Lesson 3: Communities of Living Things
How are different communities affected by climate change?

Reading One: Polar Bears

IMPACT: DIFFICULTY GETTING FOOD
Polar bears hunt ice-living seals. The polar bears walk quietly on the ice to the edge of a seal’s breathing hole in the ice. The bear then waits for the seal to surface for air. This hunting technique takes much less energy for the bear than chasing a seal while swimming. If warmer conditions cause the ice to form later in the fall and break up earlier in the spring, become unstable, or retreat too far from shore, polar bears will have difficulty getting enough food. In fact, if the ice retreats too far from the shore, bears can drown trying to swim out to the ice.

If a female bear doesn’t get enough food, she will have less fat stored to help her have cubs. Underweight females have fewer and smaller cubs that are less likely to survive. When the polar bear mother and cubs emerge from their den in the spring, it will have been between five and seven months since the mother has eaten. She will need to be successful hunting for her family to survive. She needs ice on which to hunt.

IMPACT: LOSS OF SHELTER
In addition to making it more difficult for polar bears to get food, climate change can also directly cause bear deaths. For example, increased number and strength of spring rainstorms can cause bear dens to collapse.

IMPACT: BARRIERS TO TRAVEL
Earlier break-up of sea ice can separate traditional den sites from feeding areas and young cubs would not be able to swim to the feeding areas.

IMPACT: COMPETITION FROM NEWLY ARRIVED SPECIES
As the climate warms, grizzly bears extend their range to the north. Grizzly bears are more aggressive than polar bears and can out-compete them. They can also interbreed with polar bears, thereby reducing the numbers of non-hybrid polar bears.

IMPACT: INCREASED POLLUTION DUE TO CLIMATE CHANGE
Many of the air pollutants from the industrialized parts of the northern hemisphere reach the Arctic through the circulation of the atmosphere and the flow of water. Climate change is predicted to bring more precipitation (snow and rain) and higher river flows to the Arctic. This will bring more chemical contaminants. Plants and animals that are low on the food chain will absorb these pollutants and then seals will eat them and absorb those pollutants at higher concentrations. Polar bears, at the top of the food chain, will eat seals and absorb the pollutants at even higher concentrations. Pollution stored in polar bears can affect their health, especially when they are already weak from not getting enough food.

Photo Credit: Howard Ruby
Reading Two: Ice-edge Dwellers

IMPACT: HABITAT DISINTEGRATING
Ice-dependent seals like the ringed seal, ribbon seal and bearded seal give birth and nurse their pups on the ice. They make their lairs out of snow on top of the ice. If there is not enough snow cover, they will have difficulty rearing their young. If the ice breaks up too early, pups can be separated from their mothers and drown. The seals also use the ice to rest.

IMPACT: DIFFICULTY GETTING FOOD
Walrus depend on the sea ice to find food. The edge of the ice is an area rich in plant and animal life. The most productive areas are over the shallow water nearest to the coasts. Walrus can use the ice to rest and then dive down to the bottom to eat clams and other shellfish that grow there. When the ice edge retreats away from the shallow areas, there will be fewer clams nearby for the walrus to eat.

Some sea birds like ivory gulls and little auks also depend on the ice to find food. The ivory gull nests on rocky cliffs near the ocean and then flies to the nearby sea ice to fish through cracks in the ice and scavenge for food left on top. If the sea ice retreats too far from the coast, the birds have difficulty getting enough food.

IMPACT: COMPETITION FROM NEWLY ARRIVED SPECIES
Inuit people report seeing new animals they have never seen before. These animals are expanding northward as the climate warms and now compete with native Arctic species for food and habitat.

Photo Credit: Howard Ruby
Reading Three: Land Dwellers

IMPACT: DIFFICULTY GETTING FOOD
Climate change has affected the winter temperature and precipitation in the Arctic. Precipitation that once fell as snow now increasingly falls as freezing rain. This freezing rain as well as increasingly-common freeze-thaw events (when the changing temperature rises above freezing and snow begins to melt and then falls below freezing and the water turns to ice), can cover plants in a layer of ice. Even if the plants can survive being covered in ice, animals have difficulty reaching the plants and can starve. Lemmings, musk ox and reindeer/caribou have all had large die-offs due to ice crusting making their food inaccessible.

IMPACT: DISINTEGRATION OF SHELTER
Even though snow may seem cold to you, it provides much-needed insulation for small animals like lemmings and voles who live and find food in the space between the frozen ground and the snow. For them, the snow is a shelter from the cold winds and very cold air temperatures. Mild and wet winter weather can reduce the ability of the snow to provide insulation and can even make the under-snow spaces collapse. Some animals such as snowy owls, skuas, weasels and ermines hunt lemmings and voles and almost nothing else. If numbers of lemmings and voles decline due to disintegration of their shelter, numbers of their predators will decline as well.
Reading Four: Plant Communities

IMPACT: THAWING PERMAFROST DESTABILIZES THE SOIL
The ice in the permafrost (permanently frozen ground) helps maintain the structure of the soil. When it melts, trees can start to fall over or sink-holes can develop which then seasonally fill with water and kill trees living there.

IMPACT: THAWING PERMAFROST DRAINS WETLANDS AND PONDS
In some Arctic wetlands, ponds and lakes, the water is perched on top of a layer of permafrost. The permafrost acts like the countertop in your kitchen and the wetlands are like a sponge that is completely full of water sitting on top of the counter. If the permafrost melts, then the water can drain out of the wetlands and ponds just like the water would drip out the bottom of the sponge if there were no countertop. When wetlands and ponds drain, not only are the plants that live there affected, but also the fish and other animals that rely on the water.

