



Science Unit: *Pacific Salmon and Mountain Pine Beetle*

Lesson 5: *Mountain Pine Beetle*

School year: 2007/2008

Developed for: Irwin Park Elementary School, West Vancouver School District

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Grade level: Presented to grade 2; appropriate for grades 1 – 7 with age appropriate modifications.

Duration of lesson: 1 hour and 20 minutes

Objectives

1. Explore the anatomy of mountain pine beetles
2. Investigate the anatomy of trees
3. Discover how mountain pine beetle find, attack and kill pine trees

Background Information

Mountain pine beetles are rice-sized insects that are a natural part of the ecosystem in British Columbia. They typically attack dead or dying, mature, lodgepole pine trees. Lodgepole pine trees make up around 25% of the trees in BC and are typically found in the central part of the province (between Merrit and Kamloops all the way up to Prince George and beyond). Recently, mountain pine beetles have reached epidemic numbers and are attacking and killing millions of trees in BC, becoming a huge ecological and economic problem.

Vocabulary

<u>mountain pine beetle:</u>	Small, rice-sized insect that is a natural part of the ecosystem in BC
<u>antenna:</u>	Sensory – touch, smell, taste, vibration, air motion
<u>compound eye:</u>	Specialized eye found in insects, made up of many photoreceptors that all point in slightly different directions
<u>head:</u>	(3 parts of an insect = head, thorax and abdomen) head = sensory
<u>thorax:</u>	Where the wings and legs attach
<u>abdomen:</u>	Where digestion/reproduction occurs
<u>wings:</u>	Locomotion - to fly
<u>legs:</u>	Locomotion - to walk
<u>mouth/mandible:</u>	Jaws, to chew through the thick bark and living layer of the tree
<u>bark:</u>	Outer part of a tree, for protection
<u>living layer:</u>	Thin layer between the bark and heartwood that is alive, composed of phloem, xylem and cambium
<u>heartwood:</u>	Inner part of the tree, supports the tree



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Materials

- mountain pine poster and pictures of dead trees
- pine tree rings
- pine tree bark with beetle galleries
- magnifying glasses
- tree hand-out
- dead and preserved mountain pine beetles
- forceps
- dissecting microscopes & small Petri dishes
- teaching microscope (can be hooked up to a computer and projected on a screen)
- lights (if the microscopes don't have them)
- mountain pine beetle hand-out

In the Classroom

Introductory Discussion

1. Short description of 'hook' to capture student's attention.
 - Why are trees important? Do a class brainstorm on the board (make oxygen, provides homes and shelter, cool the water, prevent erosion etc)
 - Show the Mountain Pine Beetle poster. Can the students guess what this is? Have they ever heard of the mountain pine beetle?
2. Briefly describe science experiment/activity.
 - The students will be divided into 2 groups. Half the students will examine some wood that was killed by mountain pine beetles, while the other group will look at dead and preserved mountain pine beetles under the microscope. The groups will then switch.

Mountain Pine Beetle Activity #1

Activity Title: Tree Anatomy

Purpose of Activity:

- To be able to identify the parts of a tree
- To discover how mountain pine beetles kill pine trees
- To be able to identify mountain pine beetle killed wood

Methods and Instructions:

Set-up prior to experiment:

- Bring mountain pine beetle-killed tree rings into the class. If necessary, sand the tree rings down so the students can count the rings.
- NOTE: For posters and other Mountain Pine Beetle information, go to the Natural Resource Canada website (www.nrcan-rncan.gc.ca).

1. Show the tree rings to the students



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2. Discuss the parts of the tree ring (bark, living layer and heartwood). Note that only the thin living layer is **alive**, all the rest is **dead**
3. Discuss the function of each
 - Bark = protect the tree
 - Living layer = sap and water travels up and down the tree, new cells are made
 - Xylem transports water
 - Phloem transports sugar
 - Cambium makes new cells (more xylem, phloem or cambium)
 - Heartwood = dead part of the tree, supports the tree
4. How can you tell how old a tree is?
 - Count the rings
 - The middle rings are oldest, the outer rings are youngest
5. Why is the tree sample BLUE?
 - The tree sample is blue because this tree has been killed by the mountain pine beetle. When the beetle attacks a pine tree, it brings a fungus with it (called the “blue stain fungus”) which also attacks the tree. The fungus turns the wood blue.
6. How does the mountain pine beetle kill the tree?
 - The female beetle will make a hole into the tree trunk (look on the sides of the tree rings for circular holes). It will drill a hole underneath the bark and into the living layer. It will tunnel through the living layer and lay eggs every few mm. Eventually, the eggs hatch into larvae and will tunnel (eating) through the living layer as well. If enough beetles attack the same tree (1000's of beetles), the living layer won't be able to transport water and nutrients to/from the roots/branches and tree will die. Essentially, the tree starves to death!
 - Show the students the bark samples with the egg galleries (be very careful, they are breakable!)
7. Have the students fill in their handout.

