Biodiversity

IN BC AND BEYOND

Module 3

HCTF Education

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HABITAT CONSERVATION TRUST FOUNDATION

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Biodiversity in B.C. and Beyond

Biodiversity is a complex concept. Efforts to understand this complexity only by its individual can lead to an overly simplistic understanding of biodiversity, resulting in an over-reliance on its resiliency to absorb the consequences of our actions. The complexity of climate change, its effects on biodiversity and superficial approaches to these concerns create paradoxes which can only be solved by thinking about the issues differently than we traditionally have. The information and activities presented in this module are intended to stimulate a curiosity and wonder about biodiversity and help deepen students' relatedness, interconnection and relationship with it. This shift in thinking can be achieved by encouraging relational student investigations into global biomes, BC's biodiversity, and threats to their health and stability using a problem-based approach (PBL). Please see the Problem-based learning primer for this unit from *hctfeducation.ca*. Thus, the material in this module is intended to be adapted by the teacher for this purpose. Additionally, student investigations may lead to further questions or an understanding of an issue from a different perspective and therefore provide a basis for a class action project that helps address the roots of a local biodiversity issue.

Ready

1. Provide students with an anchor or prompt such as a problem solving scenario, story or case study to create a driving question. Examples of driving questions can include such those coming from the "Be a BC Biodiversity Detective" activity, or could be derived from a list of concerns that students discover, learn or know about local or global biodiversity issues.

2. In groups, have students define the problem or project including identifying important questions and information needed to research.

In collaboration with the teacher, students will plan how to go about collaborating and communicating their findings and demonstrating evidence of their learning.

Problem-based Learning Ideas:

- How might you describe biodiversity in BC or globally in away that celebrates uniqueness and diversity within, strengthens and builds healthy relationships between humans and other species in ecosystems, and/or highlights the need to protect and restore biodiversity?
- What might the role of seed banks or reintroduction programs play in protecting biodiversity and the restoration of ecosystems?
- How might our actions, e.g. fire suppression or the actions of historical explorers contribute to or detract from biodiversity?
- What are invasive species in your local community, where did they come from, how did they get established, and what is wrong with labeling a species as invasive from a biodiversity perspective?

Set

The activities in this modules are intended to support the various components of problem-based learning such as mini-lessons, research or information tools, creation of artifacts, and templates used to record the results of investigations. When students are completing the following experiences and activities below to explore and reflect on concepts in biodiversity, consider how they will connect knowledge and insights gained from these experiences to the overarching goals, biodiversity guiding question, or work.

The activities contain sections called:

- **Aims:** What the activity will do
- **Ready:** Necessary background to connect it to a guiding question and the problem-based learning plan
- **Set:** The research and materials that will be needed to carry out the activity
- **Go**: The activity itself
- **Follow-Up**: Reflection and analysis of the activity to help students achieve the learning goals

These activities could also be used on their own to develop skills and understanding about biodiversity, recognize opportunities to build connections through conservation and restoration, and reflect and communicate about their interconnectedness to biodiversity.

When beginning a problem-based learning experience, it is important to establish the context for this experience and its importance by using an anchor. The anchor for this module might come from something in the background, a question or observation from the "Be a BC Biodiversity Detective" activity, or a list of concerns that students discover, learn, or know about local or global biodiversity issues. Alternatively, you might invite an Indigenous elder to speak about their relationships to land and the issues they face, or a local naturalist/conservation biologist to talk about their work or interests. Students could also look for anchors in local media, watch a film or documentary, or share personal stories about experiences while vacationing in B.C.

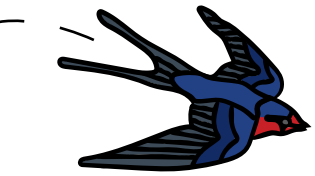
Background

BC's biodiversity is a rich topic for problem-based learning. Our province's unique geological history, ocean proximity and climate zones (polar, humid temperate and dry) combine into a rich mosaic of regions where jagged ranges of snow clad peaks, timbered foothills, fertile valleys, grasslands, deep river basins, wave-swept coasts and great lakes combine to form amazing scenery and breathtaking beauty that support an incalculable number of unique habitats and species (including humans). British Columbia's biodiversity has a relatively young history. Fossils suggest that most of British Columbia's plants and animals migrated here after the glaciers began retreating 12,000 years ago. These lands were originally and remain home to First Peoples who hunted the mammals of the forests and plains, gathered and tended to plants and harvests, and fished within the oceans and lakes.

B.C. covers 95 million hectares, and its ecosystems include:

- Coastal rainforests
- Dry interior grasslands
- Alpine tundra
- Northern boreal forests
- Coastal waters of the intertidal and subtidal zones
- Salt marshes
- Thousands of wetlands

Indigenous peoples and their ways of knowing provided a relational and interconnected existence with the land that sustained them and these places for thousands of years.



These connections to land are not only physical such as a source of food and shelter, but spiritual and cultural as well. Yet most of the land in BC is unceded and connections to traditional territories and practices are threatened, forbidden or eliminated. The unsustainable use of land and how it is governed has affected and continues to affect not only biodiversity, but also Indigenous people's livelihoods, spiritual and cultural ways of knowing, and connections to the land. For example, along with biodiversity, land use issues are influenced by the history of colonialism in the province such as the restrictions on some traditional fishing methods or over extraction of resources (minerals and trees). Even the language we use to describe land and biodiversity as resources implies and creates a colonial possessive relationship and actions with land. Looking at how Indigneous ways of knowing and interconnectedness reveal and teach reciprocal and respectful relationships with biodiversity and how the effects of colonialism continue to impact these relationships, holds potential for a problem-based inquiry.

B.C.'s species diversity is unmatched in Canada. Plant species in B.C. include:

- About 1,000 mosses and liverworts (bryophytes)
- More than 10,000 fungi
- More than 2,000 verified lichen
- At least 2,500 native vascular plants (including species, subspecies, and varieties)

> *An ecosystem is not a collection of plants and animals. It is a seamless swirl of communities and processes. If you don't save the processes, you won't save the parts.*
>
> ***–(Chadwick, 1993)***

One of the basic concepts of biodiversity is the relationships and processes of a species living within and among its habitats. At the ecosystem level this biodiversity is amplified by the number of species interrelating that as a whole creates a dynamic, flexible, healthy, and resilient system that can evolve and change without breaking its balances or degrading its diversity. Any human activity that reduces the ability of a species to fulfill its niche by removing its habitat or a component of habitat, reduces biodiversity. This is why some conservationists will speak not just about endangered species but about endangered spaces.

