

CLIMATE CHANGE IN ALBERTA: INVESTIGATING MILD, MEDIUM AND HOT SCENARIOS

OBJECTIVES

Students will:

- Investigate the impact of climate change on Alberta's precipitation, climate
- Investigate the impact of climate change on Alberta's natural regions
- Investigate the impact of climate change on our environment and economy

MATERIALS

Projector and Speakers
Internet Connection
Student Worksheets
Video Links

OVERVIEW

Part A: Climate Change in Alberta

Part B: Temperature and Precipitation Maps

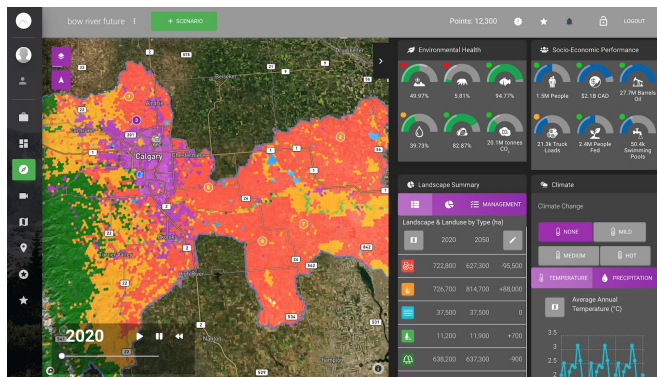
Part C: Change in Natural Regions

Part D: Impact on the Environment and Economy

Part E: Best Management Practices

Part F: Analysis

Part G: Extension: Climate Action in Alberta



TIME REQUIRED

90 min



CLIMATE CHANGE IN ALBERTA: MILD, MEDIUM, HOT SCENARIOS

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TEACHER KEY:

PART A: Climate Change in Alberta: Watch the Video: Climate Change in Alberta

1. What is the Greenhouse Effect?

The greenhouse effect is a process that occurs when gases in Earth's atmosphere trap the Sun's heat. Greenhouse gases include carbon dioxide, methane and water vapour. This process makes Earth much warmer than it would be without an atmosphere. The greenhouse effect is one of the things that makes Earth a comfortable place to live

2. Why are **too** many greenhouse gases a problem?

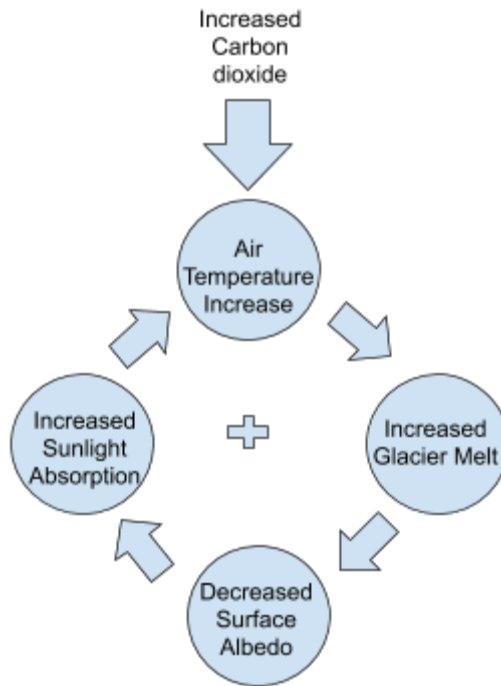
When there are too many greenhouse gases due to burning of fossil fuels or removal of carbon sinks such as forests, more heat is trapped in the Earth's atmosphere. This leads to an increase in the Earth's overall temperature, which results in changes in precipitation patterns and ocean circulation patterns.

The result is a positive feedback loop. As the atmospheric temperature rises, more sea ice melts, which means a darker ocean that absorbs more heat, adding to the warming. In land glaciers also melt, decreasing the albedo (or reflectivity) of the ground, resulting in further warming. Warmer temperatures melt peat bogs and permafrost, releasing previously trapped methane, another potent greenhouse gas that leads to more atmospheric warming.

