FOREST FIRES & MOUNTAIN PINE BEETLE
NATURE'S MULTIVITAMINS

Mountain Pine Beetle Initiative Outreach Program
Alberta and British Columbia Grades 4-6

The Mountain Pine Beetle Initiative is administered by
Natural Resources Canada and the Canadian Forest Service

FOREST FIRES & MOUNTAIN PINE BEETLE – NATURE'S MULTIVITAMIN
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Title: Forest Fires and Mountain Pine Beetle – Nature's Multivitamins (Classroom Lesson Plan)

Overview:

Mountain pine beetle is endemic to the southern Rocky Mountains and areas west of the Continental Divide; however, it has not historically occurred on the northeastern slopes of the Rocky Mountains (Jasper area). Edemic means that there is a normal insect population native to the area that is kept in check by natural factors. Even though insect outbreaks are natural ecological processes that contribute to forest diversity, historically there were few stands susceptible to mountain pine beetle due to frequent fires in the montane ecoregion and the foothills. Past fire suppression practices in Alberta and British Columbia, including the national parks, have resulted in an abundance of old, even-age pine stands that are susceptible to mountain pine beetle attack. Fire suppression, coupled with increasing frequency of mild winter temperatures, has resulted in conditions that favour beetle development, outbreak and expansion. The expansion of mountain pine beetle populations is of concern to Parks Canada and its neighbours (provinces of Alberta and British Columbia and the forest industry). Students will be introduced to mountain pine beetle and will examine its role in forest health. Students will also learn how human actions can alter the magnitude of pine beetle populations by examining fire suppression and prescribed burns.

Province, Grade Level and Subject:

British Columbia:	Grade 4 – Life Science
	Grade 4 – Earth and Space Science
	Grade 5 – Earth and Space Science
	Grade 5 – Social Studies
Alberta:	Grade 4 – Social Studies
	Grade 6 – Science

List of the Province/Territory and the Related Curriculum Expectations/Competencies/ Outcomes:

British Columbia Grade 4: Life Science – Habitats and Communities

- compare structures and behaviours of local animals and plants in different habitats and communities
- analyze how simple food chains are composed
- demonstrate the awareness of the Aboriginal concept of respect for the environment

British Columbia Grade 4: Earth and Space Science

- analyze impacts of weather on living and non-living things

British Columbia Grade 5: Earth and Space Science

- analyze how the Aboriginal concept of interconnectedness of the environment is reflected in responsibility for and caretaking of resources

- describe potential environmental impacts of using British Columbia's living and non-living resources

British Columbia Grade 5: Social Studies – Environment
- demonstrate the understanding of sustainability, stewardship

Alberta Grade 4: Social Studies – Alberta Geography and People
- people modify and change environments according to their needs

Alberta Grade 6: Science – Trees and Forests
- describe some kinds of plants and animals found living on, under and among trees; identify how trees affect and are affected by those living things
- identify human actions that enhance or threaten the existence of forests

Learning Expectations/Competencies/Outcomes for the Lesson Plan:

Students will:
- observe slides of mountain pine beetle habitat
- study mountain pine beetle anatomy
- determine the effect of mountain pine beetle on a forest web of life
- learn how forests change over time
- learn how fire suppression can lead to mountain pine beetle outbreaks

Duration: 60 minutes

Required Materials:

Pictures

Meet the Mountain Pine Beetle
- ❑ costume (black T-shirt, headpiece with antennae and compound eyes, vest with legs and wings)
- ❑ picture of pitch tubes
- ❑ picture of wood with blue stain fungi
- ❑ picture of pine beetle specimens

Web of Life Game
- ❑ ball of long string

Forests Over Time
- ❑ large brown tarp or sheet (large enough for class to stand on)
- ❑ green tarp or sheet
- ❑ woodpecker photo
- ❑ mountain aven photo
- ❑ orange cloth or towel to represent fire
- ❑ Smokey Bear picture
- ❑ toy insects

Teacher Information:

Fire is a disturbance that has been around for a long time. It has been part of grassland, brush and forest ecosystems for as long as these ecosystems have existed. Like storms, avalanches and floods, it is a powerful force of change in nature. Fire has shaped landscapes across Alberta, British Columbia, Canada and around the world.

Many ecosystems have evolved with fire and depend on it for renewal. A recent burn may seem dead but many forms of life survive, giving rise to a new forest. Fire kick starts regeneration by providing ideal growing conditions. In cool temperate areas, decay is slow and logs, leaves and needles pile up on the forest floor. Fire reduces this material to mineral-rich ash, releasing and recycling nutrients. Fire also creates openings in the forest. Sunlight penetrates into these openings or gaps, warming the soil and stimulating new growth from seeds and roots.

Over time, periodic fires create a vegetation mosaic of different ages and types. This provides a rich variety of habitats that support many species of insects, mammals and birds. This is biodiversity – it indicates a thriving ecosystem that is likely to persist in the future. So, fire not only renews and recycles, but also rearranges vegetation in a continual cycle of change.

Many plants and animals are adapted to fires and the conditions they create. After a fire, woodpecker populations may increase fifty times. They come to feast on beetles and other insects that colonize the newly burned trees. Aspen, raspberry and rose sprout vigorously from underground roots after a fire passes. Moose and elk feed on the new growth. Both lodgepole pine and jack pine have resin-sealed cones that can stay on the tree for many years. The heat of a fire melts the resin and the cones pop open. Thousands of seeds scatter onto the ground and grow into new stands of pine.

For the last ten thousand years, First Nations peoples have used fire to herd game, create new grazing habitat, and keep travel routes open. In many areas, they influenced vegetation patterns. When the Europeans arrived, they brought with them very different attitudes toward fire. Fire was dangerous and needed to be controlled. These attitudes resulted in forest fire suppression, leading to a change in the composition of our forests. Even national parks viewed fire as a destroyer. "Only you can prevent forest fires," cautioned Smokey Bear, who first appeared in the 1950s. Smokey's message, as well as the development of modern fire fighting equipment and techniques, shut fire out of most of our ecosystems. For example, over the last 65 years, the area burned in the Rocky Mountain national parks has dwindled to less than 10% of historic levels. Most researchers agree that fire suppression is altering many ecosystems. Forests are becoming older and more closed in. The open habitats favoured by many species of wildlife are becoming more rare. Forests are losing the vegetation mosaic and the biodiversity it sustains. These mature forests are also more susceptible to disease and insect outbreaks and create more of a wildfire risk because of the buildup of fuel. The effects of fire suppression are far reaching, for they affect not only parks, but surrounding lands as well.

