



Feeling Blue Follow-up Lesson

This activity meets the following:

TEKS

Art, Grade 7
7.2(D)(E)
7.8(A)
7.6(A)

NOAA Ocean Literacy Principles

3
6

GBEP State of the Bay Priorities

Mathematics, Grade 7
7.6(G)

Objectives:

- Students will use graphs of real data on climate, oceans, and coastal ecosystems.
- Students will interpret data using watercolors.

Synopsis:

In this activity, students will use data on global temperature, sea level rise, sea ice, and carbon dioxide concentration in the atmosphere to create a watercolor painting that interprets that data.

Time: 60 minutes

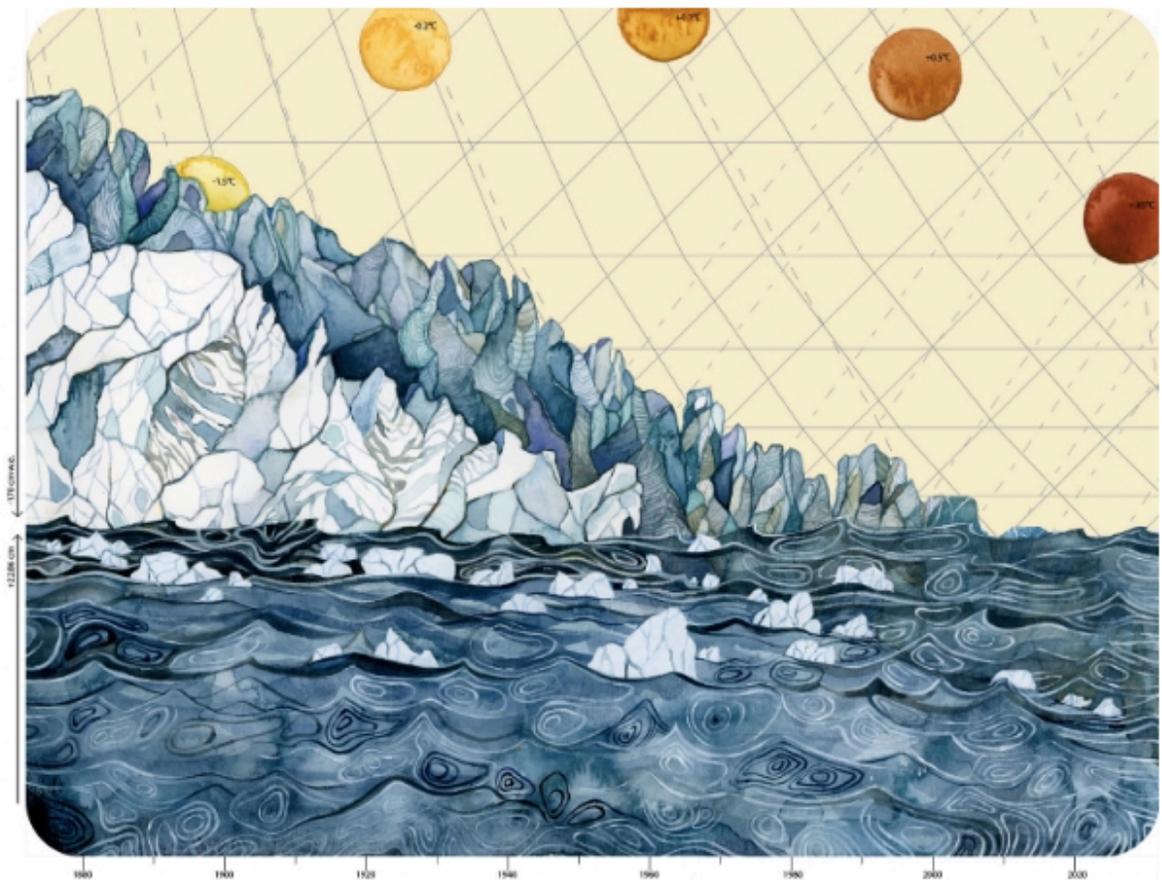
Materials:

- Pencils
- Watercolor paper
- Watercolors
- Cups
- Data Worksheets

Procedure:

1. Research the artwork of [Jill Pelto](http://www.jillpelto.com/gallery/) by visiting her website (<http://www.jillpelto.com/gallery/>). Jill Pelto is an artist and scientist who communicates data about extreme environmental issues using water color. Themes of her paintings include declines in glaciers, increases in forest fires, species declines, habitat degradation, and climate change. Selected works by Jill Pelto are below.
2. Choose a topic from the Worksheets #1-4.
3. Draw the graph from the Worksheet onto the watercolor paper with a pencil very lightly.
4. Read the information from the Worksheet about each topic and about the consequences for change.
5. Think about what the data means, then communicate what changes to the data mean for the environment.

Selected Artworks by Jill Pelto



Climate Change Data uses multiple quantities: the annual decrease in global glacier mass balance, global sea level rise, and global temperature increase. I wanted to convey in an image how all of this data must be compared and linked together to figure out the fluctuations in Earth's natural history. One of the reasons scientists study what happened in the past is to understand what may happen now as a result of human-induced climate change. I represented this by illustrating that glaciers are melting and calving, sea levels are rising, and temperatures are increasing. The numbers on the left y-axis depict quantities of glacial melt and sea level rise, and the suns across the horizon contain numbers that represent the global increase in temperature, coinciding with the timeline on the lower x-axis.

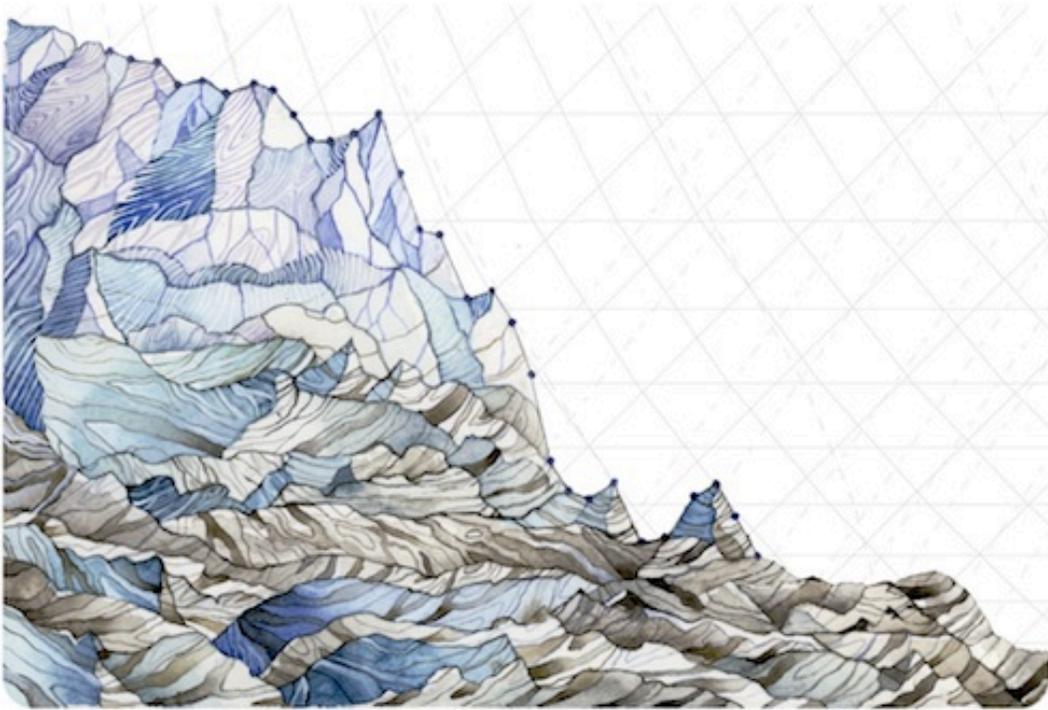


Habitat Degradation is a series which comments on humans' negative impacts on ecosystems worldwide. For each of the three habitats I depict, I chose representative species who are responding to the effects of the changes.