3. Can you make an illustration of this positive feedback loop?



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4. How has Alberta already been affected by Climate Change? Can you think of any examples in our recent history that climate change contributed to?

5.

Flood of 2013

Fort McMurray Fires of 2016

Extreme Fire Seasons of 2017, 2019

5. Watch the video: Climate Change in Alberta. It can be found in the videos section within www.albertatomorrow.ca or here: <https://youtu.be/Okh7vn60kxg>

6. What is Mitigation? Mitigation refers to effort to reduce greenhouse gas emissions
7. What is Adaptation? Adaptation refers to adapting the already higher concentrations of greenhouse gases.

Much research has been done on how climate change will affect our environment and economy. Since we have a resource economy which includes Agriculture and Forestry, how will these sectors of the economy be affected by climate change?

8. Examine the following maps from the Alberta Biodiversity Monitoring Institute.



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9. What can you infer from the maps?
10. What are the implications of these changes?

Alberta Tomorrow has 4 climate change scenarios. They are based on RCP's

What are RCP's?

- Representative Concentration Pathways
- Set scenarios from the IPCC that take into account:
- Starting conditions
- Historical Data
- Projections
- So everyone is starting on the same page for climate scenarios
- RCP 2.6=low RCP 4.5=Med RCP 8.5

We use a combination of Canadian Earth System Model (CanESM2) for emission scenarios and the Alberta Biodiversity Monitoring Institute (ABMI) Model of future Natural Subregion classification

Scenario	RCP	Amount of Emission Mitigation	Amount of Ecological Change
Mild	2.6	strong	minimum
Medium	4.5	moderate	moderate
Hot	8	none	maximum

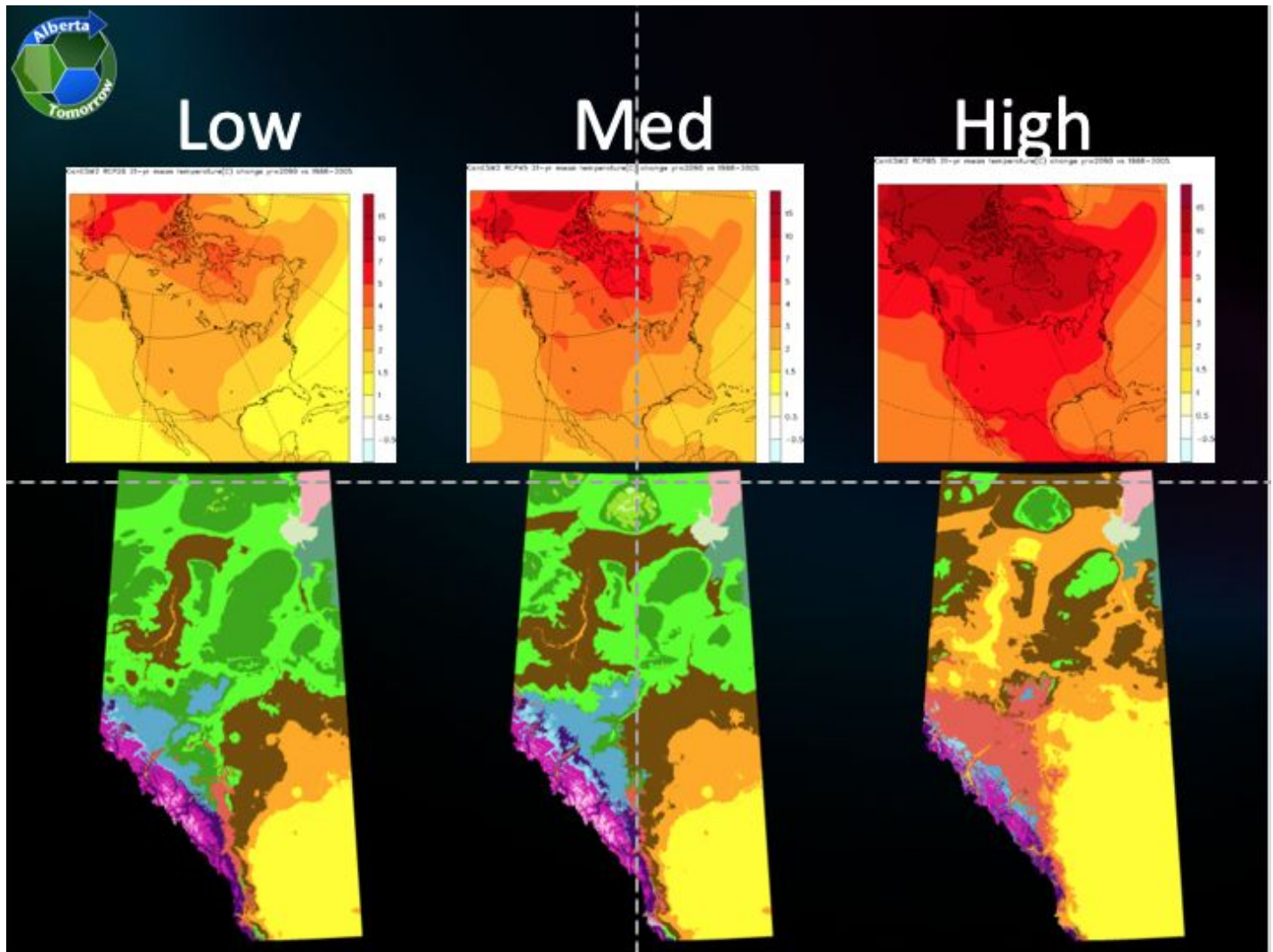
Examine the images below:

