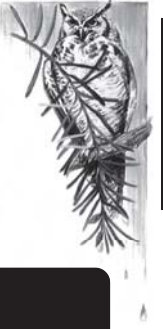


PLANTS & ANIMALS OF THE SOOKE RESERVOIR WATERSHED



KEY CONCEPTS

- HABITATS AND ECOSYSTEMS WITHIN THE GREATER VICTORIA WATER SUPPLY AREA NEED ENOUGH CLEAN WATER TO SURVIVE.
- RESPONSIBILITY FOR WATER IS EVERYONE'S CONCERN.

METHOD

Students will complete research about the plants and animals of the Sooke Reservoir watershed and make a brochure.

ACTIVITY INFORMATION BOX:

TIME REQUIRED: 120 minutes for the Activity, plus additional student research and design time

GRADE LEVEL: Grades 8-12

KEY WORDS: *food chain, ecosystems, producers, consumers, biotic, abiotic, watershed, catchment*

MATERIALS:

- *paper*
- *pens/coloured markers*
- *maps of watershed*
- *Plants and Animals of the Sooke Reservoir Watershed PowerPoint® (PDF) presentation*
- other research material

SETTING: indoors

SKILLS: data collection, observation, analysis, interpretation, classification, drawing

SUBJECTS: Science 8-10
Biology 11-12;
Resource Science 11-12

LEARNING OUTCOMES:

IT IS EXPECTED THAT THE STUDENT WILL:

- Identify the main biotic (living) and abiotic (non-living) components of the Greater Victoria Water Supply Area (GVWSA);
- Describe factors that affect productivity and species distribution in the Sooke Reservoir watershed;
- Demonstrate knowledge of the plants and animals of the Sooke Reservoir watershed including the interrelationship with the physical environment.