As trees age and mature, they become more susceptible to insect and disease outbreaks. One such outbreak in the Rocky Mountains is that of the mountain pine beetle. In the summer, the beetles bore through the bark of mature lodgepole pine trees and lay their eggs in the tunnels.

The larvae hatch and feed under the bark, which girdles the tree and cuts off the flow of nutrients and water. The larvae pupate in the spring and emerge as adults from July to September.

The mountain pine beetle does not kill the tree on its own, though. The beetles transport blue stain fungus. Together, the beetle and the blue stain fungus disrupt the movement of water within the trees and prevent the tree from producing resin to defend itself against the beetle, weakening the tree and eventually killing it.

Tree Identification Information:

Douglas Fir
Douglas fir is found on moist to very dry sites. They are sometimes referred to as "friendly fir" for their flat, soft needles. The thick bark of the Douglas fir can withstand low intensity fires. These trees can survive for many years. Banff National Park has the oldest known Douglas fir tree in the province, approximately 700 years old!!

White Spruce
White spruce is found on well drained to moist sites. They are sometimes known as "spiky spruce" because of their sharp, round pointy needles. The Aboriginal peoples had many uses for the white spruce tree: dried sap was chewed and boiled and used as a cough syrup; sap was mixed with fat to make salves for treating insect bites, cuts and burns; and the roots were peeled and split to make cord for stitching canoes and making baskets.

Trembling Aspen
Trembling aspen gets its name from the way the leaves tremble. This trembling motion is made possible by its flat stem (other deciduous trees have round stems). This tree is often the first tree that colonizes a site after the area has been burned. The trembling aspen reproduces by sending up suckers from its extensive, shallow root system. The bark of the tree is photosynthetic: it traps energy from sunlight and stores it in molecules made from carbon dioxide and water. Sometimes it produces a white powdery substance on the bark – a sunscreen for the trees.

Lodgepole Pine
Sometimes known as the "tweezer tree", the lodgepole pine has needles that are found in pairs and resemble tweezers. They are found in moist to dry sites. Lodgepole pine is a relatively short-lived tree (seldom over 200 years) that thrives in areas that are periodically burned by forest fire. Although these thin-barked trees are easily killed by fire, their cones *require* heat to melt the resin that seals their scales shut. The cone scales open when the resin is softened by a rapid pulse of intense heat from a wildfire (or if exposed to warm summer temperatures for long periods). Once the resin bond has been broken, scales will open slowly over several days, allowing the wind to dislodge and distribute the inner seeds.

The cones and seeds of lodgepole pine are not usually consumed by wildfire because the cones are subject to high heat from rapidly moving wildfires for only a few seconds or minutes. Also, a cone's internal temperature does not rise instantaneously when heated because its insulating properties resist heating such that heat conducts slowly through the cone's outer surface. Following a fire, huge amounts of stockpiled seeds are released, producing dense stands of young trees. Most regeneration of lodgepole pine occurs within the first five years after a fire. The patches of exposed mineral soil and thin duff are rapidly filled with plants such that conditions become unsuitable for seed germination after those five years.

Procedure and Discussion:

Introduction

Duration: 10 minutes

The mountain national parks are very special places. They are places where animals and plants are protected. These parks protect caribou, grizzly bears, woodpeckers, fish, and even small organisms like insects as well as their habitats and non-living parts of the ecosystem (air, water and land). Natural processes/events like fire, avalanches, insects, and floods play important roles in these ecosystems. In the same way that vitamins can help to keep us healthy, natural processes can help to maintain forest health. Forests are dynamic and are changing over time. If a variety of plants and animals and natural processes/events like fire or insects are present and in balance, the forest is likely to stay healthy. If some of the pieces are missing or if others are added that don't belong, then the forest becomes unbalanced and unhealthy, supporting fewer animals, plants, insects and birds. Today in class, we will be looking at an insect called the mountain pine beetle that makes its home in the parks. It is an insect that has been getting a lot of news coverage lately. We will also be looking at the role of forest fires in forest health.

We will start this exploration with a slide show. This will help us understand what your views are on fires and forest health. Take out a sheet of paper and label it 1 through 7. For each slide, write down your observations and feelings about the images. When the slides are finished, write down at least two general comments about the slides. There are no right or wrong comments.

Slides or Laminated Pictures:

- forest with no mosaic, made up of even-age stands of trees
- beetle-killed forest
- close-up shot of mountain pine beetle
- forest fire
- shot of landscape with a forest mosaic
- woodpecker on a tree
- new shoots coming out of blackened fire area

Turn the lights on:

What are some of the feelings or thoughts about the images you saw?

Gather student's responses in a short brainstorming session. Encourage students to listen respectfully to others. Record their feelings on the front board or a flip chart.

We will see if your feelings change at all or if you have anything to add after the rest of the activities.

The pictures I just showed you all have some connection to mountain pine beetle.

Meet the Mountain Pine Beetle

Duration: 15 minutes

One of the slides you saw was a mountain pine beetle. Where do you think the mountain pine beetle lives? The mountain pine beetle spends most of its life under the bark of pine trees. While it gets food and lodging in the trees, its young larva will also eventually kill its host. Let's take a closer look at the mountain pine beetle. For this, I need a volunteer to help me. *Select volunteer and have them stand facing the class.*

Discussion

Insects look very different from humans. They have similar senses to humans - seeing, smelling and moving but use different body parts, to do these things. Like humans, they can make very big changes to forests.

Let's just put this black T-shirt on to start. *Have the student put on the T-shirt.* They have one big bone-like structure that covers the outside of their bodies. It is called an exoskeleton. This exoskeleton is like a large shell; it protects them and gives them shape.

Remember, I said they were small? Look at your baby fingernail. You could fit about 4 or 5 beetles on the nail. They're tiny, but can kill a tree!

Like all insects, the mountain pine beetle adult has three main body parts:

The Head

The head has a small brain, eyes and mouth. *Have the student put on the headpiece.*

Brain:

The brain of an insect is very simple. Insects don't think the same way that you do. They cannot imagine or pretend. *Point to where the brain would be.*

Eyes:

Instead of two big eyes like we have, the beetle has many small eyes – these are all put together in one large eye. *Point to the eyes.* Instead of seeing one picture like we do, the beetle sees hundreds of pictures all at the same time. Have you ever looked through a Kaleidoscope? We don't think the beetle can find a pine tree just by sight … as a matter of fact, we don't really think it can see well at all. How do you think it finds the right kind of tree, then?

Trees, when stressed, have a particular smell. We can't smell it, but the mountain pine beetle, having lived with pines for thousands of years, is very sensitive to a tree's stress cologne. What do you think it uses for smelling the tree's cologne?

