



Temperate Rainforest Ecology

To many, the word rainforest brings to mind lush vegetation and an abundance of reptiles and amphibians. This rainforest of dream vacations is the “tropical rainforest.” In a tropical rainforest, there is not much change in daylight hours from winter to summer and seasons are measured by weather patterns, not by temperature. Tropical rainforests are found between the tropics of Cancer and Capricorn.

Temperate rainforests have rain and trees in common with their tropical namesakes but little else. To be considered a rainforest an area must receive 80 inches of rainfall or more each year. In the temperate regions of our planet, this amount of rain falls consistently on the eastern edge of the Pacific Ocean.

The Trees for the Forest

In Kenai Fjords, the primary tree of the rainforest is the Sitka spruce (*Picea sitchensis*). Sitka spruce trees have very sharp needles and bark that sheds in rounded, puzzle-piece-like flakes. This resilient tree lives along the coast from northern California to western Alaska. It grows straight and fast, its wood in the southern part of its range is highly valued for its straight grain and strength. It is the hardest of the soft woods.

In the forests of Kenai Fjords National Park, Sitka spruce is abundant, but held to elevations usually lower than 1,000 feet. Above this level, snow does not melt quickly enough to allow the trees a sufficiently long growing season. Even below 1,000 feet, many of the trees crack along their trunks from early frosts. Mixed with the spruces are mountain hemlock trees. Mountain hemlock (*Tsuga Mertensiana*) ranges higher up the slopes, and is tolerant of short seasons and heavy snowfall.

Traveling by boat along the shoreline of Kenai Fjords National Park, the difference between spruce and hemlock can be seen as a difference in color: Spruce trees are grayish or bluish in tone; hemlocks have a brighter, yellow-green cast.



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Kenai Fjords National Park boasts the northernmost boundary of the temperate rainforest ecosystem. The forest extends south along the coast of North America as far as northern California. Two factors combine throughout this range to produce perfect conditions for the rainforest ecosystem: high coastal mountains and ocean lying just to the west.

The location of the ocean is significant. As moisture from the ocean rises to form clouds, the prevailing winds whisk the clouds toward the mountains of Southcentral Alaska. In the Kenai Fjords, the mountains literally trap the clouds producing our somewhat soggy climate. The park receives 80-150 inches of precipitation annually; easily triple the wet climate of Seattle, Washington. Due to the damp conditions, temperate rainforests experience few fires.

The ocean also moderates the temperature of coastal regions along the eastern north Pacific, keeping them a few degrees warmer than lands out of its weather reach. Kenai Fjords National Park is dominated by conifers, but unlike rainforests to the south there is persistent snow at sea level during the winter season.

Layer Upon Layer

A temperate rainforest consists of three layers: the canopy (trees above 15 feet tall), the understory (shrubs 10-13 feet tall), and the forest floor. In Kenai Fjords, the canopy is comprised of Sitka spruce and mountain hemlock. In an old-growth forest, a forest that has not experienced disturbance in over 175 years, the canopy layer can be diverse enough to contain microclimates. Microclimates create niches, which create species diversity. The marbled murrelet is one species found in Kenai Fjords National Park that needs old-growth spruce, preferably with lots of moss for building its secretive nesting sites. Within the forest, light availability and temperatures decline and humidity increases as you work your way down through the layers.

The understory is usually comprised of thorny devil's club (*Oplopanax horridum*), blueberry bushes (*Vaccinium* sp.), or a blueberry relative called rusty Menziesia (*Menziesia ferruginea*). Waist-high lady fern (*Athyrium filix-femina*), deadly baneberry (*Actaea rubra*), and cucumber-flavored twisted stalk (*Streptopus amplexifolius*) also thrive in the cool, moist shade.

The forest floor is a fairly dark place but what it lacks in light, it makes up for in nutrient availability. Still, few plants are able to grow here. Mosses and lichens survive without much sun and the tiny leaved Lingonberry (*Vaccinium vitis-idaea*) thrives threaded amidst the moss. Mosses and lichens have also developed the ability to live without soil, as epiphytes on tree trunks and branches, this “second home” offers better access to sunlight and the ability to absorb moisture from the air.

In this tightly cycled ecosystem, the forest floor is constantly being supplied with nutrients in the form of litterfall. Litterfall is the material that works its way down from the plants above. Twigs, cones, leaves, and bits of lichen fall to the ground and are recycled into a soil layer that is thin but rich. Layers of the canopy control the throughfall, another name for the moisture that reaches the forest floor.

The Ties That Bind

Many symbiotic relationships exist within the temperate rainforest. One of the least visible, but most extensive, is the mutualistic relationship of mycorrhizal fungi with many of the forest plants including the Sitka spruce tree. These fungi have a network of root-like

mycelia delving into decaying trees and rotting leaves, working loose trapped nutrients. They penetrate into the roots of living trees, in turn, exchanging their gathered nutrients for the sugars made in the canopy far above. Fungi, bacteria, and insects act as the decomposers and recyclers of the forest, breaking down and redistributing the litterfall from the trees above.

In temperate rainforests, downed trees act as “nurse logs” to seedlings. Seeds that land on a nurse log have an advantage from the supply of nutrients, water, and soil found in the decaying wood. This commensal relationship benefits the seedlings that will become the replacement primary producers of the downed tree.

Plants and animals can have symbiotic relationships. The small, red squirrel derives the bulk of its diet from the seeds of Sitka spruce. They nest in and under their favorite trees—usually older ones that produce many cones. They store cones in burrows and do not always remember where they put them, which spreads the seeds. Their digging aerates the soil around the roots, and their waste becomes compost, returning nutrients from squirrel to tree. Both tree and squirrel benefit in this mutualistic relationship.

One does not often associate fish with forests, but salmon are another contributor to the ecosystem. As salmon travel up freshwater streams to spawn and die, their carcasses bring essential nutrients. Forest consumers such as bear, marten, eagles, and river otter feed on the salmon and carry their nutrients back into the forest.

The northern limit of the coastal temperate rainforest is a dynamic linking of oceanic, atmospheric, and physiographic conditions, which combine to produce a tightly knit biotic community. Sunlight is rationed through layers of conifers. The understory thickens in relation to the canopy overhead. On the forest floor, all manner of creatures carry on the business of recycling any cone or branch that drops to the ground. The rainforest thrives using a thin soil layer on steep slopes often enshrouded with clouds and fog, a faultless example of nature's excellence.