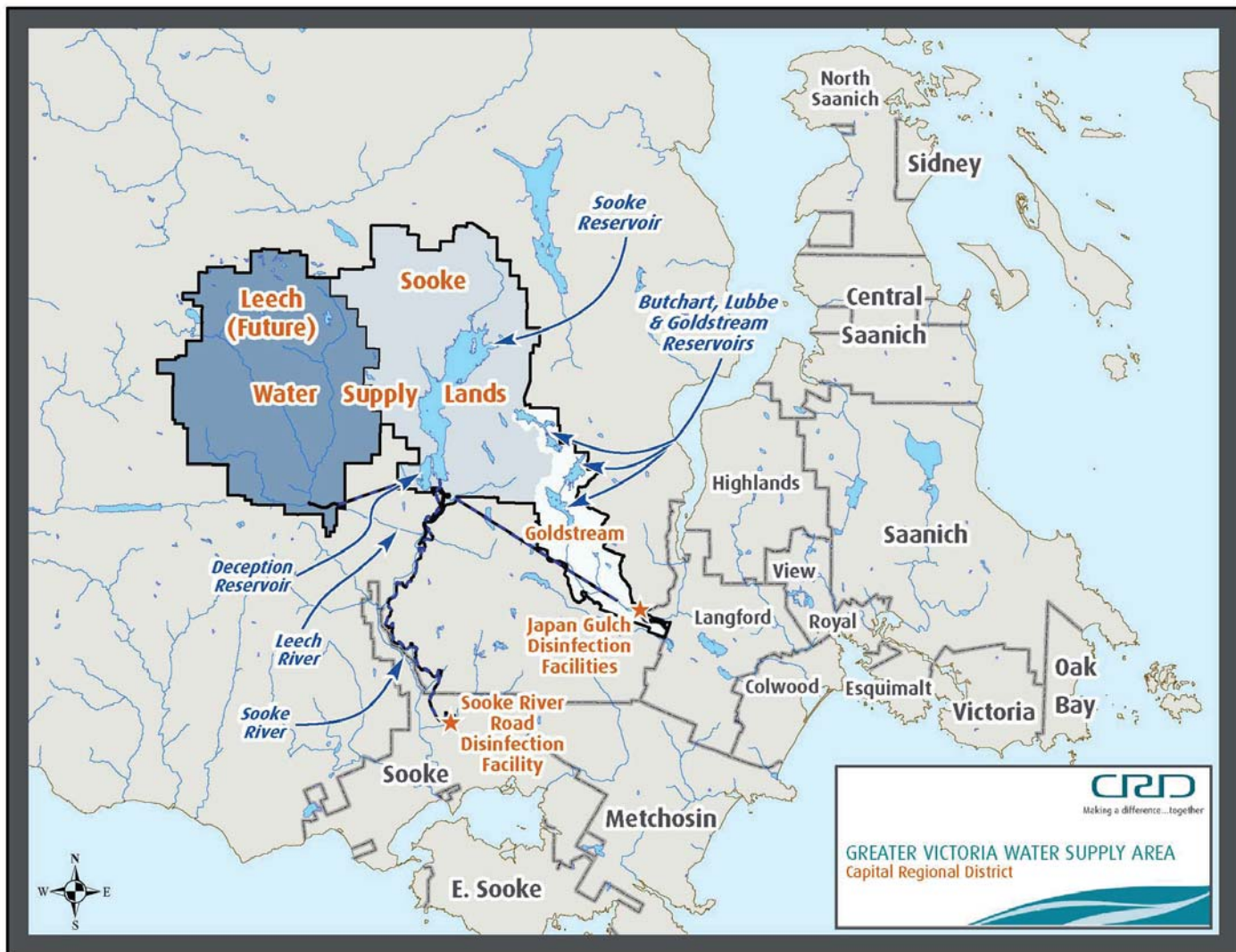
BACKGROUND

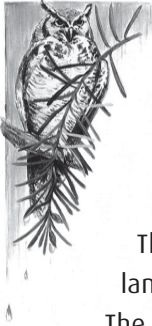
Once a year, the CRD Water Services Department offers tours of the Greater Victoria Water Supply Area. This area is typically off-limits to the public to help ensure that our water supply stays protected and pristine. The water supply area is made up of the Sooke, Goldstream (including the Butchart and Lubbe), and Leech River watersheds. A watershed can be defined as the area or catchment basin that drains into a river, lake, or other body of water. Why should we care about watersheds? Watersheds are more than the catchment basins in and around Greater Victoria. It is important to maintain the integrity of all watersheds because they support habitat for wildlife, space for native plants to grow, they can function as “green infrastructure”, and they can provide drinking water for both people and wildlife.

The Sooke Reservoir is the primary reservoir in the Greater Victoria Water Supply Area. It supplies almost 100 percent of the water used by the 340,000 area residents, while the Goldstream Reservoir provides backup storage to be used during drought conditions or during annual routine maintenance and emergencies when water cannot be supplied from Sooke Reservoir.

Watersheds in British Columbia have a considerable diversity of habitats and ecosystems. What is an ecosystem? Ecosystems are interacting complexes of living organisms (plants, fungi, bacteria, and animals) and the physical environment (soil, air, water, and bedrock) immediately affecting them. Within an ecosystem, there is a dynamic and complex interaction amongst biotic (living things) and the abiotic (not associated with or derived from living organisms). Ecosystems vary in terms of topography, geological features, soil types and climate. The physical conditions in a particular watershed influence which plants and animals will be found there.

In order to better research and understand the great diversity of ecosystems – scientists have devised a classification system whereby ecosystems are grouped on the basis of climate, physical characteristics, and biology. In B.C., these units are called biogeoclimatic zones, each with sub-zones. The Greater Victoria region lies within the Coastal Western Hemlock biogeoclimatic zone, which is one of the most productive forest areas in Canada. It extends in a broad swath along the province’s entire coast. The zone covers most of the lower elevation lands west of the Coast Mountains, from the very wet outer coast to the drier areas of the inner coast. Most of the water supply watersheds are within the Coastal Western Hemlock very dry maritime biogeoclimatic subzone although areas at the highest elevations are within the wetter moist maritime subzone.





