

Climate Change Conceptual Framework

This framework will continue to evolve as more is learned and understood about these topics; visit the [Contacts page](#) to contact someone if you have comments or suggestions for either framework.

Climate System

Atmospheric Circulation

- **Atmospheric circulation results from air moving along pressure gradients from conditions of high pressure to lower pressure.**
 - Warm air rises, while cold air sinks. Movements of air are also influenced by the motion of the Earth itself and other forces.
http://rst.gsfc.nasa.gov/Sect14/Sect14_1c.html.

Atmospheric Composition

- **Many aspects of Earth's climate are dependent upon atmospheric composition and biogeochemical cycling.**
 - The amount of solar energy absorbed or radiated by earth is modulated by the atmosphere and depends on its composition. Greenhouse gases – such as water vapor, carbon dioxide, and methane – occur naturally in small amounts and absorb and release heat energy more efficiently than abundant atmospheric gases like nitrogen and oxygen. Small increases in carbon dioxide concentration have a large effect on the climate system.
 - The abundance of greenhouse gases in the atmosphere is controlled by biogeochemical cycles that continually move these components between their ocean, land, life, and atmosphere reservoirs.
 - Airborne particulates, called “aerosols,” have a complex effect on Earth's energy balance: they can cause both cooling, by reflecting incoming sunlight back out to space, and warming, by absorbing and releasing heat energy in the atmosphere. Small solid and liquid particles can be lofted into the atmosphere through a variety of natural and manmade processes, including volcanic eruptions, sea spray, forest fires, and emissions generated through human activities.

Carbon Cycle

- **Carbon is part of the oceans, air, rocks, soil, and all living things. It is constantly cycling through the ecosystem.**
 - Carbon moves from the atmosphere to plants when plants take in carbon dioxide from photosynthesis.
 - Carbon moves from plants to animals through the food web. In this way, carbon can also move from animals to animals.
 - When plants and animals die, carbon moves into the ground through decomposition. Some of this now buried carbon will become fossil fuels in millions of years.
 - Carbon can move from living things back into the atmosphere through respiration.

- Oceans take up some of the carbon from the atmosphere.
- When fossil fuels are burned, carbon quickly enters the atmosphere as carbon dioxide gas. (http://www.windows2universe.org/earth/Water/co2_cycle.html)
- The abundance of carbon in the atmosphere is reduced through seafloor accumulation of marine sediments and accumulation of plant biomass and is increased through deforestation and the burning of fossil fuels as well as through other processes.

Climate Compared to Weather

- **Climate is not the same thing as weather. Weather refers to atmospheric conditions over a short period of time, while climate refers to long-term patterns in atmospheric conditions.**
 - Weather is a minute-by-minute variable condition of the atmosphere on a local scale. Climate is a conceptual description of an area's average weather conditions and the extent to which those conditions vary over long time intervals. In simpler terms: Climate is what you expect and weather is what you get.
 - Our understanding of climate differs in important ways from our understanding of weather. Climate scientists' ability to predict climate patterns months, years, or decades into the future is constrained by different limitations than those faced by meteorologists in forecasting weather days to weeks into the future.

Climate Feedbacks

- **The interconnectedness of Earth's systems means that a significant change in any one component of the climate system can influence the equilibrium of the entire Earth system.**
 - Positive feedback loops can amplify these effects and trigger abrupt changes in the climate system. These complex interactions may result in climate change that is more rapid and on a larger scale than projected by current climate models.
 - The abundance of greenhouse gases in the atmosphere is controlled by biogeochemical cycles that continually move these components between their ocean, land, life, and atmosphere reservoirs. The abundance of carbon in the atmosphere is reduced through seafloor accumulation of marine sediments and accumulation of plant biomass and is increased through deforestation and the burning of fossil fuels as well as through other processes.
- **Decreasing snow and ice and deforestation are examples of positive feedback mechanisms affecting climate change.**
 - Snow and ice are highly reflective (have a high albedo) and therefore reflect solar energy back into the atmosphere. When warming temperatures cause snow and ice cover to decrease, more solar energy is absorbed, which in turn causes increased warming.
 - Trees and plants store carbon dioxide from the atmosphere in their leaves, wood, and roots. Removing plants and trees takes away this storage capability and when plants are destroyed, that stored carbon is released back into the atmosphere. The open space left after deforestation is also typically darker and

less reflective (lower albedo) than the leaves on the trees. Therefore, more solar energy is absorbed and warming increases.