Antennae:

The beetle uses antennae for smelling tree cologne. *Point to the antennae.* We think it uses its sight to locate large objects and its antennae to smell and touch stressed trees. What kind of tree do you think the mountain PINE beetle likes? Right, it likes pine trees. It will try to get through

a pine tree's coat of armour, the bark, to get inside to eat and make a home. How do you think it gets through the bark and eats the tree? It uses its mouth.

Mouth:
Not all insects eat in the same way, just like a baby and an adult don't eat the same way. *Show the students where the mouth would be.* Not all insects eat the same kind of food, either. Some insects eat food that is crunchy, some that is mushy, and some that is liquid. What do you think the mountain PINE beetle eats? Pine, that's right. What kind of mouth does the mountain pine beetle need to eat bark? *Show a few different objects: turkey baster (mosquito), straw (bees and butterflies), sponge (fly), pliers (grasshoppers), scissors (MPB).*

Unlike our jaw that moves up and down, the beetle's jaws move sideways and meet in the middle. *Show the students the scissors.* Not only that, but it doesn't just have one set of jaws, but two sets! It has a large jaw for grabbing and tearing, and a set of jaws beneath for shredding food.

The Thorax

The Thorax is the middle area of the beetle's body where the legs and wings are attached. *Have the student put the vest on.* It is an important part of the body because it helps all insects walk, jump and fly. This is where most of the muscles are found.

Legs:
Like all insects, beetles have six legs. *Point to the legs.* What do you think the legs do for the beetle? Help it to crawl? Jump? Well, they help the beetle do something else, too. Some insects, including the mountain pine beetle, have sensors on their legs that help them hear and taste!!

Wings:
How many wings do you think the mountain pine beetle has? *Have the student turn around so his/her back is to the class.* They have two sets. There is a secret set of wings! These wings, called the hind wings, are hidden under some hard wings and are used for flying.

How far do you think beetles can fly? One metre? Five hundred metres? One kilometre? How about fifty kilometres? Mountain pine beetles can fly up to fifty kilometres. *Find an example of a distance students may have driven to, e.g. from Banff to Lake Louise*. Usually they will fly about eye-height, but sometimes they will fly above the tops of the trees and fly on the wind currents like birds. However, they won't fly if it is too cool or wet.

The hardened wings are called *elytra*. What do you think the beetle uses these for? They protect the beetle's body and help it crawl through narrow passages. These wings also have microscopic pits in them that are filled with the beetle's friends called fungi. Fungi are living microorganisms like mushrooms and mold but most are too small to see with the human eye.

The fungi carried by the mountain pine beetle are a form of blue stain fungus and are much too small for us to see. They might be the mountain pine beetle's best friends, but they are no fun for the tree. Once the beetle gets into the tree, the fungi take off and invade the tree.

The fungi can plug up the tree's sap-producing cells, reducing the tree's ability to try to "pitch" or throw the beetle out in its sap. The fungi also weaken the tree by stopping the flow of water and nutrients. It stains the wood a bluish-purple colour. *Show a picture of pitch tubes and wood with blue stain fungi.*

Abdomen

The abdomen is the biggest body part. The abdomen holds the insect's most important inside organs. You have an abdomen. It holds your stomach and intestines. An insect's abdomen holds its stomach and intestines, too. Insects digest their food in their abdomens, which is the same place you digest your food.

What else do you think might be in the abdomen? What other organs haven't we talked about? What about the heart and lungs?!! Yes, insects hold their hearts in their abdomens. You breathe through your mouth and lungs. Insects breathe through their abdomens. How do they do it? Insects have lots of little holes on their abdomens called spiracles. These spiracles allow them to breathe, and that keeps them alive.

Point to the dressed-up volunteer. Here we have a beautiful example of a mountain pine beetle adult. Hey, *student's name* looks just like this picture I found of a live mountain pine beetle. S*how image of beetle*. Thank you very much for helping today. *Help take off the costume and give a round of applause.*

Web of Life Game – The Role of Mountain Pine Beetle in the Forest

Duration: 10 minutes

Have students form a big circle:

- Let's look at the role mountain pine beetle play in forest health.
- *Form a circle with the class. You stand inside the circle with a ball of string.*
- Who can name a beetle that eats pines? … mountain pine beetle … good. Here, Mrs. Beetle, you hold the end of the string.
- What friend does the mountain pine beetle always carry around? (Blue stain fungi). *Take string to a student who answers "blue stain fungi".*
- Now, blue stain fungi, you are connected to the mountain pine beetle because it carries you to your food. You are very important because you can protect beetles from resin attacks by clogging up a tree's tissues.
- What do blue stain fungi and pine beetles eat? (Pine trees). Using their antennae, the beetles smell a stressed lodgepole pine tree and blue stain fungi goes along for the ride. *String the yarn to a student who answered "pine tree".*
- The tree tries to pitch out the beetle with resin. But if that tree is too weak, the beetle might get in and the blue fungus will start to invade. If the female beetle gets into the tree, she will emit some smelly cologne called pheromones, which will cause other beetles to colonize the tree. We can't smell these pheromones, but other beetles can.
- Here are some more beetles. *Pass the yarn to a few student beetles.*
- Under the bark of the tree, the mountain pine beetle will start a new generation of beetles by laying eggs. Those eggs will hatch into larvae, which will eat the tree and the blue fungi and then turn into adults to start the cycle over again.
- In the meantime, there are about 58 recognized predators and parasites that are looking to eat bark beetles. Who do you think eats mountain pine beetles?
- *Give the string to students who answer (bacteria, fungi, mountain chickadees, other insects, and woodpeckers – save the woodpecker for last).*
- Let's say the woodpecker finds a tree that was killed by pine beetle a few years ago and drills out a big hole in the tree; who might use the woodpecker hole?
- *Give the string to a few students who have answers* (*other birds, squirrels, bats).*

- Who might eat those animals that nest in standing dead trees?

- *Give the string to a few students who answer (coyotes, birds of prey).*

- *Once you have made as many connections as there are students, explain the web concept.*

- Now, just like a web, each element in the forest is somehow connected to every other element in the forest.

- What happens when a really cold winter wipes out the beetle population? Okay, beetle, you fall down, you're dead. Now everyone who felt that tug of the string give a tug. This process continues until everyone feels the effect of the loss of the beetle.

Mountain pine beetle play an important role in some forest ecosystems. When we look at mountain pine beetle, we need to understand that they are part of a forest web and so are part of a complex web of life.

Thank you, you can sit down now.