CLIMATE & PHYSICAL SETTING OF THE GREATER VICTORIA WATER SUPPLY AREA

The climate of the Greater Victoria Water Supply Area (GVWSA) is a Northern Mediterranean-type climate with warm, dry summers and wet but mild winters usually free from freezing temperatures. The yearly snow pack in the GVWSA is minimal.

The watersheds lie northwest of the City of Victoria and have a gently rolling topography and relatively uniform landscape. However, the water supply area does contain a small amount of steeper terrain and rocky outcrops. The Sooke Reservoir watershed (catchment area) has a total area of 8153 ha. The Goldstream catchment area has a total area of 2,200 hectares. The newly acquired Leech River watershed, covering 8,791 hectares, is the largest in the GVWSA.

Rithet Creek is the primary tributary of Sooke Reservoir. It is one of the few streams that run year-round in this watershed. Its drainage area is about 1,740 hectares (4,299 acres), about 25% of the reservoir's total catchment area. The Leech River is the primary stream in the Leech River watershed, which flows into the Sooke River downstream of the Sooke Reservoir watershed.

SOME FEATURES OF THE GVWSA

- *Northern Mediterranean-type climate*
- *No snow pack in winter*
- *Gently rolling landscape*
- *Some steep terrain and rocky outcrops*
- *Rithet Creek*
- *Leech River*



Rithet's Creek



FORESTS OF THE SOOKE RESERVOIR WATERSHED

The Sooke Reservoir watershed is the primary water supply watershed in the Greater Victoria Water Supply Area. Because of its importance, a number of studies have been conducted to obtain information on forests and the ecosystems found there. The CRD has recently acquired the Leech River watershed and it will also be the subject of similar studies in the future.

Forests in the Sooke Reservoir watershed are mostly classified as belonging to the Very Dry Maritime subzone of the Coastal Western Hemlock Biogeoclimatic zone. Douglas-fir (*Pseudotsuga menziesii*) dominates forested landscapes throughout. Naturally occurring periodic fires help to maintain Douglas-firs in the watershed's landscapes. At lower elevations, big-leaf maple, (*Acer macrophyllum*), grand fir (*Abies grandis*), and western red cedar (*Thuja plicata*) are common components of the forest. Garry oak (*Quercus garryana*) has a rare occurrence while arbutus (*Arbutus menziesii*) is common on exposed rock outcrops at lower elevations. Shore pine (*Pinus contorta* var. *contorta*) is found on scattered rock outcrops at all elevations. With increasing elevation, big-leaf maple and grand fir are replaced by western hemlock (*Tsuga heterophylla*), and western red cedar occupies a lesser role. Red alder (*Alnus rubra*) is common throughout on disturbed sites and in rich/moist to wet ecosystems. Shrubs such as Salal (*Gaultheria shallon*) and softstemmed plants (herbs) and mosses are found throughout the GVWSA. Sword fern (*Polystichum munitum*) is an indication of moist, more nutrient rich forest stands.

