

From the National Film Board of Canada

LAND ABOVE THE TREES



A STUDY GUIDE

Land Above The Trees is the fifth film in the Ecology Series. A series of five films exploring the importance of plants and animals in relation to their environment.



Introduction

The alpine zone in Canada is testament to the ability of plants and animals to make the adaptations necessary for survival in even the harshest of environments. Photographed in British Columbia and Alberta, *Land Above The Trees* provides an introduction to the Canadian alpine zone and examines some of the unique plants and animals that have managed to survive in this extreme environment.

The film takes us through one cycle of the alpine year. Spring arrives late compared to most environments; but when the ground begins to thaw, plants are quick to respond. Special adaptations allow a variety of alpine plants to complete their life cycles in the very short alpine summer.

With new plant growth comes the return of animal and bird life, and the re-emergence of animals like the marmot who have spent the long winter slumbering in hibernation. Both birds and insects are attracted to the colourful and oversize blossoms of alpine plants. Mammals such as the mountain goat and bighorn sheep feast on slopes where there is no competition for food.

Yet even during the most glorious days of summer, the presence of winter snows is never far away. Not only can it snow on any given day, but the accumulated snows of yesterday — in the form of huge glaciers — are present in many Canadian alpine areas. While some melting does occur during the summer, winter is really the only season on these frozen snowfields.

Autumn arrives early and the colours of alpine plants fade quickly. Most birds and animals migrate to less extreme environments. However, some animals like the pika continue storing huge quantities of food for the fast approaching winter which will last for nine months. Heavy snows and arctic temperatures dominate most of the alpine year. Survival is the simple mandate for life in the alpine zone.

Physical Features of the Alpine Zone

Elevations of the alpine zone in Canada vary from sea level in the Arctic to 1400 meters in the coast mountains of British Columbia to above 2200 meters in the Canadian Rockies. But generally we can say that Canada's alpine regions lie between tree line and summit. The alpine regions pictured in this film are all located in the midst of rugged mountain landscapes. Recent glaciers have had a major impact in sculpting these alpine regions. Ice, water, wind, and plant life continue to reshape the boulders and rock faces of the mountain peaks. Soil is thin and meagre. One Canadian study found much of the alpine soil sampled to be less than 10 centimetres deep. It is frozen for most of the year, and then disrupted by frost heaving.

Alpine Climate

The alpine zone is affected by climatic extremes. Air temperature cools about 1.5 degrees Celsius for every 300 meters in elevation gain, and strong winds are a constant presence at high altitudes. These winds dictate the shape of plants and determine where snows are deposited and soils settled. The winds are strongest in winter when they blow with a sand-blasting effect. Exposed plants are stripped of vegetation and they can suffer water dehydration. But luckily, most alpine plants are protected by a deep layer of snow that results from the heavy yearly precipitation.

During the short summer period, the sun's intense radiation helps alpine plants to develop more rapidly than most plants at a lower elevation. Yet even in the summer, the alpine climate can fluctuate wildly in the course of one day. As experienced mountaineers know, it is not uncommon to witness a wide spectrum of climatic conditions during a day's outing in July or August. Hot summer days in valley bottoms cause air to rise and, therefore, cool by the time it reaches the alpine zone. If there is moisture in the air, this often causes afternoon precipitation in the alpine.

Alpine Flora

Given the harsh environmental conditions found in the Canadian alpine zone, one might be surprised at the richness of plant life found there. At the height of plant flowering, sections of the alpine zone can easily turn into an ecstasy of colour. Alpine plants have made the adaptations necessary to survive. For instance, most alpine plants grow close to the ground. This is efficient because it allows plants to escape from the worst of alpine winds and to take advantage of higher temperature at ground surface.

There are other important adaptations in addition to those mentioned in the film. One unique adaptation allows plants to begin new growth when surface temperature is just above the freezing point. This is possible because they store carbohydrates in their root system. These carbohydrates produce a red colour pigment known as anthocyanin — which converts light rays into the heat needed to warm plant tissue. This adaptation gives alpine plants a kick start in new seasonal growth.