Global Energy Balance

- **For temperature to remain stable, Earth's energy budget must be in balance.**
 - When Earth emits the same amount of energy as it absorbs, its energy budget is in balance, and its average temperature remains stable.
 - A significant increase or decrease in the Sun's energy output would cause Earth to warm or cool. Satellite measurements taken over the past 30 years show that the Sun's energy output has changed only slightly and in both directions. These changes in the Sun's energy are thought to be too small to be the cause of the recent warming observed on Earth.
- **Biogeochemical cycles are reliant upon energy.**
 - Ecosystems use energy to maintain biogeochemical cycles—such as the sedimentary, gaseous, and hydrologic cycles—between living and nonliving systems. (KEEP Conceptual Framework)

Greenhouse Effect

- **Greenhouse gasses are what make life on Earth possible.**
 - The presence of small amounts of heat-trapping greenhouse gases in the atmosphere warms Earth's surface, resulting in a planet that sustains liquid water and life.
- **The amount of solar energy absorbed or radiated by earth is modulated by the atmosphere and depends on its composition.**
 - Greenhouse gases – such as water vapor, carbon dioxide, and methane – occur naturally in small amounts and absorb and release heat energy more efficiently than abundant atmospheric gases like nitrogen and oxygen. Small increases in carbon dioxide concentration have a large effect on the climate system.
- **Current greenhouse gas output is greater than the rate at which it can be naturally removed**
 - Natural processes that remove carbon dioxide from the atmosphere operate slowly when compared to the processes that are now adding it to the atmosphere. Thus, carbon dioxide introduced into the atmosphere today may remain there for a century or more. Other greenhouse gases, including some created by humans, may remain in the atmosphere for thousands of years.

Ocean and Climate

- **The ocean exerts a major control on climate by dominating Earth's energy and water cycles.**
 - Covering 70% of Earth's surface, the ocean has the capacity to absorb large amounts of solar energy. Heat and water vapor are redistributed globally through density-driven ocean currents and atmospheric circulation. Changes in ocean circulation caused by tectonic movements or large influxes of fresh water

from melting polar ice can lead to significant and even abrupt changes in climate, both locally and on global scales.

Orbital Cycles (Long-term and Seasonal)

- **The position of Earth in relation to the Sun leads to the climate systems to which we are accustomed.**
 - The tilt of Earth's axis relative to its orbit around the Sun results in predictable changes in the duration of daylight and the amount of sunlight received at any latitude throughout a year. These changes cause the annual cycle of seasons and associated temperature changes.
 - Gradual changes in Earth's rotation and orbit around the Sun change the intensity of sunlight received in our planet's polar and equatorial regions. For at least the last 1 million years, these changes occurred in 100,000-year cycles that produced ice ages and the shorter warm periods between them.

Regional Climates

- **Climate is regulated by complex interactions among components of the earth system.**
 - Earth's climate is influenced by interactions involving the Sun, ocean, atmosphere, clouds, ice, land, and life. Climate varies by region as a result of local differences in these interactions.
- **Climate change is a significant and persistent change in an area's average climate conditions or their extremes.**
 - Climate is determined by the long-term pattern of temperature and precipitation averages and extremes at a location. Climate descriptions can refer to areas that are local, regional, or global in extent. Climate can be described for different time intervals, such as decades, years, seasons, months, or specific dates of the year.
 - Seasonal variations and multi-year cycles (for example, the El Niño Southern Oscillation) that produce warm, cool, wet, or dry periods across different regions are a natural part of climate variability. They do not represent climate change.
- **Climate varies over space and time through both natural and man-made processes.**
 - Scientific observations indicate that global climate has changed in the past, is changing now, and will change in the future. The magnitude and direction of this change is not the same at all locations on Earth.
 - Based on evidence from tree rings, other natural records, and scientific observations made around the world, Earth's average temperature is now warmer than it has been for at least the past 1,300 years. Average temperatures have increased markedly in the past 50 years, especially in the North Polar Region.

Solar Radiation

- **The sun is the primary source of energy for Earth's climate system.**

- Sunlight reaching the Earth can heat the land, ocean, and atmosphere. Some of that sunlight is reflected back to space by the surface, clouds, or ice. Much of the sunlight that reaches Earth is absorbed and warms the planet.