11. What difference do you notice on the top temperature maps from Can ESM2?

Increased Temperatures



CLIMATE CHANGE IN ALBERTA: MILD, MEDIUM, HOT SCENARIOS



Simplified Legend:

Yellow/orange/red = grassland, Brown = parkland, Green = forest, Pink/purple=alpine/subalpine

12. What difference do you notice on the maps of Alberta showing the change in Ecoregions?
Definite increase in the area of grassland, and loss of forested areas in the north.

Part B: Temperature and Precipitation Maps in AT

13. Log in to www.albertatomorrow.ca
14. Go to "scenarios" and +scenario
15. Create a "business as usual" scenario
16. Choose your watershed



CLIMATE CHANGE IN ALBERTA: MILD, MEDIUM, HOT SCENARIOS

17. Choose Run Scenario

This scenario assumes no climate change. On the right hand box labelled climate change, choose "mild"

18. Go to the purple the map layer in the upper left corner of the screen.

19. Scroll down to "Temperature"

20. Press Play and record your observations:

- What do you notice happens to temperature from year to year?
- What is the general trend over the time period? (hint: line of best fit?) The differences won't be as obvious in some regions of the province than others. If you don't see much change, choose a different watershed.

21. Go back the the purple map layer in the upper left corner and Scroll down to "Precipitation"
Press Play and record your observations

- What do you notice happens to precipitation from year to year?
- What is the general trend over the time period? (hint: line of best fit?)

Part C: Change in Natural Regions in AT

22. Go to the purple map layer and scroll down to choose Landuse

23. Press Play and observe the changes you see.

Landscape Type/ Landuse	Color
Orange	Agriculture
Yellow	Natural Grassland
Blue	Water
Light Green	Wetland
Dark Green	Forest
Purple	Urban
Grey	Industry and Transportation
White	Alpine and Exposed



CLIMATE CHANGE IN ALBERTA: MILD, MEDIUM, HOT SCENARIOS

24. Complete Charts 1 and 2 and include screenshots if possible
25. Now go back and choose HOT. Record the results on Charts 1 and , 2.
26. What differences do you see between 2050 MILD and 2050 HOT?