For example, with a species such as a mountain goat, small parks may not necessarily ensure its survival if the habitat surrounding the park is altered or removed. If the small area restricts a mountain goat from a salt lick or if healthy individuals from one population of mountain goats cannot connect to mate with individuals from another population, the ultimate health of all the mountain goats in that area will decline. The connections inherent in a biodiverse ecosystem means that a decline in one species has consequences for every

B.C.'s vertebrate populations are among the most diverse in North America. More than 1,100 native species include:

- 20 amphibian species
- 21 reptile species
- Over 375 species of birds, of which more than 315 breed in B.C.
- Over 165 mammal species, terrestrial and marine
- Over 500 species of fish, including about 160 freshwater fish that inhabit streams, rivers and lakes, and hundreds more marine fish species in coastal waters

Please see more information on mountain goats and other species at *hctfeducation.ca*

part of the ecosystem. These consequences can be either direct such as an individual goat's health reducing the number of prey available to bear, wolves or cougars, or indirect such as the impact on a on a herbivore population that depends on mountain goat grazing to increase the plants available to them.

B.C.'s invertebrates include:

- 35,000 species of insects, such as butterflies, moths, and bees
- Thousands of species of arachnids, such as spiders, ticks, and mites
- Other terrestrial arthropods, such as beetles

Expanding outward, Canada, one of the largest countries in the world, is home to tens of thousands of known species living in a variety of habitats. Many species cross over political boundaries because of habitat continuations such as the coniferous and deciduous mixed forests, grasslands, oceans, and desert biomes. Some species migrate openly between habitats as part of their life cycle. If there are disruptions to these migrations or changes to habitats from human activities, species survival may suffer. As of 2021, there were 369 species on the Canadian endangered species list and almost 200 on the threatened list as provided by the Committee on the Status of Endangered Wildlife in Canada (*cosewic.ca/index.php/en-ca/*). The future of many of these species depends on the preservation of habitat and the restoration of already damaged areas. While the history of the Earth contains periods of time when large numbers of species became extinct as a result of natural events, many more animals became extinct or are threatened due to unsustainable relationships humans have with ecosystems than because of natural processes.

Species that are most threatened by unsustainable human activities include:

- Large animals that need large spaces as part of their habitat.
- Island species can lose their genetic diversity and are vulnerable to predators introduced from elsewhere.
- Slow reproducers, like killer whales, that only have one baby every 5-10 years.
- Species that live in the same lowland and valley habitats that are popular for human beings.

Today many British Columbians believe in the importance of preserving biodiversity and preserving and restoring enough space for healthy interrelationships between all of the components and processes of various biodiverse ecosystems. However, action to protect these interconnections will require a shift in the way that we relate to biodiversity and an understanding that biodiversity is not 'out there' but all around us everyday. We are part of biodiversity which means we are connected and our actions affect biodiversity. Furthermore, two-thirds of the people in B.C. live in the Fraser River basin (Metro and Fraser Valley regional districts) and growing numbers in the dry interior. With much of the rest of BC covered by rugged, cold mountains, plants and animals living in the same valleys and regions as humans cannot move to other locations when we transform their habitats for agriculture, homes or industry just as some cannot move out of the way of fires and floods.

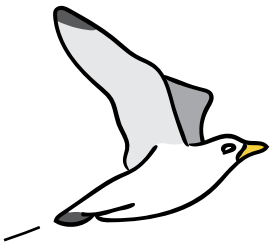
Unless we develop ways of living in harmony with biodiversity that supports all of us, not only will many species disappear, but more conflicts will arise about the use of land as places become inhabitable for humans, diseases rise, or the land will be less able to support biodiversity that produces food and clean water that we all need. Being part of the solution will require an understanding of how our past and often current relationships to biodiversity accelerate these issues and a transformation in our thinking and actions flowing from a renewed and healthy relationship with biodiversity that focuses on kinship, respect and reciprocity.

Biome Biography

Aim

To examine one way to represent the biodiversity within the biomes of the Earth now and in the past.

Ready



Globally, Earth has seven land and eight water biomes. For land these biomes are tropical rainforests, temperate forests, deserts, tundra, taiga (aka boreal forests), grasslands and savanna. The water biomes are lakes and ponds, rivers and seas, oceans, estuaries, coral reefs, wetlands, mangroves, and intertidal zones. Each land biome has its own climate with different plants and animals. This activity invites you to be a biodiversity geographer as you explore one of the land biomes looking for relationships that sustain life and reveal connections with your life.

Set

On a map of the world supplied by your teacher, write the names of the continents and oceans.

Refer to a map of the land biomes provided and your own research to identify and shade in the biome you have selected to research. Label the other land and water biomes connected to or next to your biome. Compare with others looking at different biomes, what does the pattern resemble, and what might cause that to happen?

Go!

Get together with 3 or 4 other people who have chosen the same biome as you. Work together to get as much information about your biome from your textbooks and library sources as possible. Record your information on the worksheet which follows.

My Biome Biography Worksheet

Name of biome:

_____

Continent:

_____

Location of my biome:

_____

Climate in my biome:

_____

_____

_____

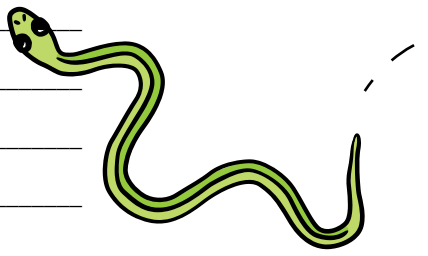
Has the climate of my biome changed in the last 500 years, and how so?

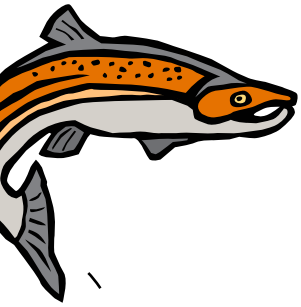
Special **plants** of my biome:

Are there any plants that used to live in my biome and do not now? If so, why not?