Habitat Degradation: Arctic Melt shows Arctic sea ice data from 1980 to present. Rapid warming in the Arctic has caused the sea ice area to decline so quickly that species cannot adjust. The Arctic fox is small and extraordinarily resilient to the most severe cold. They can withstand the frigid north and thus have this corner of the world in which to hunt. But when the temperatures mellow, competition from larger species could overcome them, as other species move further north to escape their own warming environment. I painted the Arctic foxes to look cornered and skittish. One is hunched and defensive, the other is yowling in panic. The sea ice, from which they are separated, is spaced out by large expanses of dark blue water absorbing the sun's heat.



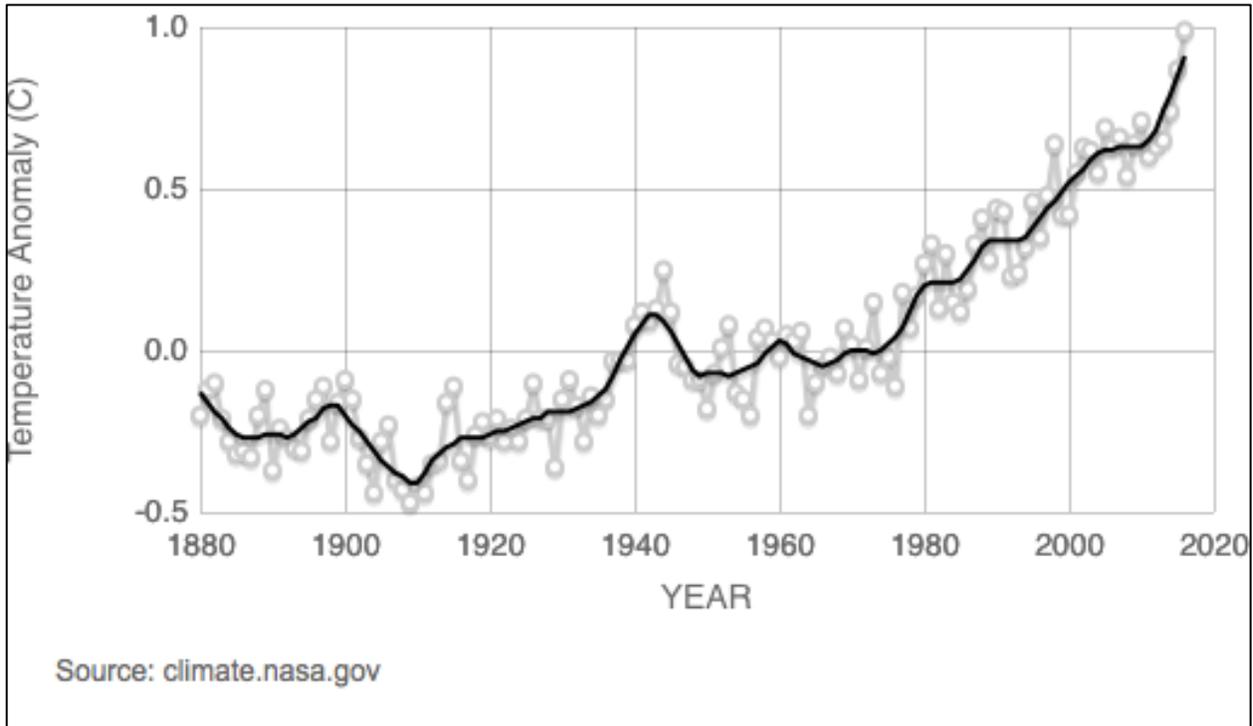
Landscape of Change uses data about sea level rise, glacier volume decline, increasing global temperatures, and the increasing use of fossil fuels. These data lines compose a landscape shaped by the changing climate, a world in which we are now living.



I created a series about some of the major impacts of global warming that I witnessed in Washington State this summer, using scientific data to show how the drought is devastating the state.

