

## Activity 2: Climate Change Mind Map

### Summary

In this activity, students will draw a conceptual map, or mind map to link together the physical impacts climate change has on the environment and the consequences these impacts have on biodiversity. Following an activity on **Adaptation and Mitigation** (p. 23), they will revisit the map to offer adaptation measures to address those consequences.

**Duration:** Two 60-minute sessions

### Learning outcomes

After participating in the activity, students will be able to:

- Identify physical impacts of climate change on the environment, and
- Discuss the consequences of climate change on biodiversity

### Competency outcomes

- Critical thinking
- Collaboration
- Communication

### Set-up and materials

- Computer and projector (for videos)
- Climate Change and Biodiversity** infographic
- Climate Change and the Environment** infographic
- Copies of **Mind Map Rubric** (one per student)
- Copies of student BLM **Climate Change Mind Map —Biodiversity and the Living World** student worksheet
- Chart paper (one per team of two to three students)
- Coloured markers or pencils
- Sticky notes (optional)

**Tip:** Some students may find it easier to put their ideas on sticky notes so that they can move them around during the planning phase.

### What to do

1. Following an introduction on climate change, discuss the implications of climate change on biodiversity.
2. Watch these videos to contribute to the discussion about biodiversity and climate change:
  - a) *Can wildlife adapt to climate change?* (TEDEd) at [www.youtube.com/watch?v=ZCKRjP\\_DMII](http://www.youtube.com/watch?v=ZCKRjP_DMII)
  - b) *How does climate change affect animals?* (DW English) at [www.youtube.com/watch?v=9h7P8gWpoIQ](http://www.youtube.com/watch?v=9h7P8gWpoIQ)
3. Brainstorm about some impacts of climate change and the consequences these impacts have on biodiversity.

4. Hand out a large sheet of chart paper to teams of two to three students and ask them to write “Climate Change and Biodiversity” at the centre of the sheet.
5. Ask each team to use their creativity and, starting from the centre of the map, build three distinct concept levels based on Climate Change and Biodiversity (show the students the figure below as an example).

**Tip:** Remind students to make a sketch of their ideas in their notebooks.

**Level 1:** Physical impacts of climate change, e.g., rising temperatures or increased precipitation (two per map)

**Level 2:** Consequences of these impacts on biodiversity and food production, e.g., infestation or competition (one or two per impact)

The next level will be filled out following the **Adaptation and Mitigation** activity (p. 23), so ask students to leave some room to add these later.

**Level 3:** Adaptation measures that could be taken to deal with these consequences, e.g., migration corridors or assisted migration (one or two per consequence)

6. Encourage students to unleash their creativity and represent the concepts with shapes, text, and drawings, using the connecting lines between concepts to justify their links.

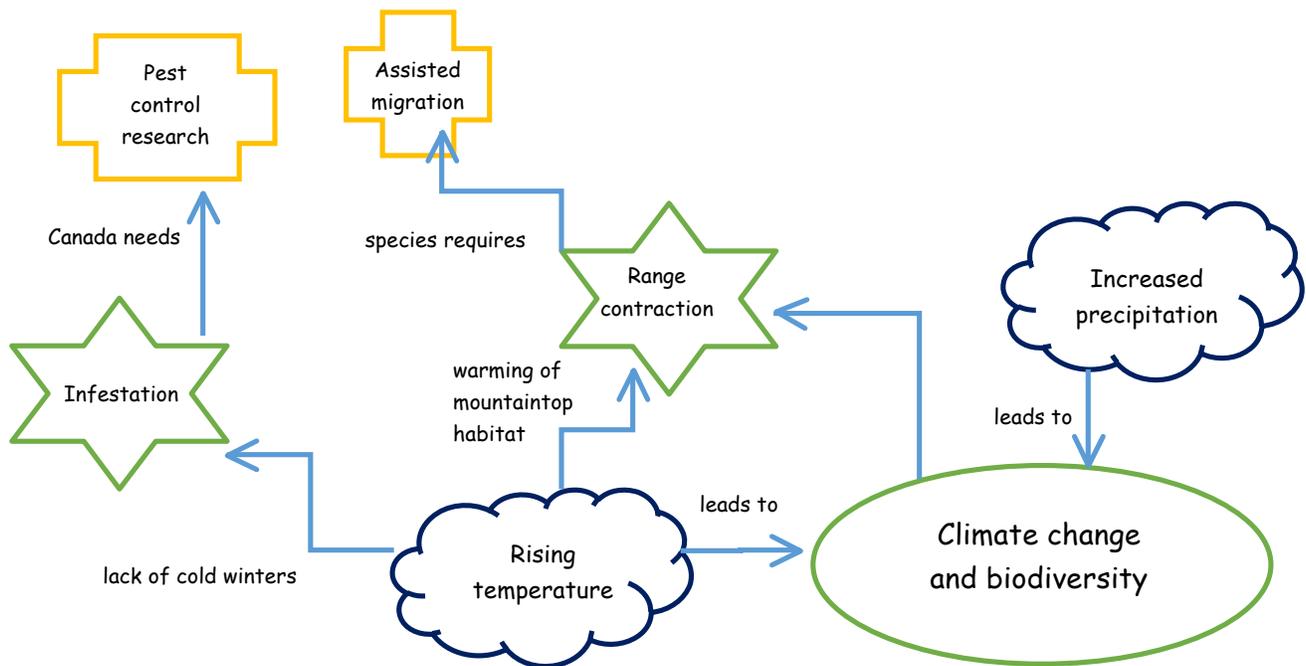
**Tip:** Students can use information from the videos, as well as the **Climate Change and the Environment** and **Climate Change and Biodiversity** infographics, as tools to complete their mind maps.