Mountain Pine Beetle Activity #2

Activity Title: Mountain Pine Beetles

Purpose of Activity:

- To examine the anatomy of a mountain pine beetle
- To learn how mountain pine locate and kill pine trees

Methods and Instructions:

Set-up prior to experiment:

- Set up all the microscopes. Place 1 or 2 mountain pine beetles in a small Petri dish for each microscope.
1. Show the students the mountain pine beetle poster. What does the mountain pine beetle look like? What key parts do all insects have?
 - Antenna
 - 6 Legs
 - Wings



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- Mouth
 - Compound eye
 - Head/thorax/abdomen
2. Look at dead and preserved beetle with the naked eye. What does it look like?
 3. Review microscope techniques with the students. Look at the beetle under the microscope. What does it look like?
 4. Have the teaching microscope with a dead and preserved mountain pine beetle hooked up to a computer/projector.
 5. Have the students fill in their handout. Draw the mountain pine beetle.
 6. Information to discuss:
 - MPB are a natural part of the ecosystem in British Columbia.
 - MPB usually attack old, dying trees
 - There are lots of different insects that live off trees (e.g. woodborers, spruce beetle, Douglas fir beetle etc).
 - How do they attack a tree?
 - They fly around until they find the right tree (they only attack pine trees)
 - They can find the right tree using their senses, especially sight and smell
 - Once a beetle finds the right tree, it will release a chemical to tell all the other MPB that it found a tree. This chemical is called a pheromone. As a result, 1000's of beetles will attach the same tree.
 - How does the tree fight back?
 - They have thick bark
 - They can eject beetles from the tree with sap, these are called pitch tubes
 - Does the MPB have any predators?
 - Woodpeckers are a natural predator of the MPB.
 - Woodpeckers are highly territorial, so we can't just breed more woodpeckers to control the beetles. Also, there are just too many beetles!
 - Why is the MPB such a big problem now? (show pictures of dead forests with red trees)
 - Global warming means that winters in British Columbia aren't cold enough to kill the beetle anymore. The temperature must drop below -25°C for several weeks in order to kill the beetle.
 - Really warm summers means that the trees are weak from drought
 - Fewer forest fires means there are lots of mature trees
 - Logging practices in British Columbia were historically clear-cutting. After an area has been cleared, people replant all the same trees that are all the same age. This allows MPB to grow to very large numbers.

Closure Discussion

1. Review how the MPB kills a tree
2. Why are there so many MPB now?
3. How might this impact the ecosystem and wildlife in BC?



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4. What can we do to help?