Early flowering is yet another adaptation. This allows alpine plants to complete their life cycle in the short summer season. Because plants form new buds in the previous growing season, the flowering process is not hindered by the still cold climate of an alpine spring. Most alpine plants have also developed an extensive root system. This helps them to obtain nutrients and water from the thin soil, and to remain anchored in the face of fierce winds.

Alpine Fauna

Elk, woodland caribou, bighorn sheep, mountain goats, and grizzly bears all reside in the Canadian alpine zone during the summer. Most of these mammals migrate to lower levels once vegetation becomes scarce and winter climate severe. Of these animals, the mountain goat is most suited for the alpine environment. Goats do not migrate down to valley bottoms, but rather, they seek out exposed mountain faces where snow does not accumulate. Thick fur and specialized feet allow them to browse at the uppermost limits of plant growth.

Two small mammals shown in the film reside in the alpine environment year-round. The marmot survives by hibernating about eight months of the year. During hibernation the marmot's body metabolism is lowered substantially, and the stored fat reserves are used slowly. In contrast, the pika does not hibernate, but lives under rock piles for most of the year. Pika survive on the large plant growth. Because this diet is not high in calories, pika must eat often to meet energy needs. They obtain maximum food value from their vegetarian diet by re-eating their faecal matter, which is high in protein.

Ecology in the Alpine Zone

Ecology can be defined as the interaction of organisms among themselves and with the physical environment. Because the physical environment is so dominant in the alpine zone, plant life is very responsive to the effects of any micro-environment. A strategically placed rock or ground depression may be the factor that allows plant growth to begin.

The barren landscape of the alpine zone makes for an ideal setting to study pioneer species and plant succession. On many boulders and rock faces lichens are the primitive plant pioneers. As the rock slowly fractures and disintegrates, gravel flows down slope and soil slowly begins to accumulate. In these fields of rock and trapped soil, more advanced plants such as the moss campion grow at absolute ground level. These so-called cushion plants are adapted to escape the alpine winds. When more soil begins to build up and a meadow to form, the cushion plants will be taken over by grasses, sedges and flowering plants.

The mountain avens family is an important part of this plant community. These plants spread to cover large areas; and their roots contain a bacteria that turns nitrogen from the air into compounds that other plants can use. Once flowering plants and grasses are established, then insects, birds, and animals all interact to form an ecological system.

Relative simplicity in the alpine ecosystem means that change to any single component can result in drastic change for the entire community.

Some Suggested Student Activities

- Before viewing the film, have students list the various vegetation zones found in their province and in Canada. Discuss what plants and animals might be found in each zone. Discuss the role of topography and climate in determining biological zones.
- View the film with no sound and let students take notes and discuss their impressions of the film's content. Then play the film with sound and have students note the main points made by the narrator.
- Students could locate on a map of Canada all areas where alpine zones are likely to occur. They could discuss why Canada has alpine regions at sea level — yet in other countries this zone might not begin until the 3000 meter elevation level.
- Research the life cycle of flowering alpine plants. Compare and contrast this cycle with both wild and garden flowers that grow in the region where the students live.
- Discuss why some alpine flowers bloom literally right through melting snow. Are there flowers in other vegetation zones that do this? Some students might investigate the role of anthocyanins in giving alpine plants an early start in new seasonal growth. How does this method of growth compare and contrast with the way photosynthesis helps plants to grow?
- Discuss the concepts of pioneer species, ecological succession and climax communities. Students could identify the kinds of plant life found in a particular Canadian alpine region. Does a climax community yet occur?
- Draw up a basic food-web for plants and animals found in the Canadian mountain alpine zone.
- Students could research and report on different animals found in the Canadian alpine zone during various times in the year. They might identify, list, and compare some of the adaptations that help these animals to function and to survive there.
- Research and discuss hibernation and migration. Students could hypothesize why some animals hibernate and others migrate. Why do some migrating animals prefer the alpine zone over lower elevations during the summer months?
- Show a film about the Canadian Arctic and have students research plant and animal life found in the Arctic alpine tundra. Compare and contrast these with plants and animals in the mountain alpine regions.
- Students could make a list of various alpine zone recreation activities that humans participate in. What special precautions must be taken due to extreme climatic conditions? What kinds of clothing should one take for even a day's excursion in the alpine?
- Students could identify some problems that human activity has caused in various alpine regions by interviewing a knowledgeable naturalist, resource conservation official, or member of a wilderness preservation group such as the Sierra Club. They might also write to provincial and federal Parks Departments requesting any reports concerning human impact on alpine regions. Why are alpine regions especially susceptible to damage from mechanized transportation? Students might debate the pros and cons of allowing mountain bikes to use hiking trails in alpine areas.