These insects help to play an important role in the life of a forest. They colonize old or weakened trees, killing the tree, which allows young saplings under the tree to get more sunlight and grow. However, unusually warm temperatures and putting out wildfires have resulted in large areas of good beetle habitat. What do you get when you have lots of good habitat? Right, more beetles. When beetle numbers change drastically, it tells us something about the forest's health. While the mountain pine beetle is at a low level, only the really weak, stressed old lodgepole pine trees die. At this level, such factors like natural enemies and limited hosts keep the population in check. When the population explodes, natural enemies are no longer albe to keep the population in balance. The population expand into larger and larger areas until they run out of food or the temperature gets cold enough to kill the beetle.

Forests Over Time

Duration: 15 minutes

Let's take a look at how forests change.

- *Put down a large brown tarp or blanket*. The last major glaciers in these mountains started receding about 12,000 years ago. In soil building terms, that is not very long ago. The glaciers would have scraped any soils off. The job of rebuilding soil is a big one, and so, our interior mountain forests have thin soil levels.

- *Lay down one layer of thin green garbage bags over the brown tarp.* Some hardy pioneer plant species take root, helping to build the soil by trapping dirt and flying materials. *Ask a few students to come up and kneel down to represent pioneer species like Mountain Avens (hold up picture).*

- Eventually, seeds of trees would find their way into the mountains, either in the wind or by animals, and we get forests. *Ask more students to stand differently for each tree you assign them. I.e., trembling aspen can stand shaking their extended arms; Douglas fir stand with folded arms (bark like armour); lodgepole pine stand with arms up over their heads (branches mostly on upper half); white spruce stand with hands on hips. Make sure to place them in patches, so that you have openings and various densities.*

- These forests might have patches of open sunny spots. *Ask a student to come up and put fingers up like antlers; place him/her in an open area.* Some animals thrive on plants that grow here. Other animals need old and shady forests. *Ask student to come up with a woodpecker picture and put him/her in with the denser trees*. See how there is a mixture of trees and different ages?

- For as long as forests have been around, there has been fire. *Using a red cloth, go through the forest. If the cloth brushes the students, ask them to sit down on the floor*. Fallen trees and ash become part of the soil. *Ask those sitting to lie down*. Fire helped keep a nice mixture of forests. Aboriginal peoples burned patches of forest and grasslands to make good animal habitat so they could hunt the animals that came and used this good habitat. Fires also helped the berries and plants grow that Aboriginal peoples used for medicine. All fires are different. Some fires were not large and killed only grasses and low vegetation, while some killed all the trees in an area. Some parts of the mountains would have fires come through every 15 to 20 years like lower valley forests. Higher up, the forest might not have had fire for a few hundred years.

- Other natural processes are at work in the forest: rain, windstorms, floods, avalanches, forest disease and insects. Pine beetles come in and kill a few closely spaced large pine trees, knocking over a few trees, creating good habitat. *Knock over a few densely spaced trees by asking the students to lie down.*

- In the last century, humans have had a big influence on one important natural process, FIRE. *Show Smokey Bear image*. Smokey thought that all fires should be put out. As a result, we aggressively fought all forest fires. *Stomp on the red cloth.* We had to, as more people moved into forested areas. *Ask a couple of students to come up as people.* All of a sudden, the force of fire was taken out of many of our forests.

- *Ask the remaining students to come up and crowd onto the sheets, putting their hands up like lodgepole pine trees*. Without fire, we started to get landscapes with similar aged trees and fewer different types of trees. What you see is a carpet of forest, with little variation.

- *Throw in a few toy insects.* Large expanses of older lodgepole pine trees, competing for sunlight and moisture, make perfect habitat for mountain pine beetle. Add to a warming trend in our climate, which brings with it warmer winter temperatures and hotter summers. This is what a lot of our forests look like today. Without fire, we are getting these big blocks of old pine trees – a beetle's buffet; this is not natural or healthy.

- *Thank the students and ask them to sit down.*

Conclusion:

Mountain pine beetles are a natural part of our lodgepole pine forest in BC and along the southern Rocky Mountains in Alberta. The numbers of beetles tell us about a forest's health. Natural processes/events such as fire create areas that are good habitat for plants and animals and help to keep a forest healthy. Without some of these natural processes such as fire, the forests are not healthy, and the populations of mountain pine beetle are getting too high. So, Parks Canada is using fire to keep the forests healthy.

Evaluation:

Duration: 10 minutes

- show same photos over again
- ask students to write what images they now evoke

Ask the students for their new responses to the slide show.

- forest with no mosaic, made up of even-age stands of trees – *The students should now recognize this as an old, unhealthy forest because it all looks the same. This forest would be a buffet for the mountain pine beetle.*
- beetle-killed forest – *This slide should bring responses showing they understand that this is what an unhealthy forest may look like after a beetle outbreak.*
- close-up shot of mountain pine beetle – *The mountain pine beetle is a natural part of the ecosystem, but it can lead to the death of pine trees. We don't want an entire forest made up of old trees to be attacked by the mountain pine beetle.*
- forest fire – *Rather than evoking responses like destruction or danger, the students should recognize that fire is a natural disturbance in the mountain forests. Fire can create areas of different types of trees of different ages, and create a healthy forest mosaic.*
- shot of landscape with a forest mosaic – *The students should recognize this as being a shot of a healthy forest, as opposed to the first picture, recognizing that there are different patches of forest composed of different types and ages of trees.*
- woodpecker on a tree – *Woodpeckers are also an important part of the forest web of life. They eat mountain pine beetles and other insects that would be found in older trees.*
- new shoots coming out of blackened fire area – *The students should recognize the regeneration that is taking place following the fire. These areas will allow young lodgepole pine to become established, as well as the other colonizer species. The area will be good habitat for other animals that depend on the younger forest type.*

Extensions to the Lesson:

There is a field trip that may be used in conjunction with this in-class lesson. See Appendix A.

For additional activities, see Appendix B.

Suggested Related Resources:

Parks Canada Fire Fact Sheet series

Web Sites
Parks Canada: www.pc.gc.ca
Banff National Park Fire Management: http://www.pc.gc.ca/pn-np/ab/banff/plan/plan8_E.asp
Fire and Disturbance Ecology: http://www.pc.gc.ca/pn-np/ab/banff/plan/plan8c_E.asp
Fairholme Range Prescribed Burn: http://www.pc.gc.ca/pn-np/ab/banff/plan/plan8d3_E.asp
Red Deer River Prescribed Burn: http://www.pc.gc.ca/pn-np/ab/banff/plan/plan8rd1_E.asp
Kootenay National Park: http://www.pc.gc.ca/pn-np/bc/kootenay/plan/index_e.asp
Yoho National Park: http://www.pc.gc.ca/pn-np/bc/yoho/index_e.asp
Waterton Lakes National Park: http://www.pc.gc.ca/pn-np/ab/waterton/natcul/natcul1k_E.asp
Canadian Wildlife Federation: http://www.wildeducation.org
Canadian Forest Service: www.mpb.cfs.nrcan.gc.ca/introduction
Alberta Sustainable Resource Development: www.gov.ab.ca/srd/forests/health/index

Books
Post, K., A. MacDonald, & C. MacDonald. Wildlife Trees of British Columbia. 2nd Edition. K-12 Resource Guide, Wild BC, 1996.
Staniforth, S., et. al. Protected Areas: Preserving Our Future. An Environmental Education Guide to Protecting Natural Areas, K-12. 2nd Edition. Province of British Columbia, 2002.