Water Cycle

- **The cycling of water is intimately linked with energy exchanges among the atmosphere, ocean, and land.**
 - Water is necessary to sustaining life on Earth, and helps tie together the Earth's lands, oceans, and atmosphere into an integrated system. Precipitation, evaporation, freezing and melting and condensation are all part of the hydrological cycle - a never-ending global process of water circulation from clouds to land, to the ocean, and back to the clouds.
 - The impacts of climate change and variability on the quality of human life occur primarily through changes in the water cycle. As stated in the National Research Council's report on Research Pathways for the Next Decade (NRC, 1999): "Water is at the heart of both the causes and effects of climate change." (<http://science.nasa.gov/earth-science/oceanography/ocean-earth-system/ocean-water-cycle/>).

Causes of Climate Change

Cyclical and Natural Changes

- **Over long periods of time, climate change does occur naturally.**
 - Climate change can occur naturally through changes in the sun's intensity, slow changes in the Earth's orbit around the sun, or natural processes within the climate system (e.g., changes in ocean circulation) (<http://www.epa.gov/climatechange/basicinfo.html>)

Human-Caused Changes

- **Humans and life in general influence the global climate.**
 - A range of natural records show that the last 10,000 years have been an unusually stable period in Earth's climate history. Modern human societies developed during this time. The agricultural, economic, and transportation systems we rely upon are vulnerable if the climate changes significantly.
 - Life – including microbes, plants, and animals and humans – is a major driver of the global carbon cycle and can influence global climate by modifying the chemical makeup of the atmosphere. The geologic record shows that life has significantly altered the atmosphere during Earth's history.
- **Recent climate change is occurring at an unprecedented rate.**
 - Natural processes driving Earth's long-term climate variability do not explain the rapid climate change observed in recent decades. The only explanation that is consistent with all available evidence is that human impacts are playing an increasing role in climate change. Future changes in climate may be rapid compared to historical changes.

- Natural processes that remove carbon dioxide from the atmosphere operate slowly when compared to the processes that are now adding it to the atmosphere. Thus, carbon dioxide introduced into the atmosphere today may remain there for a century or more. Other greenhouse gases, including some created by humans, may remain in the atmosphere for thousands of years.
- The only way to assess whether the recently observed warming fits with a pattern of natural variability is to look at how temperature has varied in the past. This can be done using paleoclimatic evidence from tree rings, glaciers, corals, and other geologic records. It is clear from extensive research and reconstructions of temperature over the past two thousand years that the magnitude and rate of change over the past century far exceeds any natural variability that occurred in the past two millennia.
(<http://www.climate.org/topics/climate-change/debunking-climate-change-myths.html>)
- **Human activities are having marked impacts on the climate system.**
 - The overwhelming consensus of scientific studies on climate indicates that most of the observed increase in global average temperatures since the later part of the 20th century is very likely due to human activities, primarily from increases in greenhouse gas concentrations resulting from the burning of fossil fuels.
 - Emissions from the widespread burning of fossil fuels since the start of the Industrial Revolution have increased the concentration of greenhouse gasses in the atmosphere. Because these gases can remain in the atmosphere for hundreds of years before being removed by natural processes, their warming influence is projected to persist into the next century.
 - Human activities have affected the land, oceans, and atmosphere, and these changes have altered global climate patterns. Burning fossil fuels, releasing chemicals into the atmosphere, reducing the amount of forest cover, and rapid expansion of farming, development, and industrial activities are releasing carbon dioxide into the atmosphere and changing the balance of the climate system.
 - Global demands for energy resources are increasing. This is due to human population growth and increasing worldwide consumption. As certain energy resources are depleted and demand increases, competition for these resources also increases. This is especially true of non-renewable resources, such as fossil fuels. (KEEP Conceptual Framework)

Measuring and Modeling Climate

Climate Modeling

- **Our understanding of the climate system is improved through observations, theoretical studies, and modeling.**
 - Observations, experiments, and theory are used to construct and refine computer models that represent the climate system and make predictions about its future behavior. Results from these models lead to better understanding of the linkages between the atmosphere-ocean system and climate conditions and inspire more observations and experiments. Over time, this iterative process will result in more reliable projections of future climate conditions.

Gathering and Measuring Climate Data

- **Improving our understanding of the climate system is essential to our ability to act appropriately.**
 - Climate information can be used to reduce vulnerabilities or enhance the resilience of communities and ecosystems affected by climate change. Continuing to improve scientific understanding of the climate system and the quality of reports to policy and decision-makers is crucial.
- **We use a wide range of methods to gain information about the climate system.**
 - The components and processes of Earth's climate system are subject to the same physical laws as the rest of the Universe. Therefore, the behavior of the climate system can be understood and predicted through careful, systemic study.
 - Environmental observations are the foundation for understanding the climate system. From the bottom of the ocean to the surface of the Sun, instruments on weather stations, buoys, satellites, and other platforms collect climate data. To learn about past climates, scientists use natural records, such as tree rings, ice cores, and sedimentary layers. Historical observations, such as native knowledge and personal journals, also document past climate change.
 - Scientists have conducted extensive research on the fundamental characteristics of the climate system and their understanding will continue to improve. Current climate change projections are reliable enough to help humans evaluate potential decisions and actions in response to climate change.