IMPACT: POTENTIAL DESERTIFICATION
Even though the total amount of precipitation is projected to increase in the Arctic, precipitation may come at times of the year when plants do not need it, or it may come in extreme events where most of it runs off to the rivers quickly. Also, as the temperatures get warmer, more water will evaporate and plants will transpire more water. Both processes acting together, known as evapotranspiration, send water back into the atmosphere. It is possible that in certain areas the increased precipitation may not be able to keep up with the increased evapotranspiration. If this happens, areas can dry out and become polar deserts.

IMPACT: INSECT PESTS THRIVE WITH WARMER TEMPERATURES.
When winters are long and very cold and when summers are short, as they traditionally have been in the Arctic, numbers of pests like the spruce bark beetle are kept in check. Spruce bark beetles can kill spruce trees. Warmer winters mean that more bark beetles survive each year. Also, the bark beetle usually needs two years to complete its life cycle. When the summers are unusually warm and long, however, bark beetle lifecycles can be accelerated and take only one year. This means that there will be many more beetles. Also, healthy spruce trees have natural defenses against bark beetle attacks. When the beetles try to bore into the tree to lay eggs, the tree can push pitch (sap) out against the beetle and keep them from being able to get into the tree far enough to lay eggs. When trees are stressed from drought and warmer than normal temperatures, however, they do not have enough pitch to fight the beetles.

Similarly, spruce bud worms, another pest that can kill spruce trees, lay more eggs when it is warmer. Also, warmer temperatures make spruce bud worms change the time of their reproduction. When this happens, the natural predators of the spruce bud worm are not available or ready to eat them, so bud worm numbers increase.

IMPACT: COMPETITION FROM INVADING SPECIES
As temperatures warm, plant species begin to shift their ranges northward, invading areas previously inhabited by Arctic species. Many of the adaptations that allow Arctic species to survive in such cold conditions also limit their ability to compete with invading species. For example, when the temperature gets above about 60 degrees F (16 degrees C), black and white spruce trees are not able to grow as well. If temperatures get too hot, the black and white spruce will not be able to grow at all.

IMPACT: INCREASED FOREST FIRES.
As climate warms and forests dry, forest fires increase. The average area of North American Boreal (northern) forests that burns each year has more than doubled since 1970.
Reading Five: Human Communities

IMPACT: DIMINISHING FOOD SUPPLIES
For thousands of years, groups of Inuit people (Native peoples of the Arctic, formerly known as Eskimos) have relied on hunting caribou to have enough food to survive through the cold seasons. Today the Inuit have access to food that is shipped into stores. For many Inuit families, however, store-bought food is too expensive to be their sole source of food. For this reason as well as for cultural reasons, Inuit rely on the caribou hunt for much of their food source. As numbers of caribou decline due to climate change-related impacts, the Inuit can face hardships.

The Inuit also hunt seals, walrus, polar bears, whales, moose, musk ox, ducks, geese, ptarmigan and fish. As the number and location of these animals are impacted by climate change, the Inuit will also face changes to their diet.

IMPACT: DECLINE IN CULTURAL RESOURCES
In addition to using caribou for food, Inuit people also value caribou as an important part of their mythology, spirituality and cultural identity.

IMPACT: INABILITY TO REACH HUNTING GROUNDS
Climate-related changes can make it difficult for Inuit hunters to reach the places where they hunt. For example, unusually deep snow, late freeze-up and early break-up of river and sea ice can make travel treacherous or impossible.

IMPACT: DIFFICULTY TRAVELING AND NAVIGATING
Many Inuit villages are accessible only by dogsled, snowmobile, or sometimes on roads over permafrost (permanently frozen ground). As the snow and ice-free period of the year gets longer, travel by dogsled or snowmobile becomes difficult or even impossible. As the permafrost melts earlier and to a greater depth, the roads become impassable mud-pits. Also, some Inuit people use the prevailing wind direction to navigate over frozen tundra and sea ice. For many generations these winds have always blown in the same direction. As weather patterns change, the wind can change direction and Inuit may get lost trying to find important cultural sites.

IMPACT: EROSION OF COASTAL COMMUNITIES
Warmer ocean water and air can melt the permafrost that stabilizes coastal land and shorelines. This, combined with rising sea levels and a reduction in the shore ice and sea ice that once buffered the wave action from storms, can make coastal buildings, pipelines and roads fall into the ocean and flood low-lying areas, contaminating them with salt.

IMPACT: INCREASED ACCESSIBILITY TO SHIPS
As the sea ice diminishes, ocean that previously was locked in ice and therefore inaccessible to most ships can now be navigated. For example, in Pangnirtung, a remote Inuit Village on the southern tip of Baffin Island in the Canadian Arctic, a cruise ship recently arrived and unloaded its passengers into a village that before was accessible only by air or dogsled.

IMPACT: INCREASED POLLUTION DUE TO CLIMATE CHANGE.
Many of the air pollutants from the industrialized parts of the northern hemisphere reach the Arctic through the circulation of the atmosphere and the flow of water. Climate change is predicted to bring more precipitation (snow and rain) and higher river flows to the Arctic. This will bring more chemical contaminants. Plants and animals that are low on the food chain will absorb these pollutants and then humans will eat them and absorb those pollutants at higher concentrations. Inuit women have such high levels of PCB pollutants in their breast milk that they are asked to not breast feed their babies.