Activities
FORED BC. *Fun in the Forests*. Primary Resource Package.
FORED BC. *Tree Parts, Function and Identification*. Primary Resource Package.
Alberta Sustainable Resource Development – Environkids Investigate Forest Health activity book and teacher's guide.
These are only some of the additional resources you may wish to use in order to expand the scope/research for this lesson.

Acknowledgements:

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Appendix A: Field Trip

Title: Forest Fires and Mountain Pine Beetle – Nature's Multivitamins (Field Trip)

Overview:

In the form of a field trip, students will use their scientific investigation skills to analyze forest health. They will look at habitat conditions for mountain pine beetle, compare an old pine forest with a recently burned forest and view forest diversity.

Site Specifications:

* This field trip requires two different sites:
    Site 1: An unburned forest with mountain pine beetle colonized trees
    Site 2: A burned forest that is safe to be in

Locate a field site that contains signs of mountain pine beetle (or forest that contains ideal conditions for pine beetle) and recently burned forest (past 4-7 years). The field site can be chosen outside a national park if it has not been altered by industry or development. At the site, determine your boundaries for the activities and test your sample plots (quadrants).

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	Grade 4 – Earth and Space Science
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- analyze how simple food chains are composed
- demonstrate the awareness of the Aboriginal concept of respect for the environment

British Columbia Grade 4: Earth and Space Science

- analyze impacts of weather on living and non-living things

British Columbia Grade 5: Earth and Space Science

- analyze how the Aboriginal concept of interconnectedness of the environment is reflected in responsibility for and caretaking of resources
- describe potential environmental impacts of using British Columbia's living and non-living resources

British Columbia Grade 5: Social Studies – Environment

- demonstrate the understanding of sustainability and stewardship

Alberta Grade 4: Social Studies – Alberta Geography and People

- people modify and change environments according to their needs

Alberta Grade 6: Science – Trees and Forests

- describe some kinds of plants and animals found living on, under and among trees and identify how trees affect and are affected by those living things
- identify human actions that enhance or threaten the existence of forests

Learning Expectations/Competencies/Outcomes for the Lesson Plan:

Students will:

- get a landscape-scale perspective of biodiversity on their travels to the field trip site
- study mountain pine beetle habitat
- compare a fire-suppressed forest with a fire-affected forest
- evaluate the health of the forest and its ability to survive mountain pine beetle populations
- share their perspectives, observations and conclusions on the influence fire and mountain pine beetle have on local ecosystems

Duration: 2 hours in the field (does not include driving time and landscape biodiversity stop)

Required Materials:

First Aid kit
Cell phone – if you can get coverage

Landscape Biodiversity Stop

- repeat photography

Mountain Pine Beetle Detectives

- photocopied sheets of Detective File: Mountain Pine Beetle
- pencils for each group
- picture of or needles of lodgepole pine, showing the pairs of needles
- picture of log with pitch tubes
- picture of blue stain wood

Life Cycle of the Mountain Pine Beetle (Quadrants)

- measuring tape or chain
- flagging tape
- 8 tent pegs
- recording sheets & pencils
- tree identification books
- fabric measuring tape

Teacher Information:

See information from Classroom Lesson Plan.

Procedure:

Travel along part of the bus route to establish a stop for the landscape biodiversity portion of the field trip.

Activities During the Drive to the Field Site

On the Bus

Today we are going to go out into the field to take a look at forest health. It will be a really active, fun day. To keep it fun, it is really important that you listen closely. This is for your safety as well as the safekeeping of the natural site we are visiting.

On our bus ride to the site I am going to ask you to look out your windows for a few things:

1. What kind of forests do you see out your window?
2. Do you see open areas, grasslands?
3. When you look at the forest, is it all the same shape and colour? Are the trees tightly spaced?
4. Do you see any evidence of dying trees? Look for red trees.

We will get a chance to stop and look at the landscape and you can share your answers then.

Landscape Biodiversity Stop

Duration: 10 minutes

Arrive at your landscape diversity location. Pull over only if it is safe to do so and discuss safety. Students are to stay on the side of the pull-off. You will get out first and lead them to the standing area.

Once at the viewing site, ask students to hold their hands straight out in front of them with their extended thumbs touching. You should be looking at a forest scene framed in your pointer fingers and thumbs. Do you see a variety of colours? A variety or shapes and sizes? Any open space? Move the frame so you get a new picture. *Ask the same question.*

Does anyone know what a mosaic is? A mosaic is an artistic term that describes a picture made up of different colours and textures. How do these photos look like mosaics?

Using the photographs of landscape mosaics ask the students if they are witnessing similar mosaic patterns in the pictures they see through their hands, or are they seeing a continuous carpet of green with no patches or variation in colour? What might that say about the landscape's diversity?

You can think of landscape diversity as interconnected pieces of that picture or mosaic, with the pieces being ecosystems, plants and animal communities, and physical habitats. The pieces are

shaped by factors such as aspect (direction the land faces), elevation, and natural forces like avalanches, wind, fire, disease and insects.

Look out there and imagine you're an elk. You are looking for good grass to eat. Do you see any open patches of grass? Imagine you're a black-backed woodpecker longing for a good insect feed that comes after a fire. Do you see any recently burned forest?

Healthy forests will look like a mosaic, having different colours, open spaces, closed spaces, younger spaces, and older spaces. The pine marten and pileated woodpeckers thrive in old-growth forests, while elk and beaver thrive in a forest with newly emerging plants like aspen and willow.

Some living organisims thrive when there is little diversity. Imagine you're a mountain pine beetle. What do they like? They like old lodgepole pine trees around 80 years old. If you are looking at one continuous forest of lodgepole pines that are all around 80 years old, you're looking at an all-you-can-eat buffet for beetles! The lack of a mosaic makes it easier for insects and diseases to spread, as there are no physical or species breaks. Do you see any brownish-red tree patches? These are trees that mountain pine beetle have already colonized and the trees are dead.