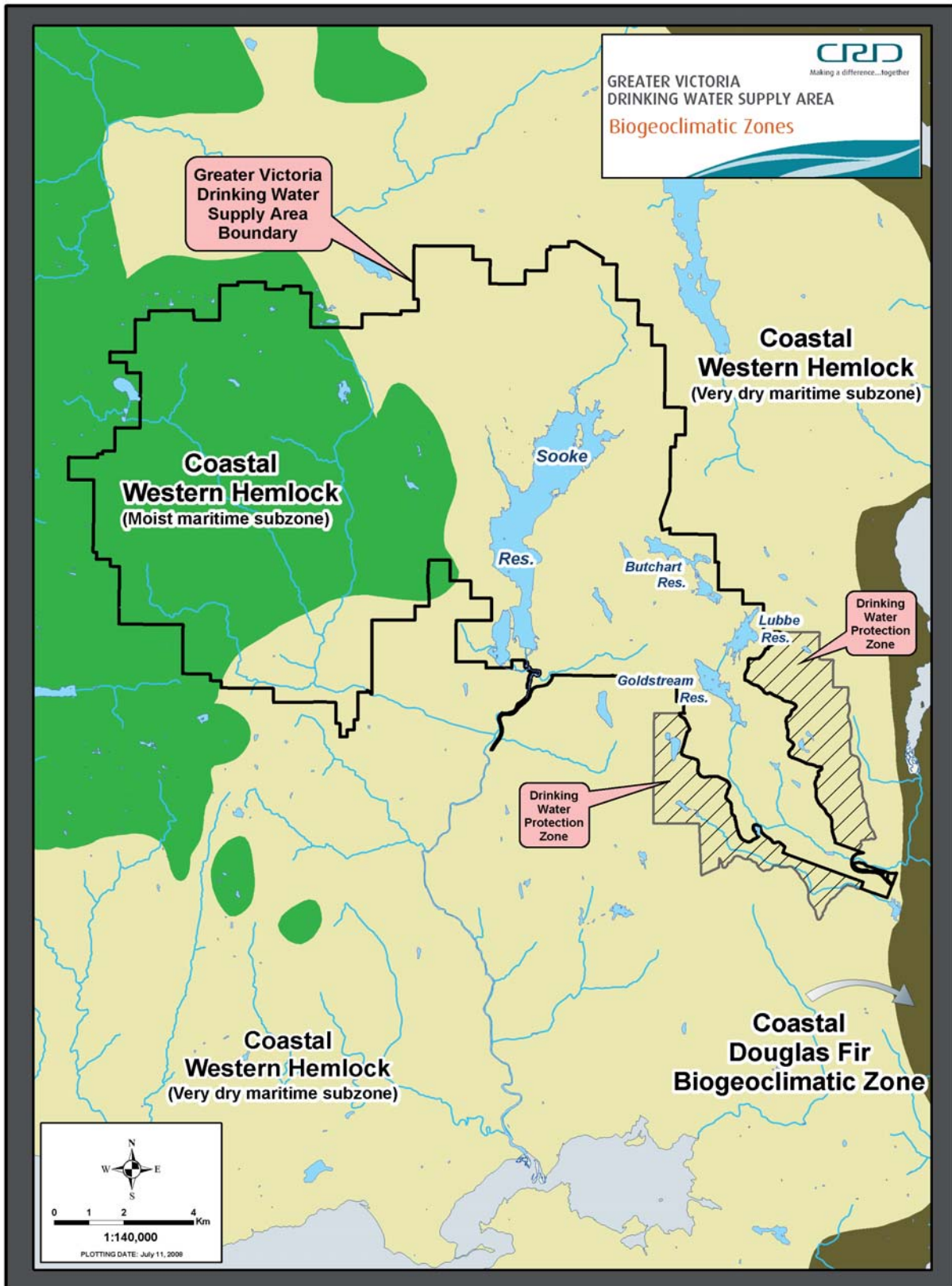
SOME PLANTS OF THE SOOKE RESERVOIR WATERSHED

Douglas-fir
Big-leaf maple
Western red cedar
Arbutus,
Shore pine
Grand fir
Western hemlock
Red alder
Salal
Oregon-grape
Huckleberry
Bald hip rose
Ocean spray
False azalea
Salmonberry
Devil's club
Labrador tea
Sword fern
Mosses





BIOGEOCLIMATIC ZONES OF THE SOOKE RESERVOIR AND GOLDSTREAM WATERSHEDS



The Sooke Reservoir watershed lies within the Coastal Western Hemlock Biogeoclimatic Zone. Most of the watershed is within the Very Dry Maritime Coastal Western Hemlock subzone while a small portion lies in the Moist Maritime Coastal Western Hemlock subzone.