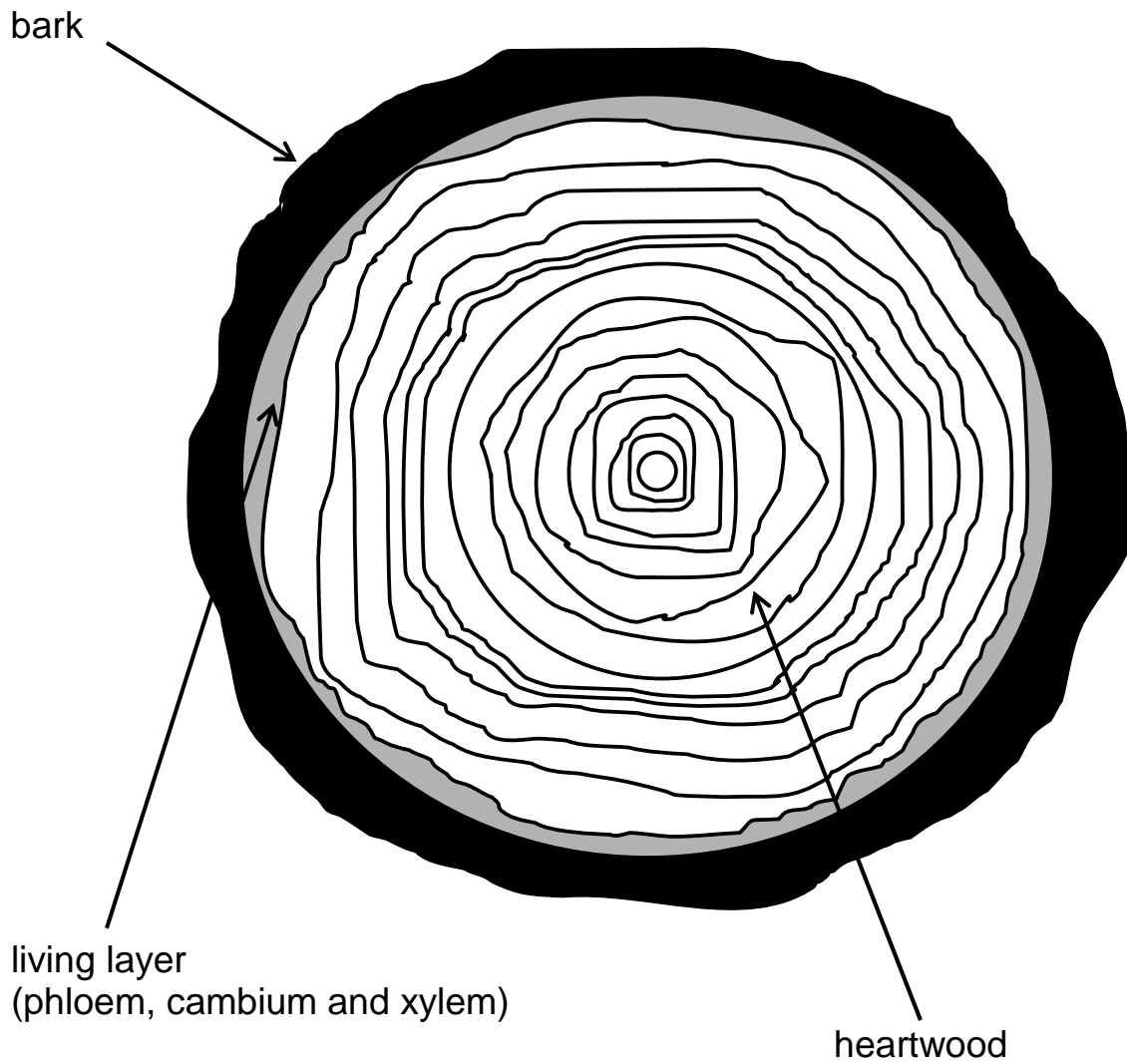
References

1. 2006. British Columbia's Mountain Pine Beetle. Council of Forest Industries Northern Operations and BC Market Outreach Network. See also <www.beetleinfo.com>
2. <http://mpb.cfs.nrcan.gc.ca/biology/index_e.html> Meet the Beetle. Natural Resource Canada. Accessed May 31, 2008.

Extension of Lesson Plan

1. Have a class discussion or write in your journal about what we can do with all the dead, blue-stained pine wood. For example, it is currently used to build log homes, as firewood, in the pulp and paper industry and also artistically (candle holders etc). Encourage the students to use their imagination!
2. Write a letter from the class (or individually, as is age-appropriate) to the editor of a newspaper or politician to tell them what you think should be done about the Mountain Pine Beetle epidemic and/or global warming.

