



TEMPERATE RAINFOREST ECOLOGY

An Introduction



From towering Sitka spruce trees to tiny clouded salamanders, the temperate rainforest provides critical habitat to countless species of plants and animals. Infinite cycles and relationships link these species together. Some, for example the banana slug, act as essential decomposers, helping to recycle decaying plant and animal material. Others, such as a standing dead Western redcedar tree, provide critical habitat for many animals, like bats, insects and owls. Ultimately, each species plays a vital role in the overall functioning of this special ecosystem.

Rainforest Plants

Temperate rainforests are a spectacular synthesis of climate, geography and biology.

An estimated 2,850 vascular plants, 1,000 bryophytes (mosses and liverworts), 1,600 lichens, 5,222 species of attached algae and well over 10,000 fungi species are present in the rainforest.

TREES

British Columbia is home to one quarter of the world's remaining temperate rainforests. Within this special ecosystem some of the world's tallest, thickest and oldest trees are found. Douglas fir and the Sitka spruce trees over 95 metres (313 feet) tall grow here, as do Western redcedar trees that span over 6 metres across (20 feet). And Yellow cedar trees over 1,600 year old have also been discovered. For sheer age and mass the planet has never seen another ecosystem quite like it. The most common rainforest tree species are the lacy-needled Western hemlock, the Western redcedar, Sitka spruce, and the amabilis fir (sometimes called balsam or Pacific silver fir).

WESTERN HEMLOCK

Did you know...

- The Western hemlock is the most common evergreen tree to flourish in coastal rainforest. Hemlock seedlings are often the only tree species that can survive the deep shade on the forest floor.
- Canada's biggest hemlock stands 55 m (180 feet). It would take you and nine friends to encircle it with your arms!
- One hemlock tree can produce over half a million seeds **each** year.



Coastal First Nations

used the Western hemlock for a variety of reasons. They steeped the bark of the tree in water to color fishnets brown, making them invisible to fish. Spoons, feast bowls, and fishhooks were all carved from the wood. Large branches were tied together into bundles to collect herring spawn, an important food source for the people. And hemlock pitch, when mixed with deer fat, was used as a balm to prevent sunburn.

WESTERN REDCEDAR

Did you know...

- The world's largest redcedar is found on Vancouver Island. It stands 20 stories tall and may be 2,000 years old!
- It has thin, stringy bark and wood that smells a bit like pineapple.
- The Kwakwaka'wakw, a coastal First Nations people, nicknamed the cedar the 'tree of life'.
- It is British Columbia's provincial tree.

First Nations peoples of the west coast used cedar wood, bark, branches and roots to produce an amazing variety of products. They carried water in watertight cedar boxes, wore long robes made from cedar bark and lived in long-house build of cedar planks. When they gathered cedar they rarely damaged the tree. These living trees, called culturally modified trees, can still be found in forests all along BC's coast. Instead fallen logs or boards were split from standing trees. They left behind a still-living tree. Only when they need to carve a totem pole or build a dugout canoe did they fell an entire tree. Few cedar trees were actually felled before European contact.

SITKA SPRUCE

Did you know...

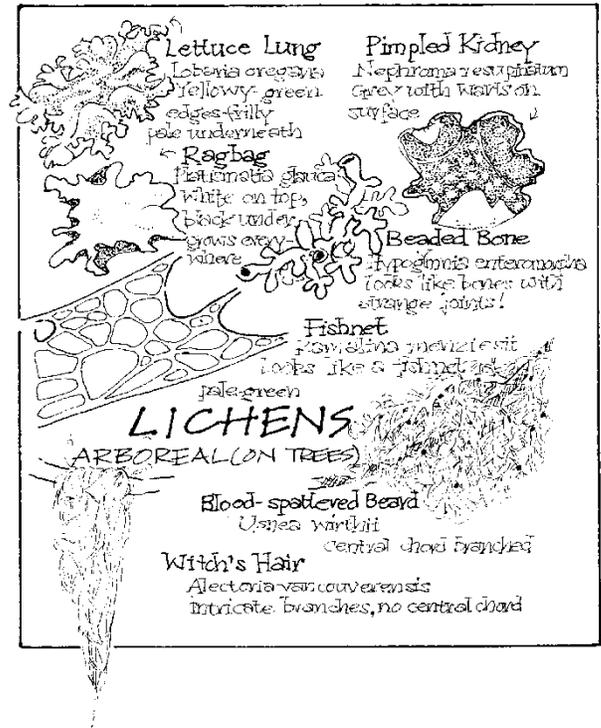
- That along with the Australian eucalyptus and the California redwood, the Sitka spruce ranks among the world's largest and longest living plants.
- They act like living shields. Because Sitka spruces grow beside the ocean and are tolerant of salt spray they are able to provide a shield for less hardy trees and plants.
- A quick way to identify Sitka spruce is to grab a branch in your hand. The stiff, sharp needles point out on all sides like a bottlebrush and hurt your hand.