SOOKE RESERVOIR

Sooke Reservoir is monitored by CRD Water Services to better understand the aquatic ecosystem and its effect on drinking water quality. Bacteria are some of the smallest residents of Sooke Reservoir and are a natural, healthy part of all environments. In aquatic systems, including Sooke Reservoir, bacteria decompose organic material and cycle nutrients such as nitrogen and phosphorus. Algae (phytoplankton) are simple microscopic plants that range in size from 1-2 micrometres to over one millimetre; they live freely in the water where there is sufficient light for plant growth; along with all plants, they are known as the primary producers. Zooplankton are small, mostly microscopic animals that also live in the open water of the reservoir. They can swim, allowing them to move away from predators and toward food. Some can move up or down as far as ten metres in the water based upon light, food and other factors. They are known as primary consumers. Freshwater mussels are found in the Sooke Reservoir and typically live on the bottom, filtering decaying organic material and other food particles from the water. Aquatic insects such as the non-biting midges are one group that usually make up the greatest numbers of insects in aquatic systems. Members of this group spend the early stages of life in the water, moving to land once they are adults. The aquatic insects will eat algae growing on rocks as well as decaying organic material and, in some cases, other animals. Animals that eat plants are known as primary consumers, while those that eat other plant-eating animals are known as secondary consumers, and those that eat animal-eating animals are tertiary consumers.

Fish are present in Sooke Reservoir, where they feed upon zooplankton and aquatic insects. Four main types of fish were found in Sooke Reservoir in 2006: Rainbow Trout (*Oncorhynchus mykiss*), Cutthroat Trout (*Oncorhynchus clarki*), Dolly Varden char (*Salvelinus malma*) and Kokanee salmon (*Oncorhynchus nerka kennerlyi*). Kokanee is a land-locked salmon that lives in freshwater only, and belongs to the same species as the sea-going Sockeye salmon. Dolly Varden and Kokanee were found to be selective feeders since only one type of zooplankton was found in their stomachs. The same type of zooplankton was found in the stomachs of both Rainbow and Cutthroat Trout in addition to aquatic insects and other fish, indicating that they are more generalized feeders.

Eagles and black bear that eat fish from Sooke Reservoir are also tertiary consumers.

SOME PLANTS AND ANIMALS THAT LIVE OR FEED IN SOOKE RESERVOIR

Bacteria

Algae (phytoplankton)

Aquatic plants

Zooplankton

Aquatic Insects

Freshwater mussels

Rainbow Trout and other fish species

Eagles

Black bear



WILDLIFE IN THE SOOKE RESERVOIR WATERSHED

Columbia black-tailed deer are by far the most common large mammal wildlife species present in the watershed. Black bears and Roosevelt elk are less common. Bird species include the Pileated woodpecker and others such as Cooper's Hawk, Winter Wren, Bald Eagle, Golden Eagle, and Great Horned Owl. It is also thought that there are potential nesting sites for the Marbled Murrelet, a vulnerable population of seabird. Other species present include Cougar, Mink, River Otter, Red Squirrel and small mammals such as mice and voles. For more information please see Powerpoint (PDF) notes and Plants and Animals at Sooke Reservoir Watershed cards.

SOME WILDLIFE OF THE SOOKE RESERVOIR WATERSHED

Columbia black-tailed deer

Black bear

Roosevelt elk

Pileated Woodpecker

Cougar

Mink

River Otter

Red Squirrel

Cooper's Hawk

Winter Wren

Great Horned Owl

Bald eagle

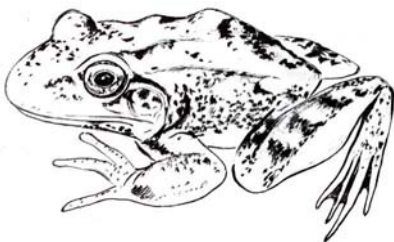
Golden Eagle

Rainbow Trout

Cutthroat Trout

Dolly Varden Char

Kokanee Salmon



SOME PLANTS & ANIMALS OF THE SOOKE RESERVOIR WATERSHED



COLUMBIA BLACK-TAILED DEER

(Odocoileus hemionus columbianus)

The Columbia Black-tailed Deer is found along the coastal mountain region of BC. These deer prefer grassy fields at forest edges, and are most active at dusk and dawn, feeding. They use their large rotating ears to let them know of predators nearby, and bound away at the first sign of danger. Black-tails feed on tender grasses, herbs, branch tips, and new leaves in spring and summer. In winter, they eat Douglas-fir, western cedar, Oregon yew, trailing blackberry, red huckleberry, and salal branches.