Decrease in Glacier Mass Balance uses measurements from 1980-2014 of the average mass balance for a group of North Cascade, WA glaciers. Mass balance is the annual budget for the glaciers: total snow accumulation minus total snow ablation. Not only are mass balances consistently negative, they are also continually decreasing.

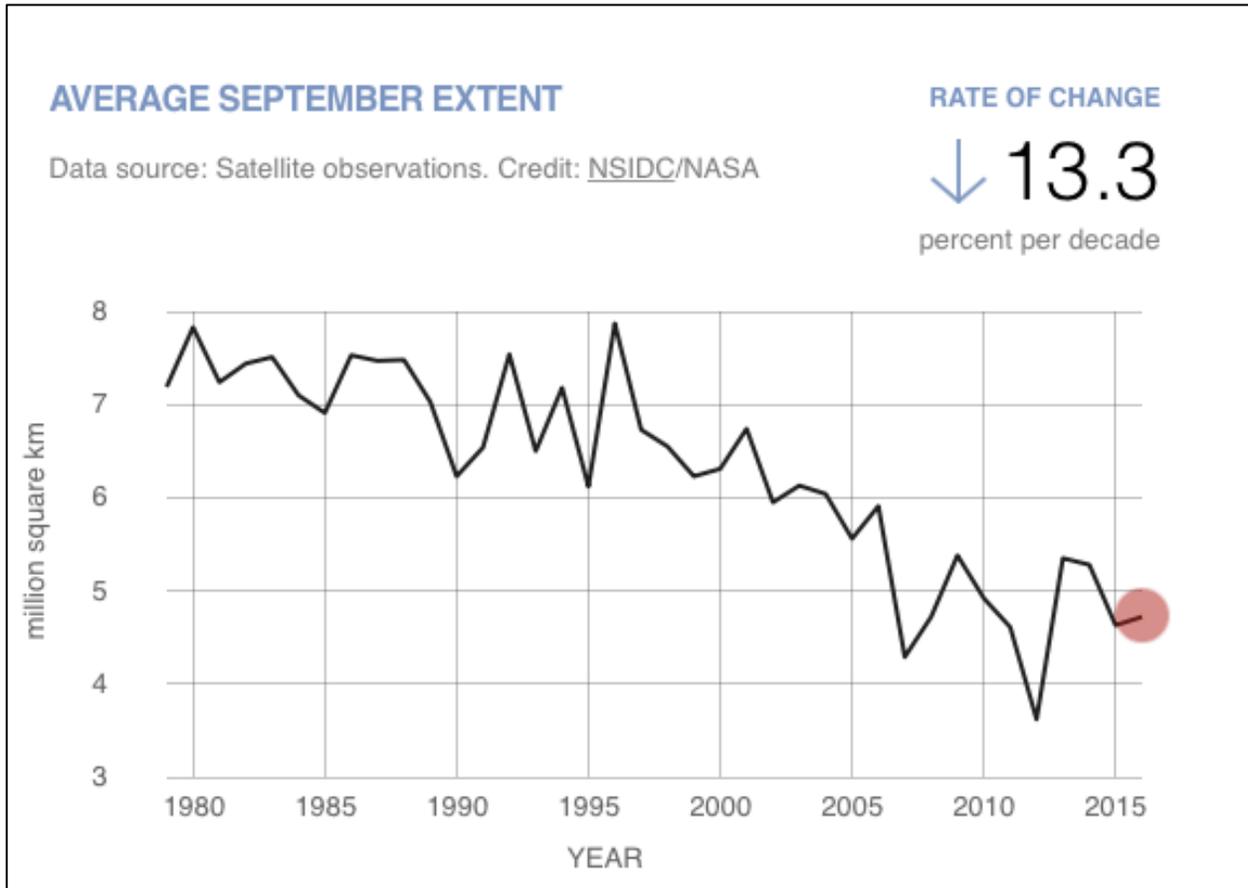
Worksheet #1 – Global Temperature



This graph illustrates the change in average global air temperature relative to 1951-1980 average temperatures. The 10 warmest years in the 136-year record all have occurred since 2000, with the exception of 1998. The year 2016 ranks as the warmest on record. (Source: NASA/GISS). This research is broadly consistent with similar constructions prepared by the Climatic Research Unit and the National Oceanic and Atmospheric Administration.