The First Nations people of coastal British Columbia used many different parts of the Sitka spruce. Many believed that the sharp needles of the Sitka spruce gave it special powers for protection against evil thoughts. In winter dance ceremonies the boughs were used to protect the dancers. The roots of the spruce were woven into beautiful watertight hats and baskets. The inner bark was eaten, either fresh or dried into cakes to be eaten with berries. And the pitch was both chewed for pleasure and was also used as medicine for burns, boils, slivers and other medical problems.

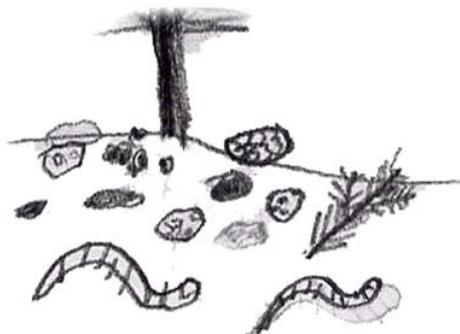
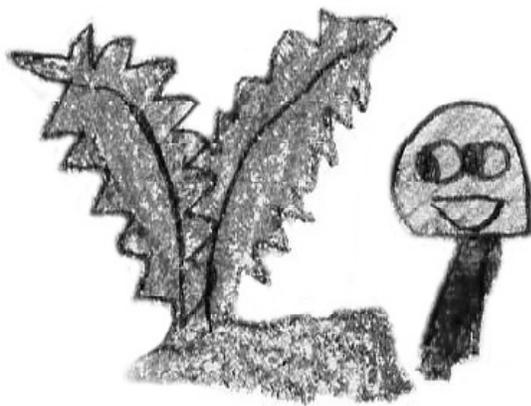


LICHENS

Lichens are not exactly plant, not exactly animal but an odd mix of algae and fungi growing together in one body. Our forests contain more than 1,100 types of lichen – some flat and frilly, others shaggy or the shape of miniature volcanoes, and researchers continue to discover new species. There are species of lichen growing in today's rainforest that date back 70 million years. Long overlooked, lichens were recently recognized for their critical role in forest ecology, transforming Nitrogen from the air into nitrates – a natural fertilizer! Lichens don't begin to flourish in abundance until a forest is 150-200 years of age. Their population peaks after the forest reaches 350 years. Without this source of nitrates, it is uncertain as to how well a rainforest will survive over the long term.



Lichen Art Credit: Briony Penn



FUNGI

We rarely see the real powerhouses of the forests – the soil fungi lying beneath the forest floor. Soil fungi appear delicate (four to six kilometres of these fungal threads fit in the palm of your hand) but many trees need them to survive. These fungal networks – collectively called *mycorrhizae fungi* – lie among the tree roots, connecting the trees with nutrients and water, feeding the tree. Without them, trees can't absorb the water and nutrients they need to grow. The fungi are nourished by the nutrients the tree produces. And mice, flying squirrels and bats all rely on these fungi for food.

An estimated 3,000 fungi species work below the surface of BC's coastal rainforest but only a few 'fruit' as mushrooms. Exotic delicacies of our woods, like wild Pine mushrooms and Chanterelles, capture attention around the world and high-prices on the global market. But most fungi are like the worker bees: always busy but rarely getting noticed. Fungi's importance in the rainforest shows us that everything is interconnected.