Next, let's take a close-up look at mountain pine beetle habitat forest. Everyone pile into the bus.

Field Trip Site

Duration: 1.5 - 2 hours

Note: Never go into an area burned by crown fire on a windy day. *If it is windy, the threat of falling trees is too great for safety. On windy days, skip the scavenger hunt and explore the unburned forest, viewing the burned forest from the perimeter.*

Orientation and Rules

Gather the group and have them sit on the ground. We are going to have some fun today and we will get to see firsthand some of the things we talked about in class. This field trip is really about using your senses to discover the world of forests. We will start with a mountain pine beetle scavenger hunt. After that, we will do some comparison of a fire-affected forest and a forest that has not seen fire for a long time. At the end of the day, you will get a chance to share what you have observed and what your thoughts are on fire and forest health.

We need to go over some safety issues and then we will get right to it. We are in a wild area. Since we don't want to lose any of you, everyone needs to stay within these physical boundaries. *Point out the physical boundaries. Explain where they should not go – near rivers, roads, etc.*

When I call the group back, it is really important that you quickly finish what you're doing and then head back, making sure all the people in your group are with you.

That covers your safety. For the safety of this natural area, please don't pick any plants. If you want help identifying them, call me to your plant. Try not to step on flowering plants. Please don't feed any animals and all our garbage needs to be taken out.

Mountain Pine Beetle Detectives

Duration: 20 minutes

(see *Detective File: Mountain Pine Beetle*)

We will start with a little detective work. You are now all world-renowned detectives. Here is your case file. *Divide the class into 5 groups. These groups can stay the same for the whole field trip. Pass out one Detective File: Mountain Pine Beetle and one pencil per group.*

You will have 15 minutes to investigate. Remember the boundaries of travel. When you're finished, come back here and we will see how you did. *Assign some adults to make sure students don't go past the boundaries. During this time you can set up your quadrants.*

After 15 minutes, or when the groups look like they are losing focus, call them in. See how they did by going over their detective files. Get the different teams to lead the class to pine beetle evidence.

Life Cycle of Mountain Pine Beetle

Duration: 10 minutes

If you find a gallery in a tree, go over the life cycle of mountain pine beetle at that tree. If there is not a tree with galleries on site, use the picture.

A mountain pine beetle can be hard to see, because 95% of its life is spent under tree bark.

During late summer, adults seek out living, green trees. The female beetle chews through the bark to get at the phloem – the sweet, juicy region that carries sugars from the pine needles to the tree roots. The female beetle builds an egg gallery in the tree's living tissue. The gallery runs vertically on the tree. *Show an actual gallery in the tree*.

While she does this, she spreads blue stain fungi (remember blue stain fungi from our *Meet the Beetle* discussion in class) that are stuck in pits and sacs on her body, and around her mouth, into the tree's living tissue. This weakens the tree and makes it harder for the tree to "pitch" out or kick out the beetles. This blue stain fungi spreads quickly, clogging up the tree's tissues that produce sap or pitch.

At this time, the female starts sending out this smell like perfume, a chemical called a pheromone. We can't smell it; however, a whole bunch of other pine beetles can and they colonize the tree all at once. She sends out a perfume smell pheromone to get males into the trees. She lays her eggs while spreading more blue stain fungi around, further stopping the tree from producing sap. The blue stain fungi also make it hard for the tree to drink up water and food. *Show blue stain fungus tree cookie picture.*

Eggs:
The eggs are laid along the sides of a J-shaped gallery. (The gallery that runs vertically). After about two weeks they hatch as larvae.

Larvae:
This is the young kid stage, kind of like you guys. When the eggs hatch they become larvae that look like small white legless grubs. They chew outward from the egg gallery and around the tree stem. The larvae eat the blue fungi and get it on their mouths, spreading fungi as they chew along the tree. What a friendship. First the beetles act like vehicles, transporting the fungi to a tree. Then the larvae eat the fungi! The combination of the larval feeding and the blue stain fungi ends up killing the tree, usually within a year.

Usually, tey are still larvae when winter hits. Do you want to know something cool about the mountain pine beetle? In cold winter temperatures, the larvae can produce a compound called glycerol, which is like antifreeze, so that they can't freeze unless it is super cold ($-40^{o}C$). The bark also insulates them. Scientists have noticed that with a warming trend in our climates, winters are not as cold as they used to be, and that a lot of the larvae are surviving through the winter. This is also allowing them to survive in parts of our province where they have never been before.

In the spring (April), the larvae construct oval-shaped chambers where they pupate or change. They were little kids for a long time (since August) and now it's time for them to grow go up. The stage just before being an adult is called a pupa.

Pupae:

This is the **teenage stage**. Just like teenagers, the pupae's bodies go through a lot of changes. They are white and start to look like the adult with wings starting to grow. Blue stain fungi is attached to their body parts and in pouches in their mouths and will go with them when they become an adult. By mid-July they are adult beetles and will fly out to find their own tree and start the cycle of life over again. (See life cycle diagram and photos).

Why don't we take a look at two forests? One has ideal conditions for mountain pine beetle while the other does not. *If you could not find a field site with both types of forests, then examine the one.*

Sample Plots

Duration: 40 minutes (20 minutes per plot)

Set up both 20 metre by 20 metre sample plots (quadrants) or smaller if need be. Pick areas that are representative of burned and unburned areas. Using flagging tape, set out your quadrant (20 m x 20 m square).

Bring the group to the outside of a sample plot and have students sit down. Hand out data sheets for burned forest and unburned forest (see Master Sheet for Plot Records).

We will be working in the same teams we had as detectives. This time, in your groups, you will be comparing a burned forest plot with an unburned forest plot. We will look at tree diversity and signs of insect and wildlife activity.

You don't have to know the different tree species, but you should be able to identify a lodgepole pine tree. Can someone go touch a lodgepole pine? If you take a look at that tree, it has long needles. It has two needles in a pair, like tweezers. Sometimes it's known as the "tweezer tree". They are found in moist to dry sites. Lodgepole pine is a relatively short-lived tree (seldom over 200 years) that thrives in areas that are periodically burned by forest fire. Although these thin-barked trees are easily killed by fire, their cones *require* heat to melt the resin that seals their scales shut. The cone scales open when the resin is softened by a rapid pulse of intense heat from a wildfire (or if exposed to warm summer temperatures for long periods). Once the resin bond has been broken, scales will open slowly over several days, allowing the wind to dislodge and distribute the inner seeds.