Part E: Best Management Practices

27. On the Landscape summary box, Click on Management practices.
28. Watch the Beneficial Management Practice video.
29. Which management practices do you think would change the outcome of the dials and why?
30. Play around with which Beneficial Management Practices can help you reach your goals.
Chart 3 will help you keep track of what you are doing.
31. Now move the Industrial Activity Slider. How does this affect the dials? Explain why.

Part D: Analysis

Climate Change is a global problem, not local. What can we do as individuals to decrease our carbon emissions? Use examples from your experience in Alberta Tomorrow where you made changes and expected to see more of a change on the screen or the dials. Why do you think you didn't see the change you expected?

Part E: Extension - Climate Change in Alberta

- Go to the Alberta government's website:
<https://www.alberta.ca/climate-change-alberta.aspx>
 - Where do most of Alberta's emissions come from?
 - What can you do to reduce your carbon emissions?



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STUDENT WORKSHEET

Name: _____

PART A: Climate Change in Alberta: Watch the Video: Climate Change in Alberta

1. What is the Greenhouse Effect?

2. Why are **too** many greenhouse gases a problem?

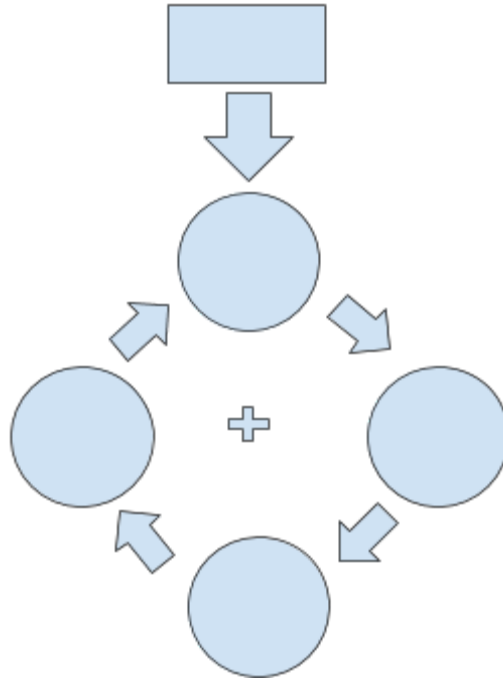
The result is a **positive feedback loop**. As the atmospheric temperature rises, more sea ice melts, which means a darker ocean that absorbs more heat, adding to the warming. In land glaciers also melt, decreasing the albedo (or reflectivity) of the ground, resulting in further warming. Warmer temperatures melt peat bogs and permafrost, releasing previously trapped methane, another potent greenhouse gas that leads to more atmospheric warming.

3. Can you make an illustration of this positive feedback loop?

Options: decreased albedo, increased greenhouse gases, increased surface temperature, increased glacier melt, increased sunlight absorption



CLIMATE CHANGE IN ALBERTA: MILD, MEDIUM, HOT SCENARIOS



4. How has Alberta already been affected by Climate Change? Can you think of any examples in our recent history that climate change contributed to?