TEMPERATE RAINFOREST PLANTS AS MEDICINE

Can rainforests really provide medicines for people? Yes! Directly or indirectly 1 in 5 pharmaceutical drugs come from the world's rainforests – both tropical and temperate. In fact, the American National Cancer Institute has identified 3,000 plants with 'anti-cancer' properties – with more than **two-thirds** of them come from rainforests! In fact, one quarter of all prescription in the US include plant extractions.

Traditionally, temperate rainforest have provided First Nations peoples with at least 150 different medicinal treatments. By 1997, 70-80% of First Nations medicinal plants tested revealed active healing compounds. Recently, more than 200 local temperate rainforest plants were discovered to have antibiotic, antifungal, anti-viral and anti-microbacterial properties.

Take the case of the Western yew. The Western yew (*Taxus brevifolia*) is a stringy evergreen resembling western hemlock that grows in the understory of the ancient coastal rainforest. Commercially unimportant to the forest industry, for many years yew trees were simply left to rot in rainforest clearcuts or burned on slash piles. Today however, the Western

yew is in great demand for its cancer-treating properties. Its bark has been found to have a chemical derivative called taxol that has cancer-fighting properties. But it takes the bark of 1,000 Western yew trees to produce one dose of this cancer-fighting drug. And Western yews grow very slowly; it may take a century or more for one tree to reach a diameter of 10 centimetres (four inches) and a height of metres (40 feet). This slow rate of growth combined with the demand for its bark could endanger the long-term survival of this life-giving tree.



GORDON SEWARD

Rainforest Animals

Almost 100 species of vertebrates (animals with backbones) depend on BC's temperate rainforest for critical habitat. In these long-lived, tall-tree forests, some 230 bird species and 68 different mammals find exactly the sustenance and shelter they need: clean water, insect-filled rotting logs; branches and snags, and dens in hollow trees. These are features found only in temperate rainforests, developed over 250 to 1,000 years. Not all rainforest creatures are evident at first glance; many live underground or overhead in the tree canopy, and others may be tiny, stealthy or nocturnal.

Educational Resource, Sierra Club BC

Mammals that live in the temperate rainforest include: Roosevelt elk, black-tailed deer, wolverine, marten, big brown bats, silver-haired bats, long-legged mice, black bears, river otters, and grizzly bears. Birds include Marbled Murrelets, bald eagles, great blue herons, ospreys, great horned owls, pileated woodpeckers, mergansers, and smaller birds such as winter wrens, hermit thrushes, brown creepers and chestnut-backed chickadees. And amphibians that make their home here include northwestern, clouded and western red-backed salamanders, as well as rough-skinned newts.

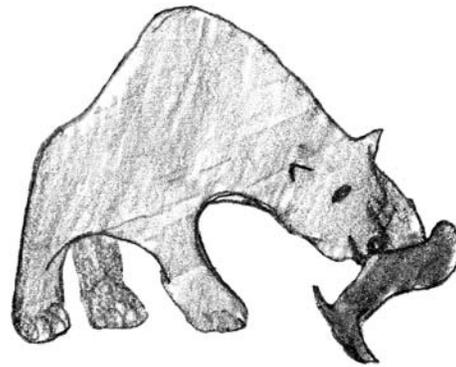
Below is information on just a few of the many, many special animals that call the temperate rainforest home.

Bears

Bears are a key element of the temperate rainforest. In British Columbia, we have grizzly bears, black bears and a rare sub-species of the black bear called the Kermode Bear or spirit bear. The Kermode Bear is a unique creamy white variety of black bear found in the Coastal Temperate Rainforest, particularly on Princess Royal Island, where about 1 in 10 bears is born white.

Grizzly bears once lived and thrived in the forests of Western North America, all the way to Baja California! Today, there is very little habitat left on this continent available for grizzlies to live. Official BC government estimates state that there are 1,500 to 3,000 grizzly bears in the central coast mainland of our province – about one quarter of the world's remain grizzly population.

Within BC they live mostly on the central and north coast because it contains the large-scale wilderness grizzlies require. Each bear must consume 25 kilograms of green vegetation in a day as it works to put on an additional 200 kilograms of body weight before hibernating. To find the wide range of foods, such as roots, plants, insects, grubs, clams, fish, and berries, a bear must travel through much of the forest. The BC government recognizes that grizzly bears require wilderness tracts of at least 5,000 to 10,000 hectares – about the size of a field 10 km long and 5 km wide – in order to obtain the large quantity and variety of food they need to survive. The health of a grizzly bear population is a good indicator of the health of the entire forest ecosystem.