BLACK BEAR

(Ursus americanus)

The black bear is the most common species of bear in B.C. Black bears prefer a forest habitat, especially ones with open areas such as meadows or wetlands. Although bears are classified as carnivores, they are actually omnivores and eat a variety of plants and animals. Plants make up about 75% of a bear's diet, including leaves, buds, catkins, stems, roots, grasses, nuts, and berries. They also eat a variety of insects, honey, and carrion (dead animals). Bears catch and eat spawning salmon and often leave old carcasses in the forest, providing key nutrients to the forest ecosystem.

PILEATED WOODPECKER

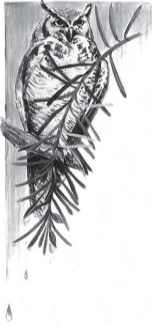
(Dryocopus pileatus)

The Pileated Woodpecker is widely distributed across southern British Columbia. It frequents forested areas in mature Douglas-fir and western hemlock forests, including adjacent logged and second growth areas, as well as open deciduous and mixed woods. It probes for insects deep within dead and rotting trees and excavates cavities for roosting and nesting. It is the largest woodpecker in North America and can often be heard before being seen by its distinctive "laughing" call.

COUGAR

(Felis concolor)

The cougar, the largest wild cat native to British Columbia, is an imposing but evasive member of our wildlife. Cougar are generally found from the British Columbia-Alberta border west, including most coastal islands. The cougar eats prey species such as deer, porcupine, beaver, hare, moose, elk, wild sheep, mountain goats, black bear (cubs), grouse, coyote, other cougar, domestic stock, and household pets. Cougar habitat generally follows the habitat of its prey species.



SOME PLANTS & ANIMALS OF THE SOOKE RESERVOIR WATERSHED

MARBLED MURRELET

(Brachyramphus marmoratus)

The Marbled Murrelet is a small sea bird found along the Pacific Coast from Alaska to California. Marbled Murrelets spend most of their time at sea where they feed on fish or invertebrates. They nest in forests within 75 km of the coastline, laying a single egg in a shallow depression formed on moss laden branches of old growth trees. Marbled Murrelets nest in old forests and are rarely seen. There are some potential nesting sites for these secretive birds in the GVWSA forests.

OREGON GRAPE

(Mahonia nervosa)

Oregon grape can be identified by its evergreen “holly-like” leaves, bright yellow flowers, and green berries that ripen into a waxy blue/purple colour. It commonly found in dry to fairly moist open forests at low to middle elevations. The tart, purple berries were sometimes mixed with salal or other sweeter fruit in traditional First Nations uses. The bark and roots of the Oregon Grape were also used to make a bright yellow dye for basket materials. Today, the berries are sometimes used for jellies and winemaking.

WESTERN RED CEDAR

(Thuja plicata)

The Western Red Cedar is a large tree, growing up to 60 metres tall when mature, with drooping branches. Its leaves are arranged on the twig in flat, fan-like sprays. It usually occurs in low to mid elevations along the coast where the climate is cool, mild and moist. Cedar has been called the “cornerstone of northwest coast Indian culture” as the easily split, rot-resistant wood was used to make important cultural items such as houses, baskets, boxes, clothing, and a variety of tools and other household items.

SALAL

(Gaultheria Shallon)

Salal is a shrub with thick, tough, spoon-shaped evergreen leaves. It grows in coastal forests from sea level to mid elevations. Salal berries have long been an important food source for B.C. native peoples – the berries were eaten fresh or dried in cakes.



