cannings and Sydney Cannings. Published by Greystone Books, Vancouver, 1996.

Available in bookstores, your local library or through inter-library loan.

An excellent, easy to read review of physical and natural environments in British Columbia

The Ecology of the Ponderosa Pine Zone/Interior Douglas-Fir Zone/Montane Spruce/Interior Cedar-Hemlock Zone/Engelmann Spruce-Subalpine Fir Zone

By B.C. Ministry of Forests, July 1998.

Available for \$1/each by calling the Queen's Printer at 1-800-663-6105.

Overview of each forest zone characteristics, history, wildlife resources and threats.

Forest in Focus

By B.C. Ministry of Forests

Available from Wild BC 1-800-387-9853 ext. 4 for \$26.00.

This environmental education guide is full of information and activities to introduce young people to the forests in BC whether in a schoolyard or treed area outside of town.

Project Learning Tree: Environmental Education Activity Guide

Formerly distributed by BC Forest Association, this guide is now distributed by a non-profit association dedicated to training educators to use these forest-based materials. Contact Robbin Clark at 1-604-737-1112 or www.rbc.bc.ca/envirothon.

Seeing the Forest Among the Trees: The Case for Wholistic Forest Use

By Herb Hammond from Vallican in the West Kootenays. Published by Polestar Press Ltd., Vancouver.

Challenges us to a new way of looking at the forest and how we use it. Available from interlibrary loan.

State of the Environment Report for British Columbia

By B.C. Ministry of Environment Lands and Parks and Environment Canada. January 1994.

Available from Wild BC by calling 1-800-387-9853.

There is an accompanying teachers guide. The document and guide are \$6 each to purchase.