Special **animals** of my biome:

Are there any animals that live in more than my biome? What is different about them as a species from a species that lives in only my biome? What important water biomes are in and around your land biome?





Can you find any examples of plants or animals that live in my biome now but did not always?

Plants:

Animals:

How did these plants or animals come to live in another biome? Or why did these stop living in my biome?

The people of my biome:

1. What type of people are native to my biome? Who else lives there now?

2. Describe the foods (plants and animals) that originate in your biome in the past and currently. Are any of these food sources non-native (e.g. cattle raised on farms, or plant crops of non-native species like peppers)

3. What do most people in my biome wear? What is the fabric made from? How has what they wear changed from what Indigenous cultures wore?

4. How do the people in my biome make a living? Has that changed from the past?

_____

_____

_____

_____

Special characteristics of my biome. Any relationships I have with my biome and the relationships of my biome to other biomes:

_____

_____

_____

_____

Follow Up

1. Examine your findings. Reflect on and analyze the relationships in your biome.
2. How was biodiversity supported? How is it being harmed?
3. What are specific examples of how your biome is connected directly to you or to your family?
4. How is it connected to your local habitat or species that live there?

Flag the Feature Creature

Aim

To explore some interesting animals found in the ecoprovinces and explore the relationships of different cultures with the biodiversity found within them.

Ready

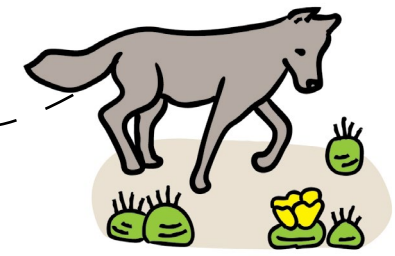
On a regional scale, scientists have taken the biomes in B.C. and created ten ecoprovinces using patterns of physical geography (mountains, rivers, ocean, plains) and vegetation (plants like trees and shrubs) that tend to be dominant and stable over time within the area. Within these ecoprovinces, scientists have created smaller biogeoclimatic units to further group ecosystems on the basis of a combination of biology (who lives there), geology (soils, rocks, landforms) and climate (weather, seasonal changes). These biogeoclimatic zones explain how locally, you might be able to identify unique biodiversity such as the Garry Oaks within your ecoprovince but on the whole, your area shares most commonalities with the lowlands along the Fraser River and Georgia Straight. These flat valley bottoms surrounded by coniferous and deciduous forests, orcas, sturgeon and Western red cedar found next to or within the same biogeoclimatic zone as the Garry Oaks. Part of your research into biodiversity in this activity will look at the differences in how scientists and First Peoples describe, classify or mark territories in BC for human communities.

Set

Make a copy of the map showing the ten ecoprovinces.

Go!

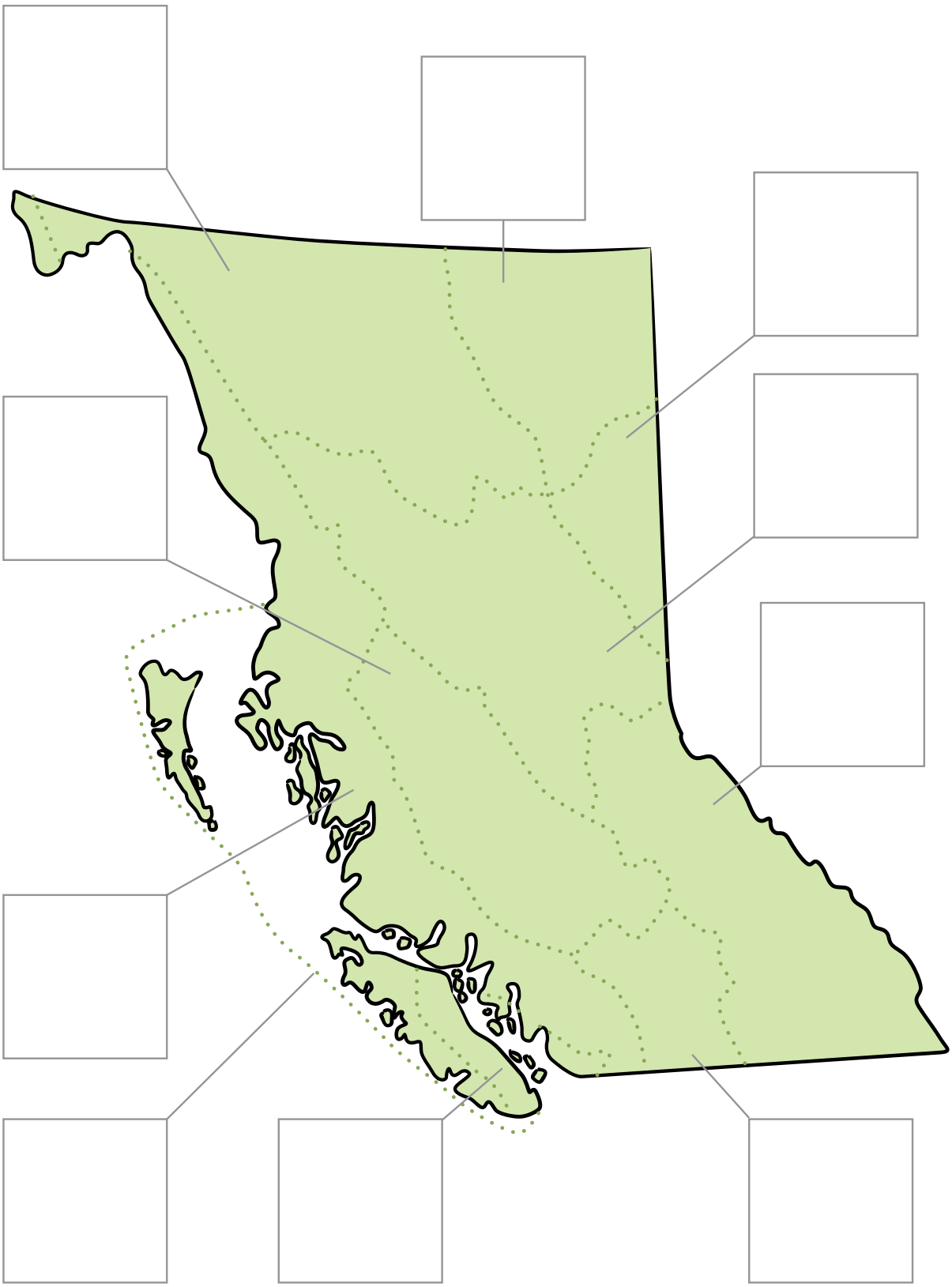
1. On the map, label each ecoprovince with its name and feature creatures. Use pictures cut out and pasted or print the name.