PROCEDURE

1. Find out what students know about the plants and animals of the Sooke Reservoir watershed by creating a “KWL” chart or a mind-map either individually or as a class.
2. Show the PowerPoint® (PDF) presentation on Plants and Animals of the Sooke Reservoir Watershed or use slides and notes for further background information.
3. Review the concepts of watershed and ecosystems with students. Discuss the ecosystems, biogeoclimatic units, and some of the plants and animals found in the GVWSA (see Background), using the material provided such as:
 - map of the Greater Victoria Water Supply Area watersheds;
 - map of the biogeoclimatic zones of the Greater Victoria Water Supply Area;
 - lists of plants and animals found in the Sooke Reservoir watershed;
 - background cards on some common animals and plants of the Sooke Reservoir watershed.
4. Tell students that they are going to make a brochure on a plant or animal found in the Sooke Reservoir watershed.
5. Using the Brochure Student Assignment sheet, challenge students to use the information provided plus their own research on a plant or animal of the Sooke Reservoir watershed. Students can look at the CRD Water Services website (<http://www.crd.bc.ca/water/>) for photos and other information about the water supply area.
6. All brochures should provide accurate information, illustrations/graphics, and effective design elements in accordance with the evaluation criteria.
7. Have students present their findings to the class. Discuss with students any differences and similarities there might be between the plants and animals found in the Sooke Reservoir watershed and the watershed in which they live.

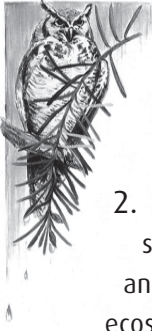
EVALUATION

Have students:

- Describe plants and animals of the Sooke Reservoir watershed, including the interrelationship with the physical environment;
- Design and produce a brochure on a plant or animal of the Sooke Reservoir watershed.

EXTENSIONS

1. Instead of a brochure, ask students to create a card on a plant or animal of the GVWSA. Cards should provide information on the habitat, abundance, and how the plant or animal interrelates to the environment.
2. Grade 9-12: Compare the watersheds of the GVWSA to the watershed your school is in using the watershed maps provided in Appendix E. Compare watershed size and features. Discuss with students the amount of area that is urban or developed in the two watersheds, especially as it relates to protecting water quality.
3. Have a watershed food festival. Create a menu, prepare, and serve some locally grown foods.



COMMUNITY CONNECTIONS

1. Plan a field trip to Goldstream Nature House or Swan Lake Christmas Hill Nature Sanctuary to learn about the local watersheds and the plants and animals that live there.
2. Go on a local “watershed tour.” Find out about local streams and where they flow – see Appendix B for a list of streams nearby Victoria area schools. What are the local native plants and animals found nearby? Do a walk-about and generate lists of plants and animals of the local watershed. Please be careful not to change or disturb sensitive ecosystems.

REFERENCES

Ecosystem Units Of The Greater Victoria Water Supply Area; Volume 1 – Technical Report. CRD Water Services. 2004

Watershed Tours. CRD Water Services Website: <http://www.crd.bc.ca/water/watersupplyarea/tours.htm>

Watershed Protection. CRD Water Services Website: <http://www.crd.bc.ca/water/watersupplyarea/index.htm>
also at <http://www.crd.bc.ca/watersheds/> and <http://www.crd.bc.ca/maps/>

Cougar in British Columbia. BC Ministry of Environment. <http://wlapwww.gov.bc.ca/wld/documents/cougar.htm>

Birds of British Columbia. Vol Two. Campbell, R.W. et al. 1990. Royal British Columbia Museum

Plants of Coastal British Columbia. Pojar, Jim and A. MacKinnon (eds.). 1994. Lone Pine Press.

Trees, Shrubs, and Flowers to know in British Columbia and Washington. Lyons, C.P. and B. Meriless. 1995. Lone Pine Press.