How old is this tree? _____

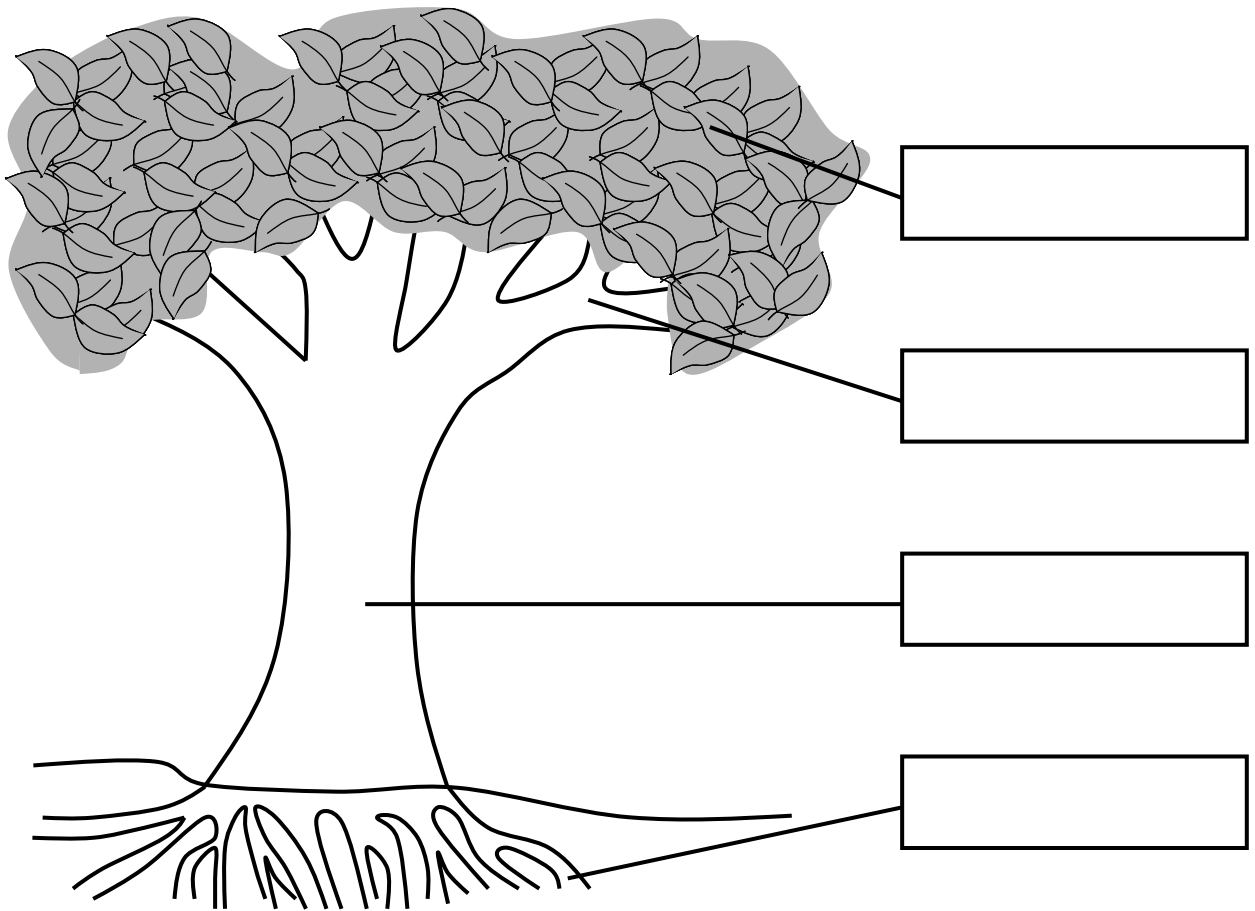


Which rings are oldest? _____

Which rings are youngest? _____

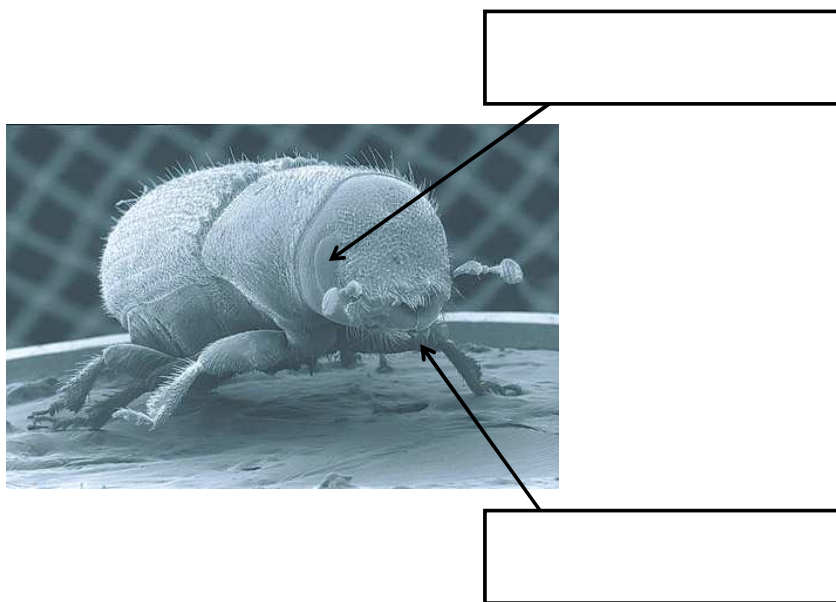
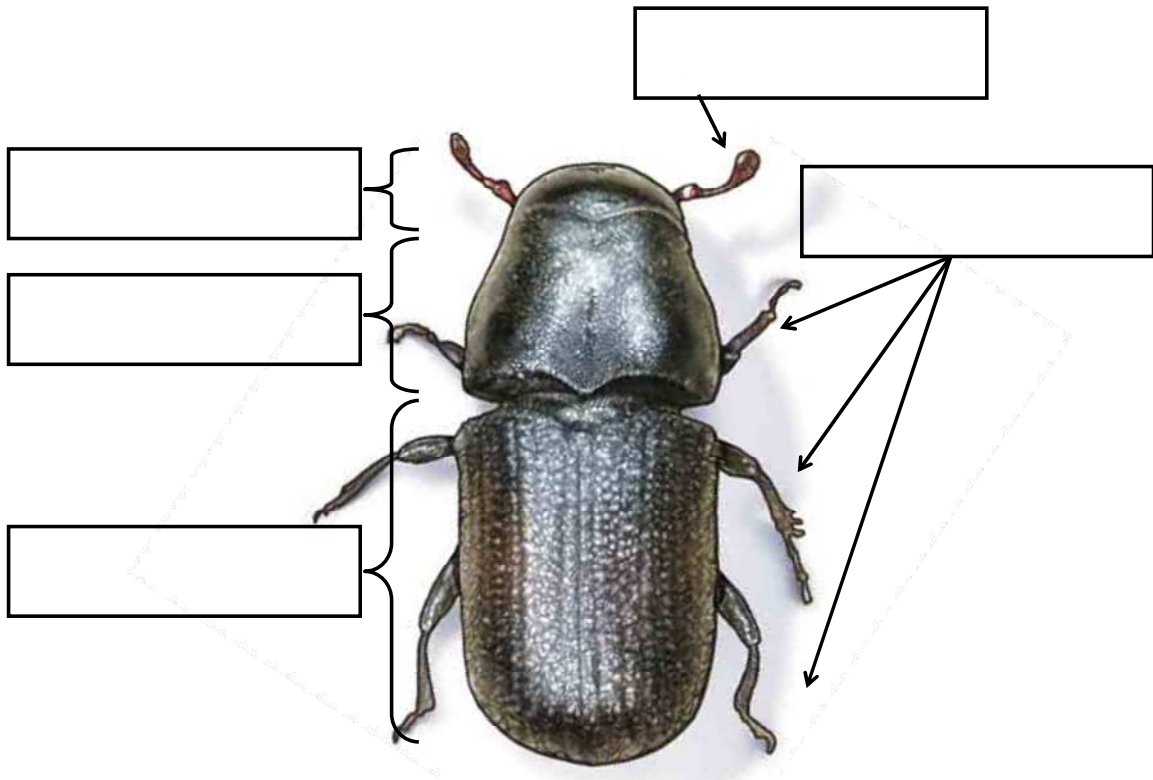
Scientist Name: _____

Parts of a Tree