- **Taiga Plains:** Spruce grouse, lynx, tamarack, black spruce
- **Southern interior:** Burrowing owl, coyotes, cactus
- **Northern Boreal Mountains:** Thinhorn sheep, black spruce, moose
- **Central Interior:** American white pelican, pines, porcupines
- **Northeast Pacific:** Sea otter, albatros, gulls, and algae
- **Coast and Mountains:** Grizzly bear, salal, salamanders
- **Sub-Boreal Interior:** Magnolia warbler, cranes, kinnikinnick
- **Southern Interior Mountains:** Osprey, elk, conifers
- **Boreal Plains:** Chorus frog, aspen grasslands, grouse
- **Georgia Lowlands:** Sturgeon, orcas, oaks, douglas-fir

2. Research a map of traditional territories of First Peoples in BC and use a different colour or line style to map the location and name these territories on your flag the feature creature map.

Flag the Feature Creature Map



Follow Up:

1. Describe the differences and similarities between the ecoprovinces map and the map of traditional territories.
2. Consider how ecoprovinces are created and how traditional territories might have been established.
3. Can you come up with any reasons to explain the similarities and differences?
4. How might the ecoprovince map look if it incorporated Indigenous people relationships and interconnections to land?
5. Find out more about these differences. If you were to redraw the map, what would you highlight and what might you call your new map?

Terms of Endangerment

Aim

To introduce species and spaces at risk and the terms used to describe the various levels of endangerment.

Ready

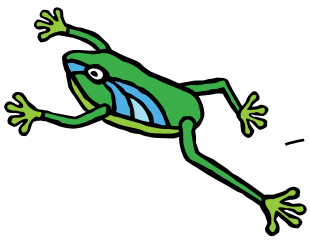
Participants play an active game of musical chairs based on the life histories and threats to a number of species at risk. There are three different scenarios for this activity and maps to show how to lay out the chairs and the possible 'end' results.

Set

You may need the following materials: rope, chalk (for outdoor set up), chairs, benches, hula hoops, pylons to create different scenarios.

Listed below are just some of the many Terms of Endangerment used to discuss species at risk in this game. In different places these terms are used differently, however there is agreement that no matter what terms you are using; these species are at risk of being lost forever.

- **Blue List:** In British Columbia, animals at risk that are vulnerable or sensitive and are not yet considered endangered or threatened.
- **Red List:** In British Columbia, animals at risk which are endangered or threatened, or are candidates for these designations.
- **Endangered:** A species of animal or plant that is in immediate danger of becoming extinct.
- **Extinct:** Gone forever. Dodo, passenger pigeon, dinosaurs, moa, stellar sea cow, etc.
- **Extirpation:** The elimination of a species or subspecies from a particular area, such as British Columbia, but not from its entire range.
- **Locally Extinct:** Elimination of a species in one area but not over its entire range. Local extinctions may aggregate into regional or eventually, global extinctions and represent a threat to genetic diversity.
- **Threatened:** A species that is likely to become endangered and could, if not protected, become extinct.
- **Vulnerable:** Any species of plant or animal that is at risk because of low or declining numbers, limited to the fringe of its range, or for some other reason, but is not a threatened species.
- **Limiting Factors:** Anything in the environment or an activity that influences or puts limits on a plant or animal or its population. Examples include: altercation or destruction of habitat through road building, homes or recreational human activities; disruptions to populations from predators; climate change; fire in non-fire dominated areas, floods, introduced species.



Go!

1. Arrange the area following the mapped scenarios presented for purple martins, sea otters and western rattlesnakes.

2. Using the *Animal Mania* activity in *Connections the Basics of Biodiversity* as a question guide, create one paragraph summary 'biographies' about each of these three species life histories. Together as a class summarize key points of each species life histories from the biographies students created.

    - For more detailed information for these three species, and many others, consult the British Columbia Species at Risk brochure series available from the BC Government *https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/species-ecosystems-at-risk/brochures*

3. To begin, go over the activity which follows the rules of musical chairs. The limiting factors and extensions give you the reasons for removing chairs or participants in each round. How many times it takes to get to the end scenario is up to you as you play the game. After playing all three versions, discuss the students' understanding of the Terms of Endangerment again.

4. From your research into biomes or *Flag the Feature Creature* activity, can you come up with a version of this game for a species you studied? Include versions for threats you have identified and include scenarios for threat mitigations.

5. Can you find an example of restoration or conservation activities of any of these species and make a new extension showing how restoration or conservation is helping that species. For example, maybe there is a wildlife crossing or tunnel location for a species of concern..

Terms of Endangerment Scenarios

PURPLE MARTIN (A RED-LISTED SPECIES)

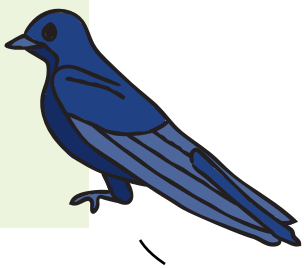
Historical Range in B.C.