Impacts of Climate Change

Agricultural Changes

- **Agriculture is highly sensitive to climate variability and weather extremes, such as droughts, floods and severe storms.**
(<http://www.epa.gov/climatechange/effects/agriculture.html>).
 - Higher temperatures eventually reduce yields of desirable crops while encouraging weed and pest proliferation. Changes in precipitation patterns increase the likelihood of short-run crop failures and long-run production declines. Although there will be gains in some crops in some regions of the world, the overall impacts of climate change on agriculture are expected to be negative, threatening global food security.
 - Populations in the developing world, which are already vulnerable and food insecure, are likely to be the most seriously affected. In 2005, nearly half of the economically active population in developing countries – 2.5 billion people – relied on agriculture for its livelihood.
(<http://www.ifpri.org/sites/default/files/publications/pr21.pdf>).

Economic Impacts

- **Climate change is affecting businesses and economies at home and around the world.**
 - If action is not taken to curb global carbon emissions, climate change could cost between 5 and 20 percent of the annual global gross domestic product,

according to a British government report. In comparison, it would take 1 percent of GDP to lessen the most damaging effects of climate change, the report says. (<http://www.nature.org/initiatives/climatechange/issues/art19627.html>).

- A range of natural records shows that the last 10,000 years have been an unusually stable period in Earth's climate history. Modern human societies developed during this time. The agricultural, economic, and transportation systems we rely upon are vulnerable if the climate changes significantly.

Ecosystem Changes

- **Ecosystems on land and in the ocean have been and will continue to be disturbed by climate change.**
 - Growing evidence shows that changes in many physical and biological systems are linked to human-caused global warming. Some changes resulting from human activities have decreased the capacity of the environment to support various species and have substantially reduced ecosystem biodiversity and ecological resilience.
 - The chemistry of ocean water is changed by absorption of carbon dioxide from the atmosphere. Increasing carbon dioxide levels in the atmosphere is causing ocean water to become more acidic, threatening the survival of shell-building marine species and the entire food web of which they are a part.

Extreme Weather

- **Incidents of extreme weather are projected to increase as a result of climate change.**
 - Many locations will see a substantial increase in the number of heat waves they experience per year and a likely decrease in episodes of severe cold. Precipitation events are expected to become less frequent but more intense in many areas, and droughts will be more frequent and severe in areas where average precipitation is projected to decrease.

Freshwater Resources

- **Climate plays an important role in the global distribution of freshwater resources.**
 - Changing precipitation patterns and temperature conditions will alter the distribution and availability of freshwater resources, reducing reliable access to water for many people and their crops. Winter snowpack and mountain glaciers that provide water for human use are declining as a result of global warming.

Surface Temperature Warming

- **The surface temperature of our planet has been increasing.**

Melting Ice and Permafrost

- **Melting of ice sheets and glaciers, combined with the thermal expansion of seawater as the oceans warm, is causing sea level to rise.**
 - Seawater is beginning to move onto low-lying land and to contaminate coastal fresh water sources and beginning to submerge coastal facilities and barrier islands. Sea-level rise increases the risk of damage to homes and buildings from storm surges such as those that accompany hurricanes.

Ocean Warming and Acidification

- **Increased greenhouse gas outputs decrease the pH of seawater.**
 - In water, absorbed carbon dioxide becomes a weak carbonic acid. Since the Industrial Revolution, the increase in carbon dioxide in the atmosphere has already lowered the average pH of seawater by .1 units, to 8.2 on the 14 point scale. Projected future output could lower the pH an additional .5 units by 2100. This level has not been seen for millions of years.
 - Increasing acidity can negatively impact corals and other organisms with calcium carbonate shells. Acidification may also have direct negative impacts on the growth and development of fish and plankton.
(<http://climatechange.110mb.com/effects-ocean-acidification-warming.htm>).
- **Changes in ocean temperatures have global impacts.**
 - As ocean temperatures warm, species that prefer specific temperature ranges may relocate. Some organisms, like corals, are sedentary and cannot relocate with changing temperatures. If the water becomes too warm, they can experience a bleaching event.
 - Warmer water expands and causes more ice melt, both of which lead to sea level rise. Higher sea level and warmer ocean temperatures can alter ocean circulation and current flow, increase the frequency and intensity of storms, alter habitat and impact weather worldwide.
(<http://centerforoceansolutions.org/climate/impacts/ocean-warming/>)

