

Structure Of The Forest

As you walk through the forest look at all the different patterns and textures. Forests are not just groups of trees. A forest is made up of many different **interconnected layers** of plants and animals, all with different sunlight and moisture needs.

A forest **community** can be thought of like a house. The tallest trees of the forest constitute its roof or canopy. In the forest at Arthur's Pass the **mountain beech tree** is the **canopy tree**. A canopy tree is one which has its crown exposed to the sun. The leaves of the mountain beech tree filter sunlight and water to the plants below.

Smaller trees and tall shrubs such as **broadleaf, three finger, celery pine, and coprosmas**, live on the first floor of our house, or in the **subcanopy layer** of the forest. These trees require less direct sunlight than the canopy trees, and are happy to live in the shade of the larger species.

The forest home is furnished luxuriantly with **creepers** and **perching plants**. Creepers like **bush lawyer**, use their thorns to climb up the trunks of canopy trees to reach the sunlight.

Perching plants, or epiphytes, grow on other plants without harming them. **Lichens and mosses** growing on the beech trees are epiphytes. They draw their **nutrients** from water running down the tree trunk and manufacture their own food using **photosynthesis**. Sometimes larger plants from the subcanopy layer find a **niche** on the trunk of a beech tree where a little soil has been formed from decaying leaves and other plant matter. Perhaps a bird ate the berry and then either wiped its beak on the trunk, or excreted the seed.

Beneath the **subcanopy layer**, on the main floor of your house, small shrubs (such as the **hebe**), and juvenile trees are found.

The forest floor is covered with a richly woven carpet of fallen leaves, twigs and logs; a beautiful patchwork quilt of mosses, **ferns, fungi, and lichens**, the larger ferns, and seedlings of trees and shrubs. The mosses and ferns that live on the forest floor are adapted to the darkness and dampness under the forest trees. On the forest floor fallen trees, branches and leaves undergo bacterial and fungal decay, yielding **nutrients** for the young plants that will take their place in the community. This **leaf litter layer** is very important for all the plants and animals in the **beech forest ecosystem**.

The soil and roots, the basement of our forest house, where the rubbish and sewage disposal is taken care of, provides the plumbing and foundation on which our house stands, and has a large storage area as well.

Within this layered structure of plants in the forest dwell a vast number of birds and insects. These animals also occupy different positions in the forest structure. Some birds like the **kea** live at the tops of the trees and feed on berries, while others like the **tomtit**, collect insects from the forest floor. Some insects live high in the different trees, feeding on leaves or other insects, some live in rotted logs, while others, like the **kiwi**, find their **habitat** in the **leaf litter** on the forest floor.

Habitat

Everything in the forest has its **habitat**. For plants this is the place where there is the right amount of sunlight, wetness and nutrients to suit the particular plant. For a bird or insect this is a cozy place to live with a good source of food.

Food Chains

Within nature there are **food chains**. A food chain is a sequence of species that are dependent on the preceding one for food. All the animals, including humans, depend on green plants either directly or indirectly as their food supply. Some birds like the **kea**, and insects like **caterpillars**, eat leaves or berries of plants and trees. These animals are called **herbivores**. Other birds like the **fantail** and **rifleman** are **predators** and eat insects on the plants, in the air, or on the forest floor. Some insects and spiders are also predators on other insects. Some of these insects may in turn be prey for the birds. Most species appear in more than one food chain. Interlacing food chains constitute a **food web**. The chain of prey and predators in nature is balanced so that no one species gets out of control. For example the birds are always eating the leaf eating insects so that these insects never have a chance to destroy all the plants in their diet. So you can see why disrupting one part of this delicate web **of interdependency** will affect the whole **forest community**. Humans, as the chief predator, have often upset this fragile balance.

Noxious Animals

When people introduced animals such as deer, chamois, stoats and possum to the mountain forests, this fragile chain was upset. There were no **predators** for these animals, and the forest had evolved without them. The introduced animals had a ball! Eating as much as they wanted with no one to stop them. From a small number of introduced animals their **population** grew alarmingly and the young plants in the forest were destroyed so that the forest started dying, and the young birds and eggs were killed. The Department of Conservation has a programme of control for these noxious animals. Over many years the numbers of the big animals like deer and chamois have been reduced so that they are not such a big threat to the forest. However the smaller animals like stoats and possums breed faster and are harder to find to kill, so are still a very big threat to our forests. In future, we humans should think more carefully about the consequences of our actions before we interfere with the balance of nature.

Adaptations

Each species of plant and animal has **adapted** to its position or **niche** in the forest so that no two organisms are directly competing for the same food supply or space, and species can co-exist. **Adaptation** enables a variety of plants and animals to live together as a community, utilizing different environmental resources.

The adaptive features of a species include its shape, where it is found in the forest, its feeding habits and food sources, and its method of reproducing itself. These adaptations enable it to occupy its particular **ecological niche**, and promote **co-existence** amongst all the different organisms.

Species are continually evolving and adapting to changing conditions, but these adaptations take a long time to develop. Many adaptations of plants to the mountain beech forest conditions at Arthur's Pass can be observed.

Green plants need sunlight, moisture, and a source of nutrients. The position a plant grows in the forest and the shape of its leaves are adaptations to enable it to get its required amount of these resources. Green plants manufacture their food within their leaf laboratories by a process called **photosynthesis**. They use sunlight, CO_2 from the air, and water to make starch. Plants use some of this starch for food and the rest for growth and to store for future use.

Sun Response

Sun response is an important adaptation of plants in the forest. Look around at the different plants in different layers of the forest. Can you see their different needs for sunlight or shade?

The mountain beech trees, which make up the **canopy** of the forest at Arthur's Pass, raise their tops above all the other plants so their leaves can absorb the sunlight. Can you see the way the branches and leaves are layered in order to get maximum sunlight? The small leaves form a lacy ceiling to filter the sunlight and rain to the plants growing in the forest below. Smaller plants in the **subcanopy** of the forest have adapted themselves to shady conditions, or grow in a special way to get their share of the light. The **bush lawyer** has adapted by growing prickles so it can climb up the beech trunks, twisting and supporting itself on the bigger trees as it reaches up and out to the light.

Other plants have left the ground altogether and perch on trees. These **epiphytes**, like the **old man's beard lichen**, live independently on the branches of the bigger trees - a grandstand view and a great spot to catch the light and obtain water and nutrients from rain dribbling down the tree trunk.

Have you noticed the spindly growth of young forest trees like the **lancewood** or **stinkwood**? The leaves are arranged so that they get the maximum amount of sunlight. Some of the subcanopy species like **three finger** and **broadleaf** have big leaves that enable them to absorb maximum sunlight and water under the beech trees. The **hebe** loves the sun and so it grows on the forest edge or in forest clearings.

The **grass tree** or **inaka** grows higher in the forest and above the bushline where it is often snow covered in winter, so it has adapted with needle-like leaves that shed the snow to enable the leaves to continue to absorb sunlight.

Though many plants grow towards the sunlight, others possess different adaptations which allow them to live in the shade. Mosses and some ferns require the moisture and the shade of the floor of the beech forest. Young seedling beech trees also like the shade and establish themselves in shady conditions. These young beech seedlings, only centimetres high, can survive for up to 20 years, until sufficient light allows further growth. They will wait until an old tree dies and falls down giving them the light and space to grow.