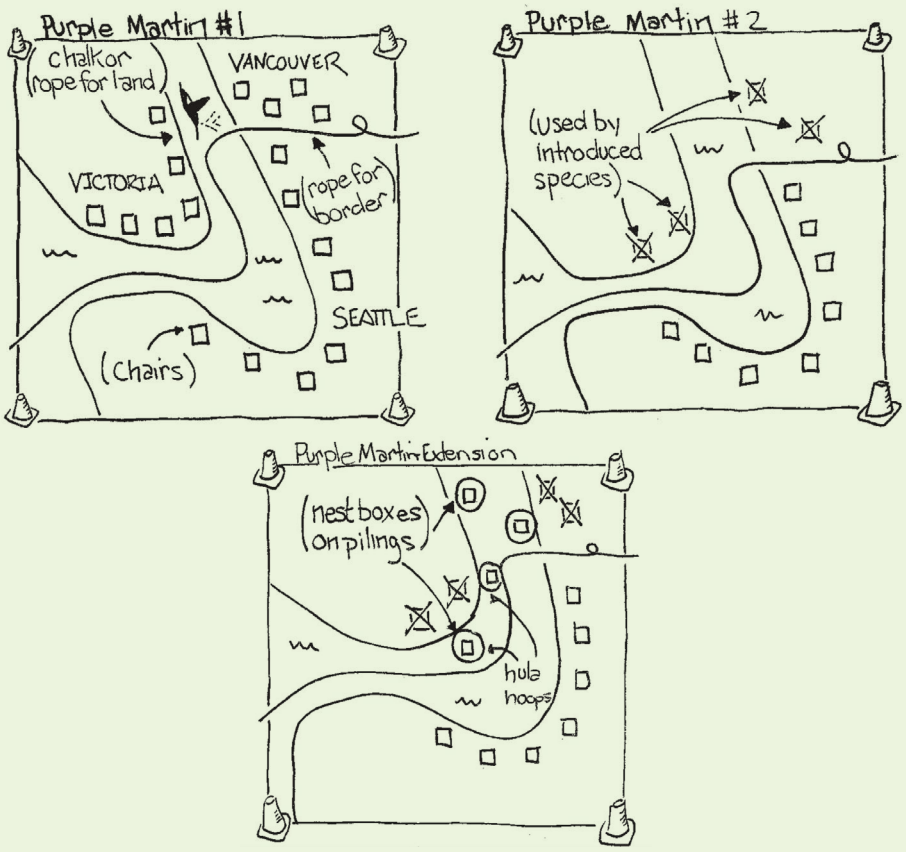
Lower Mainland; South & East Vancouver Island.

Limiting Factors

1. Introduced species competition—European starlings and house sparrows. While the music is playing, place a cutout of a starling or house sparrow on some of the chairs to represent a nest site taken over by this species. Another round could be played that limits the number of students to 2 'birds' per nest site.

2. Removal of wildlife tree nesting sites near water by humans. Slowly remove chairs to represent the removal of habitat.





Discussion

1. If all the chairs (habitat) are removed from BC that would mean that no purple martins would be able to nest. If purple martins are still nesting in Washington State that means they are extirpated from British Columbia.

2. What can we do to help the purple martin?

Extension

Nest boxes placed on pilings in saltwater areas can be represented by hula-hoops around a few of the remaining chairs as well as a few new chairs. Starlings and house sparrows usually stay away from these artificial cavities.

SEA OTTER (A RED-LISTED SPECIES)

Historical Range in B.C.

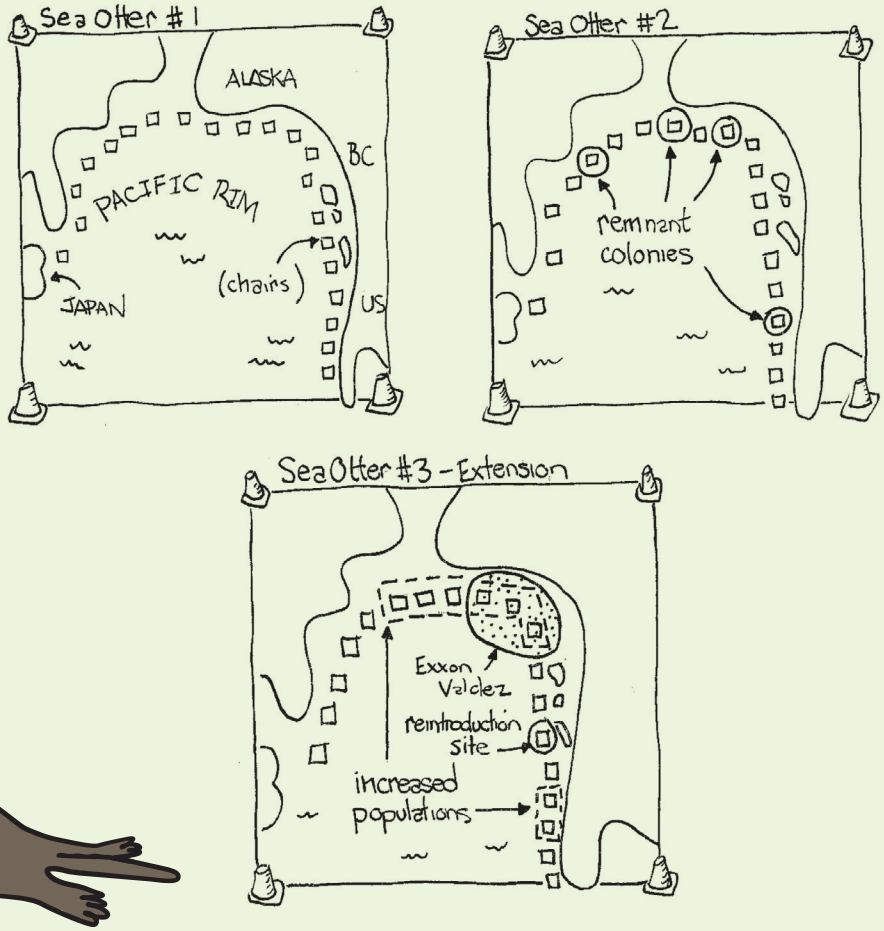
From Japan, through Kamchatka, Aleutians, Gulf of Alaska, BC and all the way to northern Mexico. Chairs represent kelp beds and abalone food sources.

Limiting Factors

1. Maritime fur trade.

2. Natural factors—predation from sharks, orcas and bald eagles. Severe, prolonged storms cause deaths while excessively worn teeth can also make it difficult for sea otters to survive.

3. Kelp, otters and urchins have a dynamic and well balanced relationship. Kelp beds help to slow down storms and reduce damage to shorelines and provide places for fish to rest and forage while also offering otters with the same benefits. When not fishing, sea otters eat sea urchins, clams and abalone and thereby reduce the predation of kelp beds. However, without sea otters to prey on them, sea urchins, clams, and abalone increase in and kelp beds decline in area. These invertebrates are important food sources for First Peoples and non-Indigenous people. As sea otters recover from the fur trade, they may threaten these shellfish and fish stocks. Kelp is also important for climate change as it draws in carbon in northern latitudes. While the relationship between kelp and sea otters is complex (they also eat kelp) it is clear that kelp forests, sea urchins, clams, abalone and fish flourish when sea otter populations are healthy.