Suggested Audiences

With superb photography and an informative narration, *Land Above The Trees* is suitable for a wide audience from the intermediate level upwards. General science, earth science and geography students might examine the effects of water, ice and climate on shaping the physical features of the alpine zone. For biology students the film offers a starting point for studies of succession, habitat,

adaptation, and biological niche. The extreme environmental conditions make for an interesting study of this fragile ecosystem.

This fifth film in the NFB ecology series is also most suitable for environmental education and outdoor recreation groups. Not only does it explore the ecology of the alpine zone in Canada, but it also shows the extreme climate that awaits human activity in the land above the trees.

Terms and Concepts Used in the Film

Adaptations A characteristic of an organism that contributes to its survival in its environment.

Alpine Zone A vegetation zone found between tree line and summit. Elevations vary depending on geographical location.

Ecosystem A community of interdependent, interacting organisms within a specific physical environment.

Glaciers A large mass of compacted snow which forms into ice, and then flows slowly down a slope after reaching a critical thickness.

Hibernation A method of winter survival by which an animal lowers its metabolic rate and remains

dormant, living off accumulated fat reserves.

Krummholz From German meaning "crooked wood." A scrubby, stunted growth-form of trees. Found in alpine areas above tree line.

Lichens A plant formed by the symbiotic relationship of an alga and a fungus. In the alpine zone, the fungus produces acids which dissolve rock minerals into a chemical that the alga can absorb. The alga synthesizes these minerals into nutrients on which both can feed.

Plant Successions The gradual change over time in the nature of a plant population in an area. Plant succession occurs during plant colonization of barren areas like the alpine zone.

Rutting Season The time in autumn when male members of some of the larger mammal groups engage in ritual or real combat, with horns, for dominance over females during the mating season.

Symbiosis The living together in close association of organisms from two different species. Lichens are an example of a plant formed by a symbiotic relationship.

For Further Reading

Land Above The Trees
Zwinger, A. & Willard, B.
1972, Harper & Row
New York

Alpine Canada
Russell, A.
1979, Hurtig Publishers
Edmonton

The Whistlers

Parks Canada
1986, Ministry Of Supply & Services
Canada

Columbia Icefield

Interpretive Service,
Jasper National Park
1987, Ministry Of Supply & Services
Canada

For Further Viewing

High Country (15 min.), produced by Karvonen Films Ltd. Available through Magic Lantern Film Distributors, 136 Cross Avenue, Oakville, Ontario, L6J 2W6, and Suite 210, 10151 No. 3 Road, Richmond, B.C. V7A 4R6

Glacier Country (15 min.), produced by Karvonen Films Ltd. Available through Magic Lantern Film Distributors, 136 Cross Avenue, Oakville, Ontario, L6J 2W6, and Suite 210, 10151 No. 3 Road, Richmond, B.C. V7A 4R6

Ellesmere Land (27 min. 50 sec.), produced by C.B.C. for The Nature of Things series. Available through C.B.C. Enterprises, Institutional Sales, P.O. Box 500, Station A, Toronto, Ontario, M5W 1E8

Three Above 60° N (22 min. 33 sec.), produced by National Film Board of Canada. Available through National Film Board of Canada libraries.

Study Guide

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Land Above The Trees may be rented from the nearest NFB library in 16mm film, and ½" video format as part of the Ecology Series compilation cassette. It may also be purchased in 16mm or video format.

16mm Colour
Screening Time
19 minutes 25 seconds

16mm: 106C 0188 013
¾": 116C 0188 013
VHS: 113C 0188 013
Beta: 114C 0188 013

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Flora and Fauna Mentioned in the Film

Plox
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Western Anemone
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Stonecrop
•
Marmot
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Lichen
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Mountain Goat
•
Blue Grouse
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Pika
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Ptarmigan
•
Bighorn Sheep