The cones and seeds of lodgepole pine are not usually consumed by wildfire because the cones are subject to high heat from rapidly moving wildfires for only a few seconds or minutes. Also, a cone's internal temperature does not rise instantaneously when heated because its insulating properties resist heating such that heat conducts slowly through the cone's outer surface.

Following a fire, huge amounts of stockpiled seeds are released, producing dense stands of young trees. Most regeneration of lodgepole pine occurs within the first five years after a fire. The patches of exposed mineral soil and thin duff are rapidly filled with plants such that conditions become unsuitable for seed germination after those five years.

Notice the cones and, on older trees, dead branches half-way up the tree. This tree wants sun, and when the lower branches get shaded, they die off.

Douglas fir is found on moist to very dry sites. They are sometimes referred to as "friendly fir" for their flat, soft needles. The thick bark of the Douglas fir can withstand low intensity fires. These trees can survive for many years. Banff National Park has the oldest known Douglas fir tree in the province, approximately 700 years old!!

White spruce is found on well drained to moist sites. They are sometimes known as "spiky spruce" because of their sharp, round pointy needles. The Aboriginal peoples had many uses for the white spruce tree: dried sap was chewed and boiled and used as a cough syrup; sap was mixed with fat to make salves for treating insect bites, cuts and burns; and the roots were peeled and split to make cord for stitching canoes and making baskets.

Trembling aspen gets its name from the way the leaves tremble. This trembling motion is made possible by its flat stem (other deciduous trees have round stems). This tree is often the first tree to colonize a site after the area has been burned. The trembling aspen reproduces by sending up suckers from its extensive, shallow root system. The bark of the tree is photosynthetic: it traps energy from sunlight and stores it in molecules made from carbon dioxide and water. Sometimes it produces a white powdery substance on the bark – a sunscreen for the trees.

Each group will walk through the whole sample plot, staying inside the flagged area. Keep a record of the different trees you see within the flagged area. This will be a review of things you have already been learning in class. To tell if you're looking at a different species of trees, here is a hint: look at the bark, needles, and cones. They look different on the different tree species. Check the trunk size of three lodgpole pines in the plot with your measuring tape. It seems mountain pine beetle prefer these larger pines as they have thicker bark, which will give the beetle more insulation from the cold and more space for all the beetles to live in and eat. Keep a lookout for evidence of mountain pine beetle. Draw or record any interesting findings.

Let's start here in the unburned plot. Walk through with your team and record your data. You have 20 minutes.

Move the group to the next burned plot. Give a brief history of how the fires started and what year. Ask them to do the same thing for the burned plot as the unburned plot.

Note: *If your field trip has more than one class you can start them in both plots, and then have them switch.*

Gather the group into a circle to discuss what they recorded.

- Was there anything really different between the two plots?

- Were there any differences between the plots regarding diversity of tree species and tree diameter?
- Did you find many lodgepole pines with large trunks?
- Did you see any evidence of mountain pine beetle activity in either plot? What else did you find?
- If you were a mountain pine beetle, which forest would you choose?

Conclusion

Mountain pine beetles are a natural part of our lodgepole pine forests in BC and along the southern Rocky Mountains in Alberta. The numbers of beetles tell us about a forest's health. Natural processes/events such as fire create areas that are good habitat for plants and animals and help to keep a forest healthy. Without some of these natural processes such as fire, the forests are not healthy, and the populations of mountain pine beetle are getting too high. So, Parks Canada is using fire to keep the forests healthy.

Evaluation:

Sharing Circle

Let's take this opportunity to find out about your experience here today. We will go around the circle and each person can share what you learned, what surprised you and what you liked.

We have learned that fire suppression has changed the forests, leaving many landscapes unable to remain healthy from insect or disease infestations.

Healthy Forest Mosaic

Have the students create a mosaic from pieces of construction paper and images clipped out of magazines to show that they understand how healthy forests are like a mosaic.

Limerick or Rap

Have the students write a limerick or rap to show what they learned on the field trip.

Master Sheet for Detective File: Mountain Pine Beetle

Detective File: Mountain Pine Beetle

Detective Case Description: mountain pine beetle (MPB); also goes by the name *Dendroctonus ponderosae.* Last known whereabouts: a few kilometres from the field site and moving.

Detective Team: _____

Investigate this forest scene, looking for the following pieces of MPB evidence. Check off the following if you find them:

1. _____ Look for mountain pine beetle hangouts, specifically lodgepole pine trees measuring 20 cm around the trunk.

2. _____ Yellow or red needles on the entire tree crown. Note: many things cause red needles (drought, other insects, etc.), so this cannot be your only piece of evidence.

3. _____ Find a tree that has bark missing. Look for galleries with beetle, eggs or larvae.

4. _____ Look for "pitch tubes" – globs of sap on the trunk where beetles tunnel into the bark.

5. _____ Look for "sawdust" at the base of the trees. When mountain pine beetle bore through the bark and dig galleries, they produce this "frass".

6. _____ Look for woodpecker activity, such as holes in the trunk and bark chips on the ground.

Investigation notes:

_____

_____

_____

Master Sheet for the Plot Records

PINE BEETLE PLOTS **NAME OF GROUP:** _____

RECORD FOR UNBURNED SAMPLE PLOT	RECORD FOR BURNED SAMPLE PLOT
Tree Diversity a) total # of species of deciduous (leaf) trees: _____ b) total # of species of conifers (needle trees): _____	**Tree Diversity** a) total # of species of deciduous (leaf) trees: _____ b) total # of species of conifers (needle trees): _____
Tree Diameter a) measurement of lodgepole #1? _____ b) measurement of lodgepole #2? _____ c) measurement of lodgepole #3? _____	**Tree Diameter** a) measurement of lodgepole #1? _____ b) measurement of lodgepole #2? _____ c) measurement of lodgepole #3? _____
Overall Observations: Any sign of mountain pine beetle? Other insects? Any wildlife signs? Other observations (weather, description of site):	**Overall Observations:** Any sign of mountain pine beetle? Other insects? Any wildlife signs? Other observations (weather, description of site):

Appendix B: Additional Activities

Title: Species Charades

Objective:

Students will be able to:

1. Demonstrate the effects that fire has on various species and the interrelationships among them.

Materials:

- books and posters on wildlife – mammals, birds, insects, plants (including flowering plants, mosses, fungi, etc., if possible)
- copies of the species cards

Teacher Information:

If each student is to have a turn, with a discussion about the species afterward, this activity may take two class periods. It is important in the discussion that the students recognize the benefits of fire for the species (e.g., increase in grazing area, dead trees for nesting cavities, etc.). They need to look at long-term impact at a species level, not just the immediate effect on an individual animal. If students become stumped in acting out the name, perhaps they could draw it on the chalkboard.