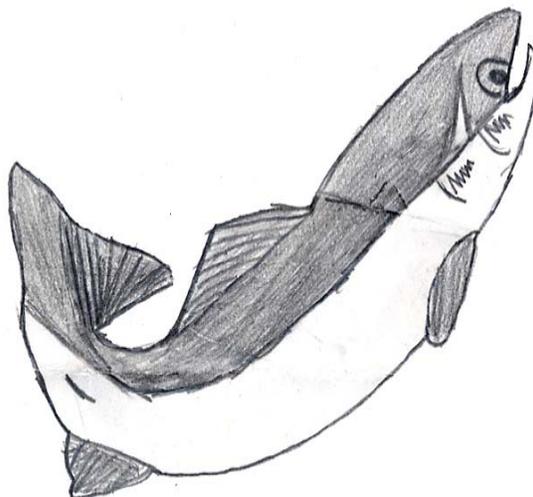
Did you know...

- BC's rich temperate rainforest historically produced large numbers of record-sized grizzly bears (up to 500 kilos and nearly 3 metres long).
- Worldwide, the grizzly bear has been eliminated in more than 50 percent of its historic range.

SALMON

There is a critical link between fish and forest: salmon! Salmon are an old growth dependent species. For thousands of years, salmon have been born and reared in the countless large and small streams that thread through BC's rainforest. The salmon spawn and are born in these small forest tributaries. Upon maturation, they migrate into the Pacific Ocean and return to the forest years later to spawn and die. They deliver masses of oceanic nutrients to rainforest streams when they spawn, decomposing into nitrogen and carbon, fertilizing stream side vegetation and nourishing new salmon fry. Spawning salmon are also food for wilderness carnivores such as bears, wolves and bald eagles. During late summer and early fall, black and grizzly bear populations feed almost entirely on salmon, making up 95 per cent of their diet.

The remains of what the bears do not eat, decompose into lush, nutrient rich topsoil perfect for trees and plants to grow. Salmon remains add the single



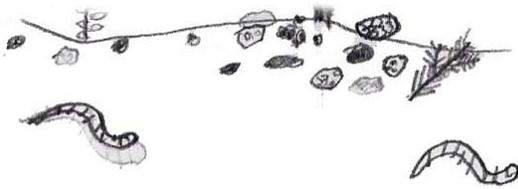
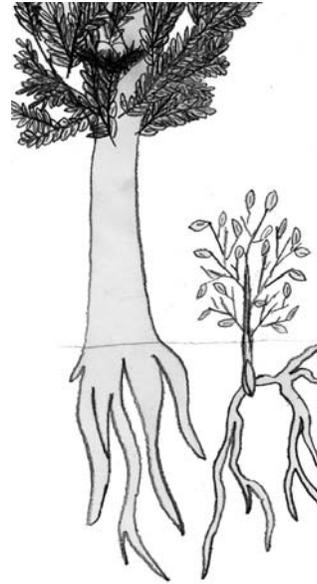
greatest organic input to rainforest ecosystems giving rise to the large, majestic trees so distinctive of a temperate rainforest. Scientists estimate that 25-30% of the nutrients found in streamside vegetation and up to 80% of the nutrients in some lakes can be traced to salmon carcasses. One study found that on Haida Gwaii (formerly the Queen Charlotte Islands) each bear transferred 1600 kg of salmon into the forest over 40 days! From these types of studies, it becomes evident that the health of salmon populations is important to support bear populations.

But salmon require their spawning grounds to remain wild, intact and clear of industrial refuse. Extensive clearcutting causes heavy water run-off loaded with silt and debris. The downpour flushes streams, erodes banks, alters water temperatures and clogs spawning beds. The loss of small, genetically distinct salmon populations may be the single greatest threat to salmon survival. Five species of salmon and one species of steelhead (another salmonid which has a similar life cycle as salmon) make their home in the temperate rainforest.