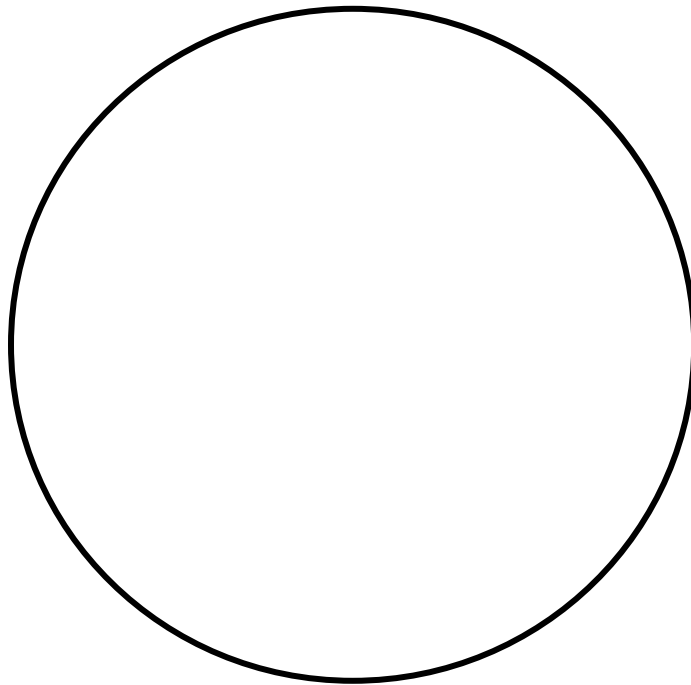


Scientist Name: _____

Mountain Pine Beetle



Draw a picture of what the beetle looks like under the microscope:



magnification: _____

Mountain pine beetles use chemicals to communicate with other beetles. What is this chemical called?
