Climate Change as a Scientific Theory: Theory vs. Scientific Theory

http://www.pbs.org/newshour/extra/lessons_plans/climate-change-scientific-theory

"Science never proves anything, only disproves." –Alex Dainis

Background on Scientific Theory:

Theory- an idea that is suggested or presented as possibly true but that is not known or proven to be true (source: http://www.merriam-webster.com/)

Scientific Theory- a concept that has been well tested, and is accepted as an explanation to a wide range of observations. (source: http://www.biology-online.org)

Scientific Theory consists of four parts:

1. Rigorous scientific testing- can be repeated over and over and achieves the same results
2. Prediction and explanation-allows you to predict what will happen and explain what is going on in the natural world
3. Consistency- aligns with other scientific knowledge and can be used in adaptation and modification
4. Parsimonious- Use the simplest explanation for why something happens

Warm Up Questions:

What do you know about the scientific theory of climate change?

How would you go about studying it?

Background on Climate Change from the Environmental Protection Agency:

Our Earth is warming. Earth's average temperature has risen by 1.4°F over the past century, and is projected to rise another 2 to 11.5°F over the next hundred years.

The evidence is clear. Rising global temperatures have been accompanied by changes in weather and climate. Many places have seen changes in rainfall, resulting in more floods, droughts, or intense rain, as well as more frequent and severe heat waves. The planet's oceans and glaciers have also experienced some big changes - oceans are warming and becoming more acidic, ice caps are melting, and sea levels are rising. As these and other changes become more pronounced in the coming decades, they will likely present challenges to our society and our environment. There are many indicators of climate change. You are going to explore one indicator of change in depth and evaluate the evidence.

The Earth's surface contains many forms of snow and ice, including sea ice, lake and river ice, snow cover, glaciers, ice caps and sheets, and frozen ground. Together, these features are sometimes referred to as the “cryosphere,” a term for all parts of the Earth where water exists in solid form.

Snow and ice are an important part of the global climate system. Because snow and ice are highly reflective, much of the sunlight that hits these surfaces is reflected back into space instead of warming the Earth. The presence or absence of snow and ice affects heating and cooling over the Earth’s surface, influencing the planet’s energy balance.

Climate change can dramatically alter the Earth's snow- and ice-covered areas. Unlike other substances found on the Earth, snow and ice exist at temperatures close to their melting point and can thus change between solid and liquid states in response to relatively minor changes in temperature. As a result, prolonged warming or cooling trends can result in significant changes across the landscape as snow and ice masses shrink or grow over time.

What is happening?

Some regions that usually receive snow are receiving less snowfall and do not have as much snow on the ground. Glaciers in the United States and around the world have generally shrunk, and the rate at which they are melting appears to have accelerated over the last decade. Additionally, the amount of ice in the Arctic Ocean has decreased, and many lakes are freezing later in the fall and melting earlier in the spring.

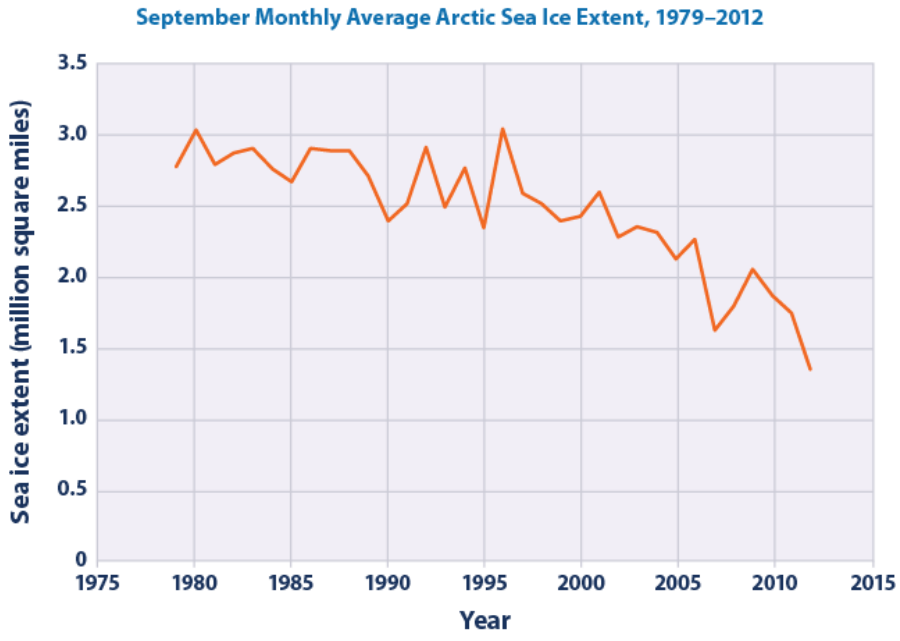
Why does it matter?

Reduced snowfall and less snow cover on the ground could diminish the beneficial insulating effects of snow for vegetation and wildlife, while also affecting water supplies, transportation, cultural practices, travel, and recreation for millions of people. For communities in Arctic regions, reduced sea ice could increase coastal erosion and exposure to storms, threatening homes and property, while thawing ground could damage roads and buildings and accelerate erosion.

Such changing climate conditions can have worldwide implications because snow and ice influence air temperatures, sea level, ocean currents, and storm patterns. For example, melting ice sheets on Greenland and Antarctica add fresh water to the ocean, increasing sea level and possibly changing ocean circulation that is driven by differences in temperature and salinity. Because of their light color, snow and ice also reflect more sunlight than open water or bare ground, so a reduction in snow cover and ice causes the Earth's surface to absorb more energy from the sun.

Thawing of frozen ground and reduced sea ice in the Arctic could affect biodiversity on local and global scales, leading to harmful effects not only on polar bears and seals, but also on migratory species that breed or feed in these areas. These changes could affect people by compromising their livelihoods and traditional means of gathering food, particularly Arctic indigenous populations. Conversely, reduced snow and ice could present commercial opportunities for others, including ice-free shipping lanes and increased access to natural resources.

The graph below shows the relationship of total sea ice and time over the last four decades.



Data source: NSIDC (National Snow and Ice Data Center). 2012. Archived monthly sea ice data and images. Accessed October 2012. http://nsidc.org/data/seaice_index/archives/index.html

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climatechange/indicators.

Source: http://epa.gov/climatechange/basics/