Earth's climate has varied a lot throughout history, with cycles of warming and cooling occurring that usually take approximately 100,000 years to complete. During each cycle, global average temperatures rise and fall about 9 °F (5°C), which led Earth into ice ages and warming trends. However, during the 20th century, Earth's average surface temperature rose by 1.08°F (0.6°C). Additional warming of more than 0.25°F (0.14°C) has been measured since 2000. Though the total increase may seem small, it likely represents an extraordinarily rapid rate of change compared to changes in the previous 10,000 years. The temperature in the 21st century is expected to continue to rise, at a rate faster than it did during the 20th century. This will cause a lot of changes on Earth, the most notable being rising sea levels and an increase in heat waves, droughts, and floods. Obviously, this will have profound effects on humans and animals.

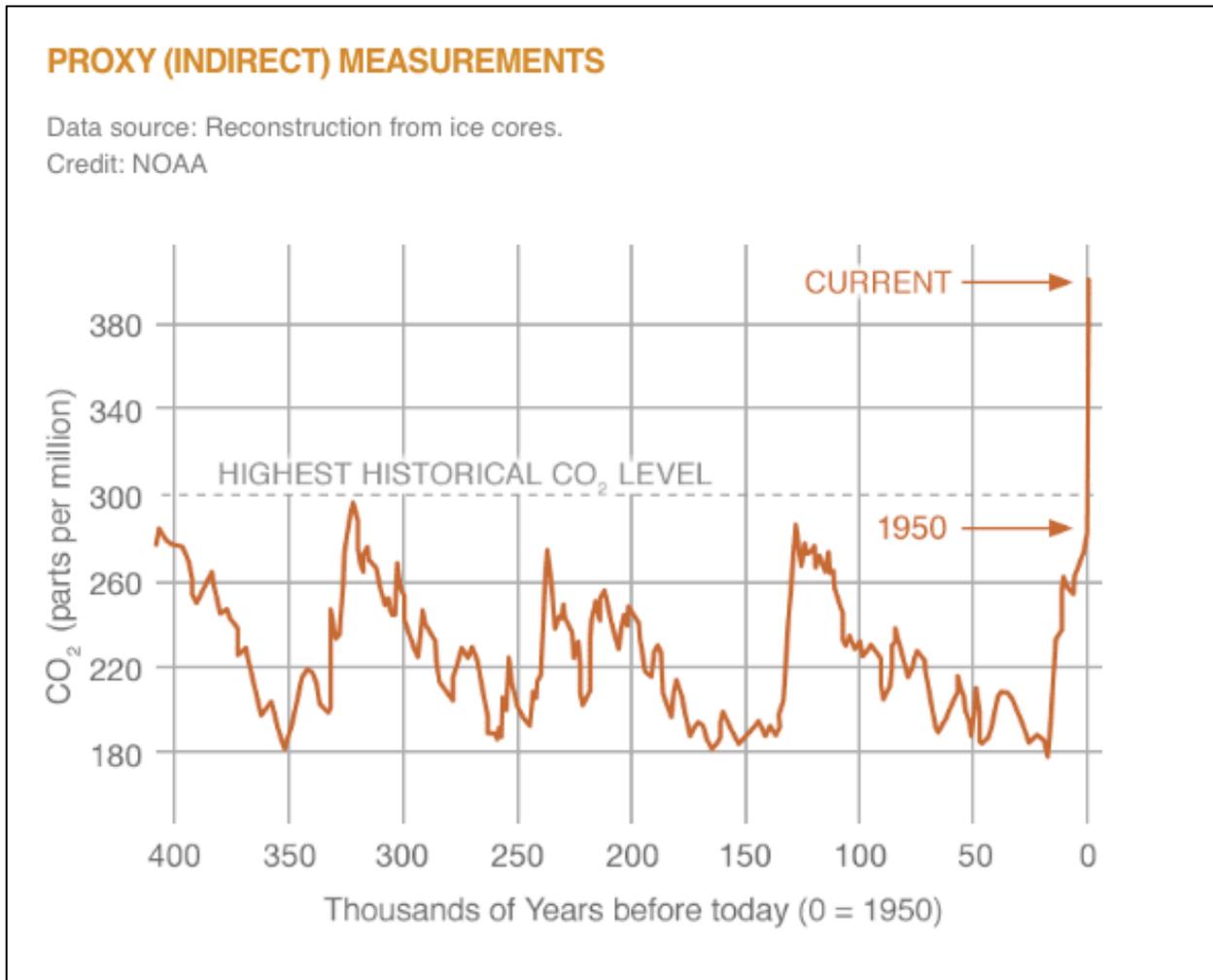
Worksheet #2 – Arctic Sea Ice



This graph shows the average monthly Arctic sea ice extent in September since 1979, derived from satellite observations. Arctic sea ice reaches its minimum each September. September Arctic sea ice is now declining at a rate of 13.3 percent per decade, relative to the 1981 to 2010 average.

The loss of sea ice in the Arctic can have an effect on many animals. Polar bears rely on sea ice for hunting and traveling from one area to another. Less winter sea ice means less food, which in turn affects reproductive success of females, among other things. In Hudson Bay, polar bears are starving during the long summer months as the ice they rely on to hunt for food melts earlier each spring and freezes later in the fall. Certain seal species that rarely come to land, such as the harp seal, spotted seal and the ringed seal, depend on Arctic sea ice for resting, giving birth, raising pups, and feeding. Some seabirds such as ivory gulls and little auks are likely to be negatively affected by a decline in sea ice because they nest on rocky cliffs and fly out to the sea ice to fish through cracks in the ice and scavenge on top of the ice. The number of ivory gulls in Canada has already decreased by 90% over the last 20 years. The ice edge in coastal areas is an important feeding ground for the walrus that use the ice as diving platforms to feed on clams on the sea floor. As the ice edge retreats away from the continental shelves to deeper areas, there will be no clams nearby to feed on. Walrus also travel large distances on floating ice, which allows them to feed over a wide area.