NAME:

BLOCK:

PLANTS & ANIMALS OF THE SOOKE RESERVOIR WATERSHED

ASSIGNMENT INSTRUCTIONS

Your task is to use your notes, the Internet and the information provided to research and create a brochure on some of the plants and animals of the Sooke Reservoir watershed. Your goal is to present high quality accurate information and illustrations/graphics about a plant or animal of the watershed. You may choose to complete this assignment in pairs or individually.

TIPS FOR BROCHURE PLANNING

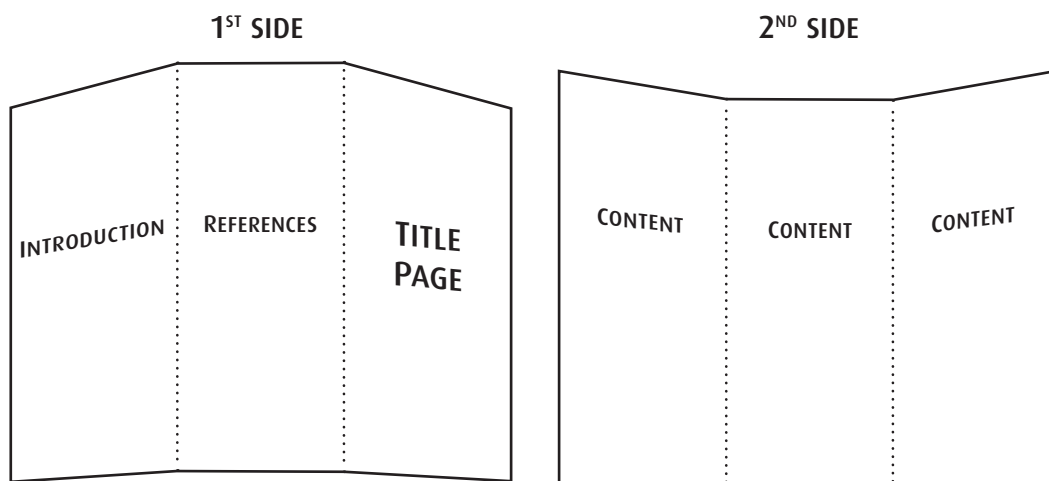
CONTENT: Select a plant or animal of the Sooke Reservoir watershed from the material provided. Describe the information about the plant or animal features in clear, concise language with information from accurate sources. Include:

- Description
- Ecology
- First Nations or other uses

Pay attention to graphic design: highlight your main points with larger or bolder type. Details of the main points should be in smaller type. Use photographs or drawings to complement your text – make your design visually interesting and engaging.

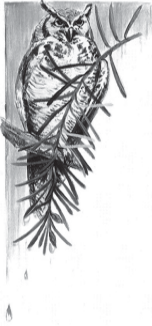
REFERENCES: Include three or more reliable references.

FORMAT: You are required to organize your information in a brochure format. This can be done by hand, or on the computer if you have a program on your own personal computer. You will need a blank piece of paper (8.5 X 11 inches) folded into three equal sections. Use the following layout as a guide.



EVALUATION: Your brochure will be evaluated based on these four criteria:

1. Attractiveness and Organization
2. Research skills and References
3. Accuracy and Quality of information
4. Quantity of information



NAME: _____

BLOCK: _____

**PLANTS & ANIMALS OF THE SOOKE RESERVOIR WATERSHED
ASSIGNMENT EVALUATION**

CATEGORY	4	3	2	1	Mark:
Attractiveness & Organization	Format is exceptionally attractive & information is well organized.	Format is attractive & information is well organized.	The brochure has well-organized information.	Format and organization of material are confusing to the reader.	_____
Research Skills & References	Three or more reliable references are cited.	Only two references are cited.	Only one reference is cited.	References are not cited.	_____
Content: Accuracy & Quality	All facts in the brochure are accurate.	99-90% of the facts in the brochure are accurate.	89-80% of the facts in the brochure are accurate.	Fewer than 80% of the facts in the brochure are accurate.	_____
Quantity of Information	All topics are addressed in full.	One topic is incomplete or missing.	Two topics are incomplete or missing.	Three or more topics are missing.	_____