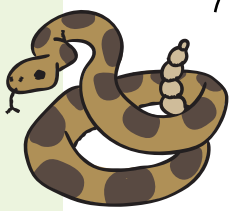
Discussion

1. What do extinction, red-list and endangered mean?
2. What can we do to help the sea otters?
3. Investigate how Indigenous cultures managed this dynamic balance between shellfish and sea otters.

Extensions

1. Include rounds in the musical chairs game for re-introduction. Participants removed during the maritime fur trade round can be reintroduced into the game.
2. Include rounds that introduce oil spills like what happened with the Exxon Valdez.
3. How might you draw an extension map for this game if there was an overabundance of sea otters because recovery efforts were successful.

WESTERN RATTLESNAKE—A BLUE-LISTED SPECIES

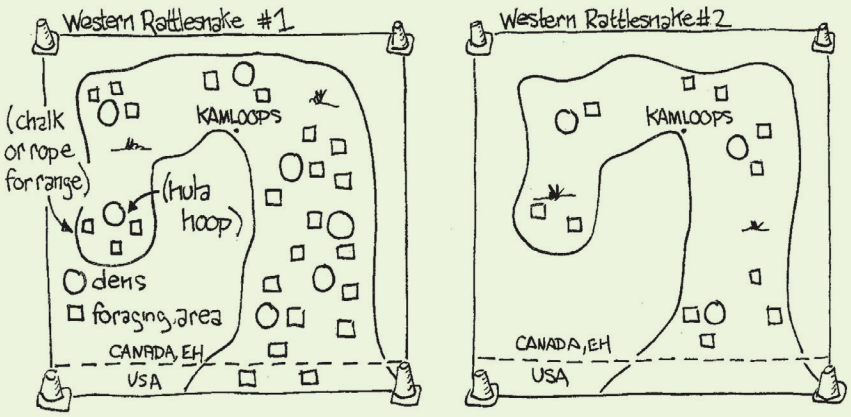


Historical Range in B.C.

Confined to the dry valleys of the southern interior.

Limiting Factors

1. Needless killing by fearful humans.
2. Heavy settlement by humans across range. This destruction of dens and foraging areas can be represented by removal of some of the hula-hoops and chairs.
3. Natural predators and low annual survivorship.



Discussion

1. What does blue-listed and vulnerable mean?
2. What can we do to help the Western Rattlesnake?

Extension

Look at the sites that still have dens and foraging areas. Have a few participants run along ropes that represent highways and a consistent speed. Any 'snakes' that they hit during a round are out of the game.

Follow Up:

1. Create new scenarios for other species at risk around the province—especially the ones in your own backyard.
2. Add extensions that outline the efforts of conservation and restoration, even in places where this may not be happening yet. Where you can, add extensions for this game that incorporate the ways Indigenous cultures related to these species.
3. Explain what is happening to these species in a story format and include descriptions of the changing relationships with these species.
4. Consider and write about the implications to biodiversity at the ecosystem level to any of these endangered species scenarios by looking at the relationships with other species and yourself.

Endangered Species and Spaces of British Columbia

Aim

To introduce species and spaces of British Columbia that are threatened because of unbalanced human relationships.

Ready

Over the millennia of Earth's existence, millions of species have lived and then disappeared through natural processes such as changing vegetation due to a warming or cooling climate, volcanic eruptions, and asteroids colliding with the Earth. Extinction still happens today and the extinction rate has increased due to human activities (relationships) that are not in balance with the ecosystems. Some species can adapt to these changes, while other species cannot. Today, people who are concerned about the species and spaces work in conservation and restoration careers to support biodiversity.

Supporting biodiversity also includes centering Indigenous ways of knowing and practices that are in balance and reciprocity with the land, animals and plants. As our climate changes, we will need more people who live relationally as part of biodiversity at the same time as those who are able to complete and increase restoration and conservation activities. British Columbia has a number of programs to identify, conserve, restore and protect endangered plant and animal species and their habitats. The goal of these programs is to prevent human activities from contributing further to the extinction of B.C. species, and others conserve our unique and varied biodiversity in perpetuity.

Set

1. First, use the internet to compile a list of Red or Blue listed species at risk in your area or ecoprovince. Include animals and plants, insects from the large fauna to smaller plants like mosses. Gather photos where you can.
2. Next, use the internet to compile a list of B.C endangered ecosystems and describe their biodiversity - don't forget to include plants, landforms and soil and water.
3. Finally, gather a map that shows the locally protected places, regional parks, ecological reserves, conservation lands, federal, regional and provincial parts and reserves. Hint: invite a local land conservation group, member from a land trust or conservancy to talk about what lands are conserved in your area.

Go!

1. Using your lists and drawings, place the species and endangered ecosystems on a larger map of your ecoprovince where each of these belong. If you live near the boundary of an ecoprovince, include the adjacent ecoprovince in your map and research. Are there any places where there are endangered species but not endangered ecosystems?

2. Now consider the maps of protected places and mark protected places on your map then answer the following:

   - Are there any places where endangered ecosystems or species are not protected or actively conserved?
   - Why might this occur?

3. Based on your initial research in the first part, organize into small groups or individually, select an endangered species or ecosystem you want to learn more about. Use the study guide below to help organize your investigations.

4. Invite a local naturalist or conservation / restoration biologist to visit your class and discuss some of the plants, animals and spaces of your community which need special attention. Use the questions in the study guide below to generate questions for your guest speaker.

Special Species or Spaces Study Guide

You can copy these questions down in a journal to give you more room or to add more questions.

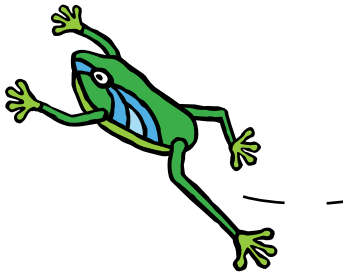
1. Name of the space or species I am studying.

_____

2. Locations (e.g. physical location, attach a map, name of forest or wetland).

_____

_____



3. Describe the significance of the space or species for First Peoples and why?

_____

_____

_____

_____

_____

4. Is there any current protection for this space or species (e.g. park) and if so what level of protection is it. Some park designations allow for human activities, while privately conserved lands are well protected, but often limit human visits.