Plants and Animals

- **Climate change will have consequences for living things.**
 - Individual organisms survive within specific ranges of temperature, precipitation, humidity, and sunlight. Organisms exposed to climate conditions outside their normal range must adapt or migrate, or they will perish.
 - Changes in climate conditions can affect the health and function of ecosystems and the survival of entire species. The distribution patterns of fossils show evidence of gradual as well as abrupt extinctions related to climate change in the past.

Public Health

- **The effects of climate change will have widespread impacts on human health and wellbeing.**
 - Ecosystems on land and in the ocean have been and will continue to be disturbed by climate change. Animals, plants, bacteria, and viruses will migrate to new areas with favorable climate conditions. Infectious diseases and certain species will be able to invade areas that they did not previously inhabit.
 - Human health and mortality rates will be affected to different degrees in specific regions of the world as a result of climate change. Although cold-related deaths are predicted to decrease, other risks are predicted to rise. The incidence and geographical range of climate-sensitive infectious diseases – such as malaria, dengue fever, and tick-borne diseases – will increase.

- Drought-reduced crop yields, degraded air and water quality, and increased hazards in coastal and low-lying areas will contribute to unhealthy conditions, particularly for the most vulnerable populations.

Sea Level Rise

- **Rising temperatures can lead to sea level rise through thermal expansion and melting ice.**
 - As temperatures increase, the oceans warm and thermal expansion occurs. This leads to rising sea levels
 - Rising temperatures cause ice to melt. When land ice such as mountain glaciers and ice sheets begins to melt, that water enters the ocean and leads to higher sea levels. (<http://centerforoceansolutions.org/climate/impacts/ocean-warming/sea-level-rise/>)

Great Lakes Impacts

- **Climate change will have local impacts here in the Great Lakes region.**
 - A changing climate will have both positive and negative impacts. Too much or too little precipitation, too much heat, or too many freeze-thaw cycles may become more common in weather patterns. Certain regions of the state, ecosystems or economic activities will be more vulnerable to these types of changes, while others will be more resilient. Assessing the possible winners and losers is a complex and potentially controversial process. (<http://www.wicci.wisc.edu>).
 - Models predict that by the end of the century the Great Lakes region will experience temperature increases of 5-10°F rise in the winter and 8-17°F rise in the summer
 - Although average annual precipitation may not change much, an overall drier climate is expected because rainfall cannot compensate for the increase in evaporation resulting from greater temperatures. Seasonally, winter precipitation is expected to increase by as much as 25% and summer precipitation is expected to decrease as much as 20%. Thus we may see drier soils and more summer droughts.
 - Extreme heat will be more common, and the frequency of heavy rainstorms will increase. These increases could be 50-100% higher than today.
 - The growing season could be 4-7 weeks longer.
 - Declines in ice cover on the Great Lakes and inland lakes have been recorded over the past 100-150 years and are expected to continue. (http://www.ucsusa.org/greatlakes/glregionwis_cli.html).

Uncertainty

- **Different climate change scenarios result in different potential impacts.**
 - Scientists and economists predict that there will be both positive and negative impacts from global climate change. If warming exceeds 2 to 3°C (3.6 to 5.4°F) over the next century, the consequences of the negative impacts are likely to be much greater than the consequences of the positive impacts.

Human Responses to Climate Change

Personal Responsibility

- **Our actions in response to climate change will have broad local and global implications.**
 - Reducing human vulnerability to the impacts of climate change depends not only on our ability to understand climate science, but also on our ability to integrate that knowledge into human society. Decisions that involve Earth's climate must be made with an understanding of the complex interconnections among the physical and biological components of the Earth system as well as the consequences of such decisions on social, economic, and cultural systems.
 - Actions taken by individuals, communities, states, and countries all influence climate. Practices and policies followed in homes, schools, businesses, and governments can affect climate. Climate-related decisions made by one generation can provide opportunities as well as limit the range of possibilities open to the next generation. Steps toward reducing the impact of climate change may influence the present generation by providing other benefits such as improved public health infrastructure and sustainable built environments.
- **There are many avenues through which people can make a positive change.**
 - If everyone were to make small changes in their lifestyle, the collective effect would be significant toward reversing the harmful effects of climate change.
 - A citizen, acting individually or as part of a group or organization, may make decisions (such as deciding to ride a bicycle instead of driving a car) and take actions (riding the bicycle) that determine how the energy they use will be managed. Citizens may also affect the actions of other individuals, groups, or organizations to determine how the energy they use will be managed. This can be accomplished by ecomanagement (physical action), education, persuasion, consumer action, political action, or legal action.(KEEP Conceptual Framework)