7. Ask students to present their conceptual maps to the class. Encourage dialogue by asking students with similar concepts to add their interpretations to the discussion.

### Extension

Ask students to cut out their concepts to make a large classroom concept wall. Glue each level on a different cardboard backdrop to keep the hierarchy visible.

### Mind Map Example



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## Activity 2–Vocabulary list

### Adaptation

1. **Protect:** Create parks, wildlife reserves, and marine protected areas to provide safe habitat spaces
2. **Research:** Combine research from different disciplines (e.g., ecology, biology, chemistry, geology, and technology) to identify issues and plan accordingly
3. **Monitor species populations:** Involve citizens (schools, communities) in collecting data about climate change impacts on various species
4. **Restore:** Rebuild habitats or increase the variety of plant species in an area
5. **Connect:** Build migration corridors (e.g., a land bridge over a highway) or assist migration by physically moving an animal or plant species to new areas

**Competition:** Species competing for limited resources such as food, space, water or mates. Can result from other species migrating north or into new territories.

**Ecological (or ecosystem) services:** The variety of resources and processes that are supplied by ecosystems and benefit human societies. These include products like clean drinking water and processes such as waste decomposition.

**Habitat destruction:** Habitats can be destroyed due to an increase in fires, droughts, precipitation, ice storms, windstorms, rising sea levels, acidification, and higher water temperatures.

**Habitat fragmentation:** Natural landscapes can be broken up by human constructions like river dams and highways. This makes it difficult for species to move around and limits the resources they need to survive. For example, salmon migrating upstream can be impacted by dams.

**Hybridization** is the mixing of two different but similar species. The movement of species to new areas as they try to adapt to climate change can cause hybridization. Hybridization can result in rare species becoming extinct or, in other cases, can help species adapt by introducing new genes into the population. For example, Black-capped chickadees are interbreeding with Carolina chickadees, who might replace Black-capped chickadees in southern Ontario.

**Infestation:** Insect, disease, and parasite outbreaks are predicted to become bigger and more frequent because of climate change, as cold winters will no longer stop their spread. New diseases and parasites from the south can cause much damage for species that have not evolved defences against them. For example, the Mountain Pine Beetle has destroyed large parts of British Columbia’s pine forests, and caribou have seen a decrease in health as a result of mosquitoes affecting their summer foraging.

**Phenological mismatches** happen when changes in the timing of life cycles between dependent species mean they fail to match up. For example, by the time migrating birds arrive at a feeding site, the best availability of the insect they eat may already have passed. The earlier arrival of spring also changes the life cycle of many plants that provide food and habitat for other species.

**Phenology:** The study of plant and animal life cycles and how these are affected by variations in environmental factors.

**Range contraction** is the shrinking of a species' habitat. Many arctic species found in mountain habitats are at risk of range contraction because there may be no opportunity for their habitats to expand upwards or northwards. For example, polar bears have their hunting grounds restricted by shrinking ice cover.

Names: \_\_\_\_\_

Date: \_\_\_\_\_

### Activity 2–Student BLM: Climate Change Mind Map

Draw a sketch of your mind map, including the impacts of climate change and the consequences of these impacts biodiversity and the living world.

What I learned from my classmates' presentations:

Names: \_\_\_\_\_

Date: \_\_\_\_\_

**Activity 2–Teacher BLM: Mind Map Rubric**

	<b>Highly effective</b>	<b>Effective</b>	<b>Satisfactory</b>	<b>Unsatisfactory</b>
<b>Concepts and terminology</b>	Shows an understanding of the topic’s concepts and principles and uses appropriate scientific terminology.	Makes some mistakes in terminology or shows a few misunderstandings of concepts.	Makes mistakes in terminology and shows a lack of understanding of some concepts.	Shows no understanding of the topic’s concepts and principles.
<b>Relationships between concepts</b>	Provides highly relevant and original links between concepts.	Provides adequate links between concepts.	Provides some links between concepts.	Provides no links between concepts.
<b>Adaptation solutions</b>	Provides highly relevant and realistic solutions.	Provides relevant solutions.	Provides a few relevant solutions.	Provides no solutions.
<b>Work ethic</b>	Plans the concept map in a highly effective manner.	Plans the concept map in an effective manner.	Plans the concept map in an adequate manner.	Does not plan the concept map.
<b>Communication</b>	Presents the concept map in a highly effective manner and provides examples to support the analysis.	Presents the concept map in an effective manner.	Presents the concept map in an adequate manner.	Does not present the concept map in an effective manner
<b>Design and layout</b>	The design and layout contribute greatly to the flow and clarity of the map in a highly effective manner. An original and effective design is used to denote level hierarchy.	The design and layout contribute to the clarity of the map in an effective manner. The level hierarchy is evident.	The design and layout contribute to the clarity of the map in an adequate manner. The level hierarchy is present.	The design and layout do not contribute to the clarity of the map. Attention has not been paid to the level hierarchy.
<b>Collaboration skills</b>	Consistently works towards group goals and encourages people to work well together.	Frequently works towards group goals and encourages people to work well together.	Adequately works towards group goals and encourages people to work well together.	Rarely works towards group goals.