_____

_____

_____

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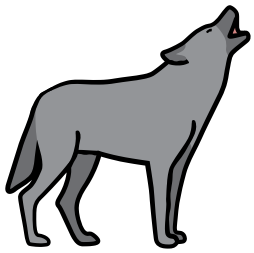


5. Provide reasons for why it is endangered or still threatened if it exists within a protected place.

_____

_____

_____

_____

6. List suggested strategies and programs in existence for its protection and/or restoration.

_____

_____

_____

_____

7. What projects could your class, school or your family get involved with that would help the status of this species.

_____

_____

_____

Follow Up

1. Describe your connections to the place or species before you started studying it and describe any changes to this relationship after you completed the activity or project.
2. How important is visiting a space or seeing a species to protecting it? How might we ensure that species and spaces are protected but not 'loved to death' through visitation? Is there a reason why humans might not be able to visit an endangered place or examine a species up close (e.g. phantom orchid, grasslands)? What could you think of to replace the experience of seeing these places or reduce the impact of visitation on these species and spaces?
3. Can we protect and conserve endangered species and spaces without visiting it?
4. What could you do to mitigate recreational activities you and your family might partake in for an endangered species or a space?
5. Is the continuation of this species or space important to human health and living? Justify your answer in terms of biodiversity and include any personal experiences you may have with this place or species.

The Aliens Have Arrived

Aim

To learn about plants and animals that are not native to British Columbia.

Animals and plants introduced into British Columbia by humans can cause problems depending on the species' relationship to their new ecosystems and our perspectives about these new species. Some have become endemic to an area and therefore impossible to remove, still others may be beneficial in certain areas or activities. These species can take over food, shelter and space of native species or harm managed non-native species like the honey bee. Some may only be expanding their range, e.g. Barred Owl. Dandelions thrive in everybody's lawn, yet that may not be a bad thing!

Ready

In a group of two or three, complete a small research project and present your findings. You will need:

- A copy of the Alien Notes sheet (see following page).
- Journal or notebook.
- Several natural history guides on plants and animals that outline alien species in your area.

Set

Decide on a species for your research. Suggested research subjects:

- Dandelion
- House sparrow
- Slug
- Knapweed
- Bullfrog
- Scotch broom
- Vetch
- Black rat
- European starling
- Canada thistle
- Earthworms
- Grey squirrel
- European earwig
- Tent caterpillar
- Sowbugs
- Gray squirrel
- Butterfly bush
- Eurasian water milfoil

Go!

1. Observe the animal or plant in its habitat if possible.
2. Complete your field notes on the Alien Notes sheet. Note: You may have to take some of your questions to people in your community who know a lot about the plants, animals and birds of the area.
3. Present your research to the class through drama or art. Prepare a skit presenting the life history of your species from where it originated to its location in your community. Or draw a mural or cartoon sequence telling its story. Be sure you talk about the animals or plants your alien species displaces. Include a description of its relationship to others in its ecosystem.

Alien Notes

Study subject:

_____

Scientific name:

_____

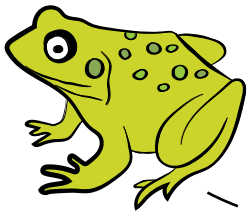
Specimen location: Where did I find or observe my specimen?

_____

_____

Specimen sketch:

Specimen description:



Library research (origin of my specimen): Where did it come from originally? What biome is it from?

_____

Immigration story: How did it get to my community?

_____

_____

Current status: What is its effect on the community? Is it common? Has it taken over? Is it a serious problem and why and from whose perspective? Does it enhance/disturb the biodiversity of the community?

_____

_____

_____

_____

_____

Reasons for success: Why is it successful at competing with native species? Did people help it get established, does it only flourish in certain areas? Can it be controlled, if it has some benefit to the ecosystem it is now in?

_____

_____

_____

_____

_____

Comments: Are there any programs to control the spread of my species? What do people think of the new species? What should be done with the non-native species?

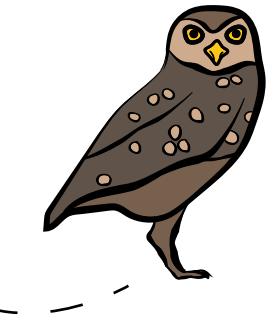
_____

_____

Follow Up

1. What steps can you take to reduce the spread of alien species in your community so that current ones do not continue to spread or so that new aliens do not get a foothold?
2. What could you or your class do to help native species?
3. What might be a reason for not calling a species invasive? Think about your answer in terms of the implications of calling something invasive and frame your answer in terms of why biodiversity is important.
4. Can you make a case for keeping the alien species? Outline how you would demonstrate your case to someone that wants to remove the alien species.
5. Are there some alien species that should be included in an ecosystem because they now serve a purpose (e.g. Eastern Bumblebee)? How do our perspectives on alien and invasive species hinder our relationships with them?

Be a British Columbia Tour Guide



Aim

To provide an artifact that describes and synthesizes your learning creatively.

You might Imagine that you have been hired as a guide. Your company expects you to prepare a brochure for possible future clients inviting them to join your tour of B.C.'s biodiversity. Your job is to emphasize and display the wonders of biodiversity in B.C., the issues and the opportunities to support biodiversity to the people on your tours.

Ready

1. In groups, select an area of BC, BC biome or an area of the map you created in the *Flag a Feature Creature* reflection activity to concentrate on.

2. Use the map you created in *Flag a Feature Creature* and other research from the activities to help you plan your tour and write your brochure. Decide in your group what sections to have and what the topics of each section are. Include not only unique features and relationships in biodiversity you have explored and discovered, but also the conservation and restoration activities that are possible as well as connections to Indigenous peoples and culture. Think about the reasons why someone would want to read your guide by connecting your ecoprovince brochure to other places across the globe. (e.g. Explore the desert biome through this back pocket guide to B.C.'s pocket desert).

Set

Before you can write a good brochure you need to do some "market research". For the purpose of this project make some good guesses about the likes and dislikes of your target market. Use the questions below as a guide.

1. Decide who is your target audience for this brochure. Is it other B.C. residents? Is it international tourists? Is it other Canadians? Is it another class in an exchange program? Each audience will respond to a different approach.