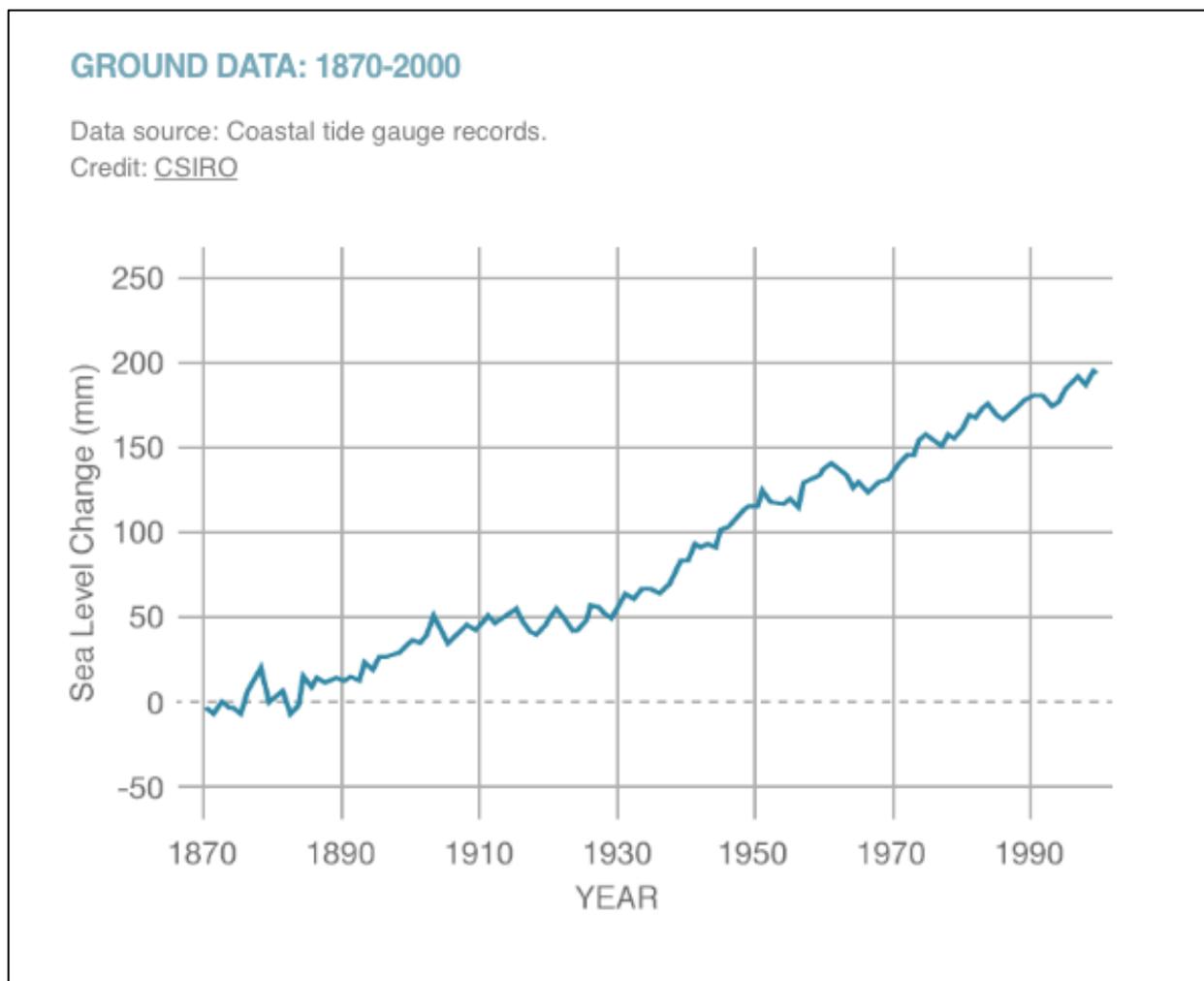
Worksheet #3 – Global Carbon Dioxide Concentration



This chart shows carbon dioxide (CO₂) concentration during the last three glacial cycles, as reconstructed from ice cores.

Carbon dioxide (CO₂) enters the atmosphere through human activities such as the burning of fossil fuels (coal, natural gas, and oil), solid waste, trees, as well as through certain chemical reactions (i.e. manufacture of cement). It is also released into the atmosphere from natural processes such as respiration and volcanic eruptions. Carbon dioxide traps heat in the atmosphere, kind of like glass in a greenhouse, hence CO₂ is referred to as a 'greenhouse gas.' As humans add CO₂ to the atmosphere, therefore, we are causing the earth to warm up. Carbon dioxide is removed from the atmosphere (or "sequestered") by plants during photosynthesis. The ocean also removes CO₂ from the atmosphere where it is stored in the vast volume of water.

Worksheet #4 – Global Sea Level Rise



This chart depicts sea level rise from 1870 to 2000 based on coastal tidal gauge data.

Sea level rise is caused primarily by two factors related to global warming: more water being added into the oceans from melting land ice and the expansion of sea water as it warms. Global sea level rose about 17 centimeters in the last century; however, over the past decade, the sea level rose twice the rate of the preceding century. Projections of sea level rise in the next 100 years range from almost 1 ft to 23 ft! Rising seas will have the biggest impact on coastal areas, where it will cause erosion, flooding of wetlands, contamination of agricultural areas, and a loss of habitat for animals. If the largest estimates of sea level rise hold true, some of the largest cities in the US would flood, including New York City, Houston, Los Angeles, and Miami.