MARBLED MURRELET

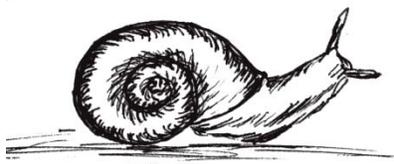
One of the most mysterious birds to evolve along with our temperate rainforests is the marbled Murrelet. In recent years these drab-colored seabirds have captured attention not only for its unique relationship with the old-growth forest, but also with its dramatic decline in numbers. The Murrelet relies on wide, moss-covered branches and protective surroundings of old-growth temperate rainforests for essential nesting habitat.

Murrelets commute great distances from the ocean to their ideal nesting habitat, often flying over 50 kilometres – every day! It builds a nest on a mossy branch of a tall tree, 20 to 50 metres above the ground, where its single egg is safe from most predators. As old-growth forests disappear, so too does their nesting habitat. In B.C. marbled Murrelets are officially designated as a threatened species. When we learn about the temperate rainforest, we also learn about the many other species such as the Murrelet, which rely on the temperate rainforest for critical habitat.



INSECTS

Not all the animals of the temperate rainforest are easy to see. A shovel-full of healthy forest soil contains more living organisms than there are humans on earth!

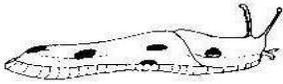


Neville Winchester of the University of Victoria has been studying invertebrates on Vancouver Island. (Insects are invertebrates, meaning they don't have vertebrae like human beings do.) After collecting 1.4 million specimens, he estimates that the Carmanah Valley, in the temperate rainforest, is home to between 10,000 and 15,000 species of invertebrates, mostly insects. This is about one-third of the total known species for Canada and includes about 500 new species to science.

From Cannings and Cannings. *British Columbia, A Natural History*



BANANA SLUGS



Another creature without a backbone is the banana slug – often affectionately referred to as 'the vacuum cleaner of the forest floor'. These slimy creatures are invertebrates that can grow to 26 centimeters in length. One of the largest slugs in the world, banana slugs play an important role in the rainforest web of life. Banana slugs cruise the forest floor, devouring leaves, stems, bark, etc. In turn, other rainforest creatures such as shrews, garter snakes, crows, ducks, geese and amphibians eat banana slugs themselves. There are over 12 species of slugs in the temperate rainforest and these voracious slugs live in harmony with the other plants in the rainforest – some plants have distinct ways of coping with the slugs plant-based appetite! The Wild Ginger plant, for example, either grows new leaves or buds more quickly than the slug eats them, or produces chemicals that slugs find distasteful.

Did you know...

- Slugs are found in lots of different colours, including bright yellow.
- Slugs eat by scraping a long, toothy tongue across their food. One Banana Slug tongue can have over 10,000 teeth!
- Their sticky slime helps protect them from predators.
- Slugs need to remain moist, so the Temperate Rainforest makes a good home for them.

THE AMPHIBIANS: SALAMANDERS AND FROGS

Ensatina, clouded, Western red-backed and Northwestern salamanders all rely on the temperate rainforest for critical habitat, as do rough-skinned newts, and Pacific tree frogs. Both frogs and salamanders are very sensitive to air pollution. In the past century, the diversity of frogs and salamanders has been decreasing. Some scientists think that the reason for this decline in amphibian species is due to the increase in air pollution and/or global warming.



Did you know...

- Pacific Tree Frog are able to change their colour to their surroundings
- Salamanders are different from reptiles because they have smooth skin.
- Salamanders have many different ways of defending themselves. Some have brightly coloured bodies to scare away predators, and others will bury themselves under a rotting log. One type, the rough-skinned newt, is actually poisonous to eat!
- Some salamanders breathe *only* through their skin! For this reason, you can find salamanders near water and in moist rotting logs. The temperate rainforest makes a good home for them.
- If a salamander loses its tail, it is able to grow a new one!

Bats

Did you know...

- Bats use echolocation (ultrasonic sound) to locate objects and food.
- Bats in British Columbia do not hibernate. Instead, they undergo a daily *torpor*, which is like a very deep sleep, in order to help them save energy.
- Bats eat insects. The Little Brown Bat can eat over 600 mosquitoes in one hour!
- Some bats can live to be 30 years old!
- Wildlife trees are important homes for bats. They can also live in caves, cliffs, and people's attics!