2. What kind of language, photographs, illustrations, or pictures will appeal to them? What kinds of biological features will interest them? Will they be most interested in plants or will they want to see an overview of endangered species and spaces? Will they enjoy some birdwatching? Will they want to spend time in the parks of a city or town?

3. Will you need to have your guide translated into another language, if so which one? Consider having parts of your guide translated in the language of a local Indigenous people.

Go!

1. Plan your brochure. Use the Brochure Planner included on the following page.
2. Prepare a "mock-up" of your brochure with all of the words included and pictures cut from magazines or other brochures. This "mock-up" will look more or less like the finished product would if it were printed.
3. Present the mock up to your teacher or other groups for feedback and redesign.

Follow Up

1. Plan a mini-EcoTour of your community for other students in other grades. Plan a tour for senior citizens. Make a video or scan your brochure and publicize your work through social media.
2. Invite your local government to view your collection of brochures. Take them on an EcoTour of your community and point out places and species of significance and what they can do to help biodiversity. Find out what they are doing to support biodiversity.
3. Join up with a community organization, biologist or naturalist and plan a restoration project or be part of conservation or restoration activities. Invite your school to join you in these efforts.

Brochure Planner

Ecoprovince to visit:

_____

Target audience:

_____

Number of days for tour:

_____

Comments:

_____

_____

_____

_____

Main towns for overnight	Important things to see and do	Important trees, plants, animals, birds, etc. to point out	Other

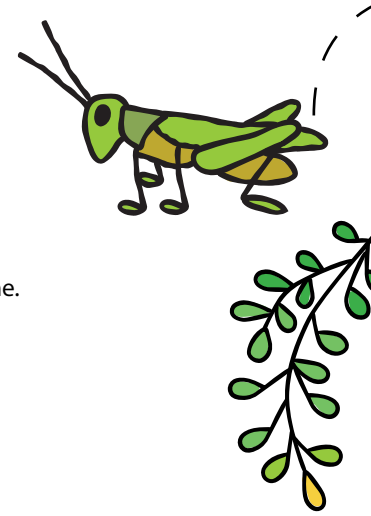
Reach-Out

This section contains a few ideas on how you could focus the activities in a biodiversity problem-based learning for disciplines other than life sciences.

Mostly Language Arts

1. Imagine you are traveling to a distant land. You climb a mountain range and descend into a valley no one has ever seen before. There is a unique relationship between climate, landforms and wildlife. Describe your imagined ecoprovince and prepare a set of field notes on the unusual plants and animals you find there. Describe a couple of the species you found in detail. How will you define and evaluate the quality of the relationships between the inhabitants of this valley. What should the role and/or describe the relationship of humans to this land, what do they say, how do they act?

2. Set up bird feeders near your school. Count the number of birds that come to the feeders, identify the species using a field guide, and note the changes as the seasons change. Which birds are most common in summer fall, winter and in the spring? Choose one species of bird to research and compose a story from the point of that bird. Perhaps about a dangerous journey on their way to your bird feeder. Embed factual information from your research into your story about the particular species of bird (ie. predators they would encounter, an explanation for why the bird would be in your area at a given time of year). Include character names and follow basic storytelling conventions.



Mostly Social Studies

1. Research the history of one of British Columbia's ecoprovinces. In the presentation of your material use a timeline or chart to note how various human activities in the ecoprovince affected the plants and wildlife.

2. Study the climate and geography of B.C. and make connections between various climates, landforms and wildlife biodiversity and the geography of humans over time.

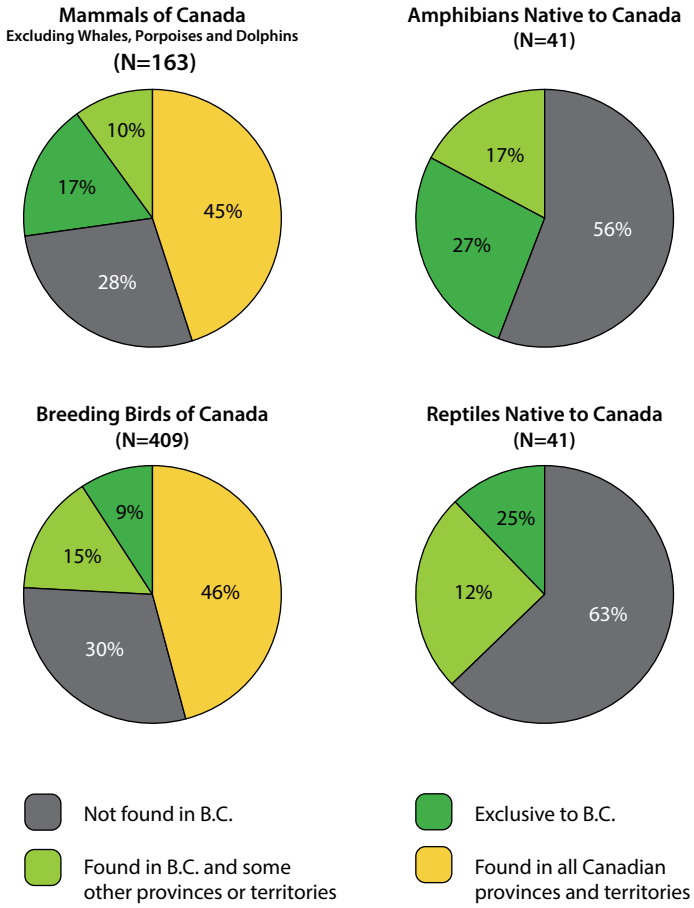
Mostly Mathematics

1. Prepare a bar graph using the following statistics about B.C.'s biodiversity.
British Columbia is home to:

   - 100% of the world's Vancouver Island marmots
   - 80% of the world's Cassin's auklets
   - 75% of the world's stone sheep
   - 60% of the world's mountain goats
   - 50% of the world's blue grouse
   - 50% of the world's winter population of trumpeter swans
   - 25% of the world's grizzly bears and bald eagles.

2. Use the circle graphs below to answer the following questions:

- What percent of birds that live in Canada also live in B.C.?
- Which animals are more common in other parts of Canada?
- Which group has the most species that are found only in B.C.?



Source: *Managing Wildlife to 2001, A Discussion Paper.* B.C. Environment Wildlife Branch, 1991