Risk Management

- **Climate change adaptation can help us to improve the resilience of communities and ecosystems.**
 - Climate information can be used to reduce vulnerabilities or enhance the resilience of communities and ecosystems affected by climate change.
 - Humans can adapt to climate change by reducing their vulnerability to its impacts. Actions such as moving to higher ground to avoid rising sea levels, planting new crops that will thrive under new climate conditions, or using new building technologies represent adaptation strategies. Adaptation often requires financial investment in new or enhanced research, technology, and infrastructure.
- **We can take steps to minimize future climate change through mitigation.**
 - Humans may be able to mitigate climate change or lessen its severity by reducing greenhouse gas concentrations through processes that move carbon out of the atmosphere or reduce greenhouse gas emissions.

- Although mitigation of climate change is a global process that will take centuries to take effect, it is valuable to take certain mitigation steps now. Reducing the production of greenhouse gases in a region will result in immediate improvements in the regional environment and contribute to better health and well-being and to economic efficiencies in households and businesses. (<http://ccir.ciesin.columbia.edu/nyc/pdf/q4a.pdf>).
- Energy resources may be managed through conservation, which includes reducing wasteful energy use, using energy for a given purpose more efficiently, or reducing energy use altogether. Energy conservation and using renewable energy resources prolongs the availability of nonrenewable energy resources and contributes to the development of a sustainable society. (KEEP Conceptual Framework)
- Using renewable energy will reduce some personal and community health risks since it generally releases fewer pollutants into the environment than fossil fuels. (KEEP Conceptual Framework)
- **We will need to be creative and resourceful in our efforts to reduce the risks related to climate change.**
 - Achieving the very large reduction in greenhouse gas emissions that scientists say is needed to avoid the worst effects of climate change will require action across all sectors of the economy. A portfolio of technologies exists today for achieving cost-effective emission reductions, and emerging technologies hold promise for delivering even more emission reductions in the future. The successful development of these technologies will require research, incentives for producers and consumers, and emission reduction requirements that drive innovation and guide investments. (<http://www.pewclimate.org/climate-change-101/technological-solutions>)
 - A combination of strategies is needed to reduce greenhouse gas emissions. The most immediate strategy is conservation of oil, gas, and coal, which we rely on as fuel for most of our transportation, heating, cooling, agriculture, and electricity. Short-term strategies involve switching from carbon-intensive to renewable energy sources, which also requires building new infrastructure for alternative energy sources. Long-term strategies involve innovative research and a fundamental change in the way humans use energy.

Social Values

- **Climate change impacts may lead to compromised national security.**
 - The impacts of climate change may affect the security of nations. Reduced availability of water, food, and land can lead to competition and conflict among humans, potentially resulting in large groups of climate refugees.
- **The effects of climate change will vary greatly from region to region.**
 - Human health and mortality rates will be affected to different degrees in specific regions of the world as a result of climate change. Although cold-related deaths are predicted to decrease, other risks are predicted to rise. The incidence and geographical range of climate-sensitive infectious diseases – such as malaria, dengue fever, and tick-borne diseases – will increase. Drought-reduced crop yields, degraded air and water quality, and increased

- hazards in coastal and low-lying areas will contribute to unhealthy conditions, particularly for the most vulnerable populations.
- Many low income and underdeveloped communities are located in areas that are predicted to receive some of the most detrimental impacts. These communities are also the most ill-equipped to effectively cope with these changes. Meanwhile, the least developed areas are also typically the areas that are contributing the least to greenhouse gas emissions.
 - **Politics affect and are affected by climate change policies and regulations**
 - The political views of those in power have a strong impact on the course of climate change policy. Therefore, the types of policies and regulations that are put in place vary greatly depending on the political climate. Meanwhile, the effects of climate change and climate change policy have great influence over local, state, national, and international social systems and politics.
 - **Working at the community level to minimize the effects of climate change can build and reinforce community values.**
 - Working within your community can build inertia for change and help to disseminate information and ideas for solutions. It can also create or reinforce values such as innovation, conservation, and community improvement.