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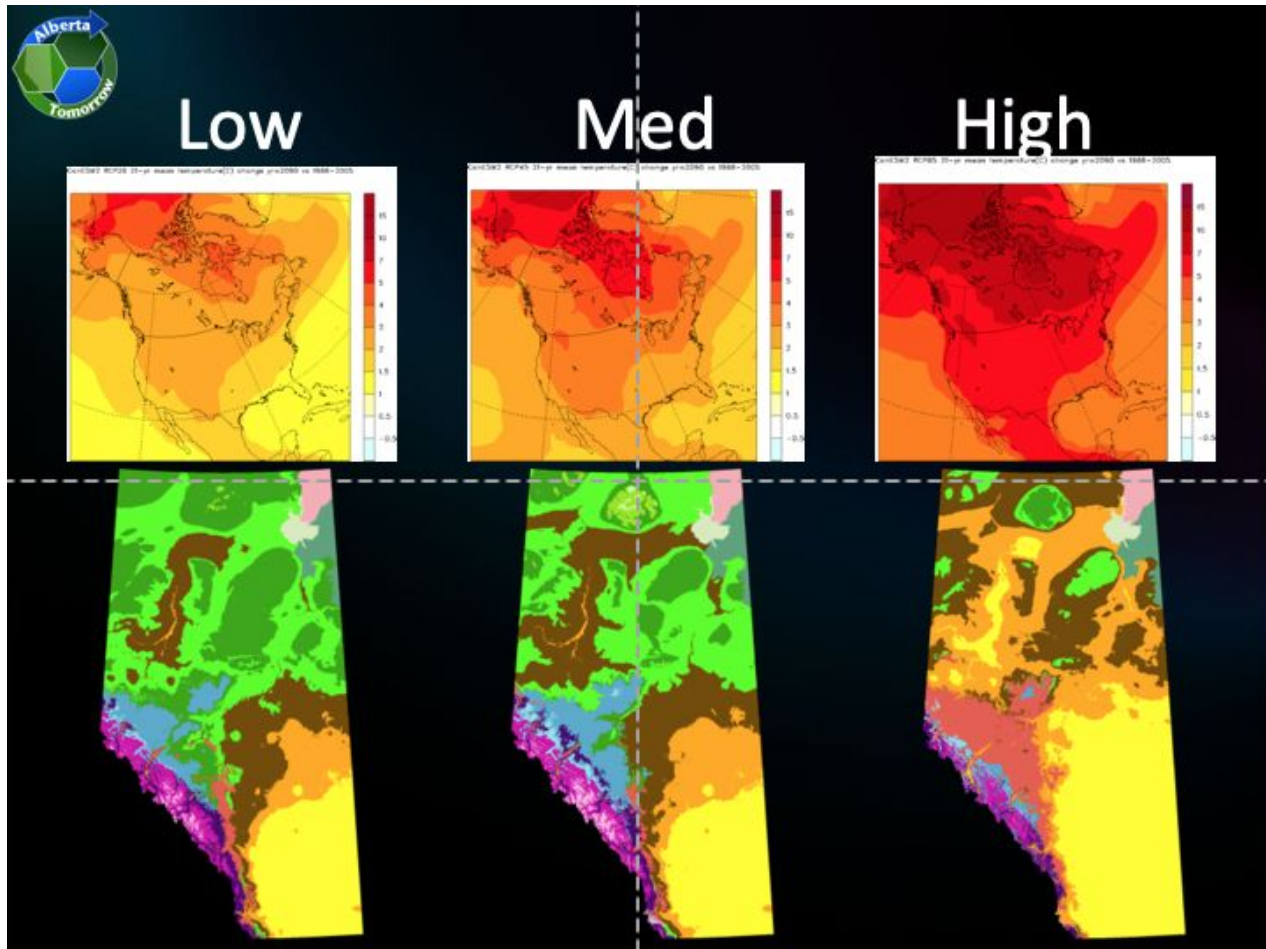
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CHART 1: Area	2020	2050 MILD	2050 HOT
Agriculture			
Grassland			
Water			
Wetlands			
Forests			
Urban Area			
Industry			
Alpine			

Chart 2: Screenshots	2020	2050 MILD	2050 HOT



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CHART 3: Management Practice Used	Biotic Carbon Level no MP: ____	GHG Level no MP: ____	Water Quality Level no MP: ____	Water Consumption Level no MP ____
Ag fertilizer application				
Agricultural Water Conservation				
Municipal Water Conservation				
Energy Sector Water Conservation				
Increased Energy Generation by Renewables				
Phase out Coal Electricity				
Electricity and Heating Conservation				
Increased Electrical Vehicle Use				
Walkable Cities/Urban Densification				
Decreased Industrial Footprint				
Carbon Capture				



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