Procedure:

1. Introduce the game to the students.
2. When a student's turn comes, that student draws a card. He/she reads the clue, then acts out the animal or the plant. Students may want to devise signals for each category – plant, animal, insect, etc. (e.g., to indicate a plant, use the hands to form a P). Once the species has been guessed, the player should suggest how fire would affect the species – would it destroy a home, increase food supply, etc.? Other students can then contribute to the discussion if they have other ideas. The additional information below may help in the discussion.

Generally, students should be aware that:

a) shrubs and other plants respond to increased light and nutrient levels in the soil after a fire
b) herbivores often feed in open areas left by fire, though they may still seek cover in treed areas
c) carnivores find more prey as herbivore populations increase
d) insects increase – some feed on damaged trees; others are attracted to increases in wild flowers
e) birds that feed on insects increase

Additional Species Information:

Plants

Bearberry – eaten by many birds, bears and voles.
Buffaloberry – found in open forests and shrublands.
Douglas fir – when mature, is relatively fire-resistant and can survive losing up to three quarters of its branches.
Fireweed – requires lots of sunlight. It appears quickly after a fire. Insects and birds feed on it.
Grasses – provide food and cover. Their root systems help prevent soil erosion. They need sunlight for photosynthesis so grow best in open areas.
Horsetail – a primitive land plant that produces spores, not seeds, for reproduction.
Lodgepole pine – seedlings begin growth after release of seeds by fire.
Moss – species vary in habitat requirements but most require moist conditions. They can be found on decaying wood, soil and rock, as well as on forest floors.
Prickly rose – usually found in open thickets or clearings, not in dense forest. Three hips (the fruit of the rose) contain as much Vitamin C as an orange.
Trembling aspen – produces large numbers of seeds each year (one tree can produce millions) but few result in the growth of new trees; most reproduction occurs by suckering from rootstocks.

Birds

Chickadees – require nesting cavities such as those found in snags. They eat seeds, berries and insects and may be preyed on by owls and hawks.
Hawks – prey on small mammals and birds.
Owls – hunt voles, mice and shrews and find excellent habitat along forest edges. Some species are large enough to hunt hares. The hawk owl often nests on tall, blackened stumps.
Woodpeckers – move into burned areas. The black-backed, three-toed and hairy woodpeckers respond to an increase in bark beetle populations and carve out nesting cavities in snags.

Mammals

Beaver – builds dams that create aquatic or wetland habitat for many species.
Bighorn sheep – live on or near steep mountain slopes where winds sweep the snow away from dry grasses during the winter. The ram's horns indicate annual growth rings.
Black bear – most frequently inhabits open forests.
Cougars – eat deer, elk, porcupine, hares, etc. They will inhabit dense forests but may find more food near forest edges.
Coyote – hunts small mammals in a variety of habitats.
Deer – require trees for cover and open areas for feeding.
Elk – prefer semi-open forests but use areas of dense cover for shelter. After fire, they browse on aspen shoots stimulated by heat to grow from the rootstocks of burned trees. Heavy browsing may prevent the establishment of aspen after a fire.
Grizzly bear – habitat is declining in some areas due to lack of fire – fire maintains open areas that promote berry production. Research indicates that grizzlies depend on old burn sites for food.

Human – the effects of a fire depend on individual circumstances.
Lynx – population cycles are closely linked to those of the snowshoe hare, its primary food source.
Moose – feeds on young willow shoots and similar vegetation. It finds ideal habitat 10-30 years after a forest fire or other disturbance.
Porcupine – feeds on vegetation and uses hollow trees or caves under rocks or logs for denning.
Red fox – eats small mammals, birds and eggs, and sometimes insects and berries. Favours early successional forests.
Snowshoe hare – uses forests for cover but feeds on young willow, aspen and birch which grow in open areas.
Wolf – populations are generally low. As hunters, they follow a source of prey.

Invertebrates

Beetles – are sensitive to smoke and heat which help them locate burned areas. Some fly in search of burned trees for their food and shelter.
Bees – require pollen and nectar, so are most often found where there are lots of flowering plants.
Butterflies – adults feed on flower nectar while larvae feed on roots, stems, leaves and fruits.
Worms – many species live on decaying vegetation. They in turn become food for other species.

Extension:

Have students use the information in the game to develop food chains that can be found following a burn.

Butterfly – I'm not a bee but I help pollinate flowers.	Bee – I love areas with lots of flowers.	Beetle – I burrow into trees and feed under the inner bark.
Woodpecker – Some of my species catch flying insects; others hunt under the bark of trees.	Elk – I eat aspen shoots and like to graze on plants like fireweed, clover and grasses in summer.	Black bear – I may seem ferocious and I do eat fish and meat, but 3/4 of my diet is vegetation, mostly berries.
Deer – I eat twigs in winter but like grasses in summer.	Hawk – Forest edges make good hunting grounds for many of my species.	Coyote – My scientific name means 'barking dog'.
Bighorn sheep – I have growth rings but I'm not a tree.	Moose – I browse on shrubs and grasses as well as water plants.	Chickadee – I like forest margins as I eat seeds but bark might hide a tasty meal of insects.
Snowshoe hare – I'm an important food chain link, eating plants but being eaten by lots of hunters.	Grizzly bear – I have to search farther for food when buffalo berries aren't available in open areas.	Beaver – Where most trees are conifers, I move on as I prefer willow and aspen for building my home.
Owl – I hunt hares and other small animals, mostly at night.	Fireweed – I can help control soil erosion when I grow in an open area.	Lodgepole pine – I was used by native people to help hold tipis in place.
Douglas fir – I grow larger that any other tree in Canada.	Buffaloberry – I was the main ingredient in a foamy dessert known as Indian ice cream.	Bearberry – I stick close to the ground in open areas and woodlands.
Prickly rose – My fruit, known as a hip, is full of Vitamin C.	Trembling aspen – I need lots of sun to grow well. After fire, I grow from surviving rootstocks.	Wolf – I hunt large animals as well as small. In winter, I often find shelter under the roots of fallen trees.
Porcupine – In winter, I eat the inner bark of trees, but in summer I prefer lush green leaves.	Worm – I help to keep the soil broken up with lots of nutrients.	Cougar – I'm a hunter and deer are my favourite food.
Red fox – My den is often at a forest's edge.	Human – I can live almost anywhere but my activities often affect forests.	Grass – I provide food for many species.
Moss – People look for me at the base of trees but some of my species live on dead wood in open areas.	Horsetail – I'm green with cones but I'm not a tree.	Lynx – I use mature forest for cover but depend on snowshoe hares for food.