Chasing Ice Clip: Glacial Retreat

Chasing Ice Clip

1. What do you think James Balog meant by the term "**retreat**"?
2. How might warming temperatures impact glacier growth? Do you think this would present a problem? Why or why not?

Changes in Precipitation Vary By Region

- Some regions are receiving more precipitation than usual, and others are receiving less
- Droughts have become more frequent and severe
  - Harming agriculture, promoting soil erosion, reducing drinking water supplies, and encouraging forest fires
- Heavy rains have contributed to flooding
  - Killing people, destroying homes, and inflicting billions of dollars in damage (2002=Czech Republic)

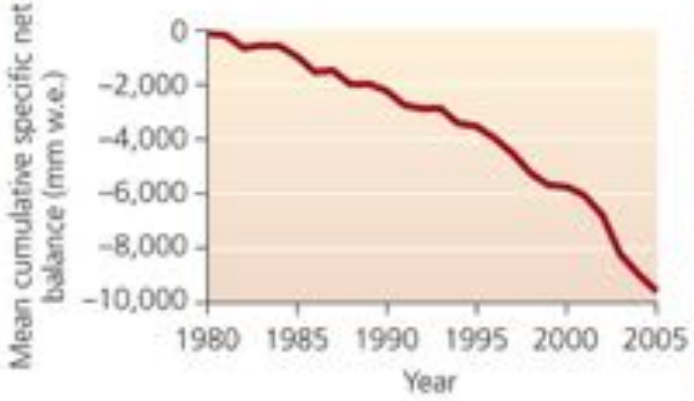
Projected Changes In Precipitation

- This shows changes from 1980-1999 to 2090-2099 with a 5 degree F increase in temperature

Melting Snow and Ice

- Mountaintop glaciers are disappearing
  - In Glacier National Park, only 27 of 150 glaciers remain
  - Risks of sudden floods as ice dams burst
  - Reducing summertime water supplies
- Melting of the Greenland ice sheet is accelerating
- As ice melts, darker, less-reflective surfaces are exposed and absorb more sunlight, causing more melting

Worldwide, Glaciers Are Melting Rapidly



(a) Grinnell Glacier in 1938

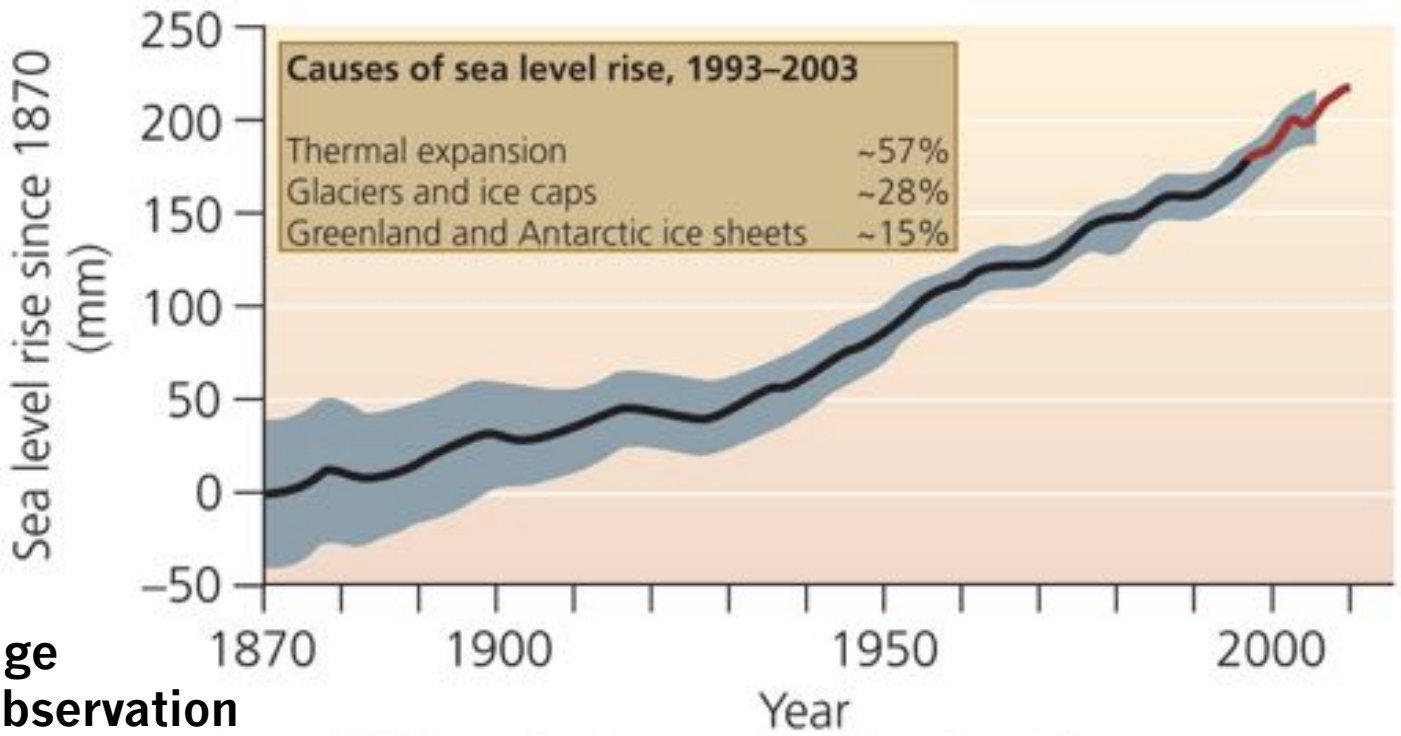
(b) Grinnell Glacier in 2005


1900 Glacier Position
1856 Glacier Position
1602 Glacier Position

Glacier National Park: Before/After

Rising Sea Levels

- As glaciers and ice melt, increased water will flow into the oceans
- As oceans warm, they expand
- Leads to beach erosion, coastal floods, and intrusion of salt water into aquifers



Black Line = Tide gauge
Red Line = Satellite observation

Coastal Areas Will Flood

- **Storm Surge:** Temporary and localized rise in sea level brought on by the high tides and winds associated with storms
- Cities will be flooded
- Millions of people will be displaced from coastal areas
- IPCC predicts mean sea level to be 18-59 cm (7-23 in) higher than today's at the end of the 21st century

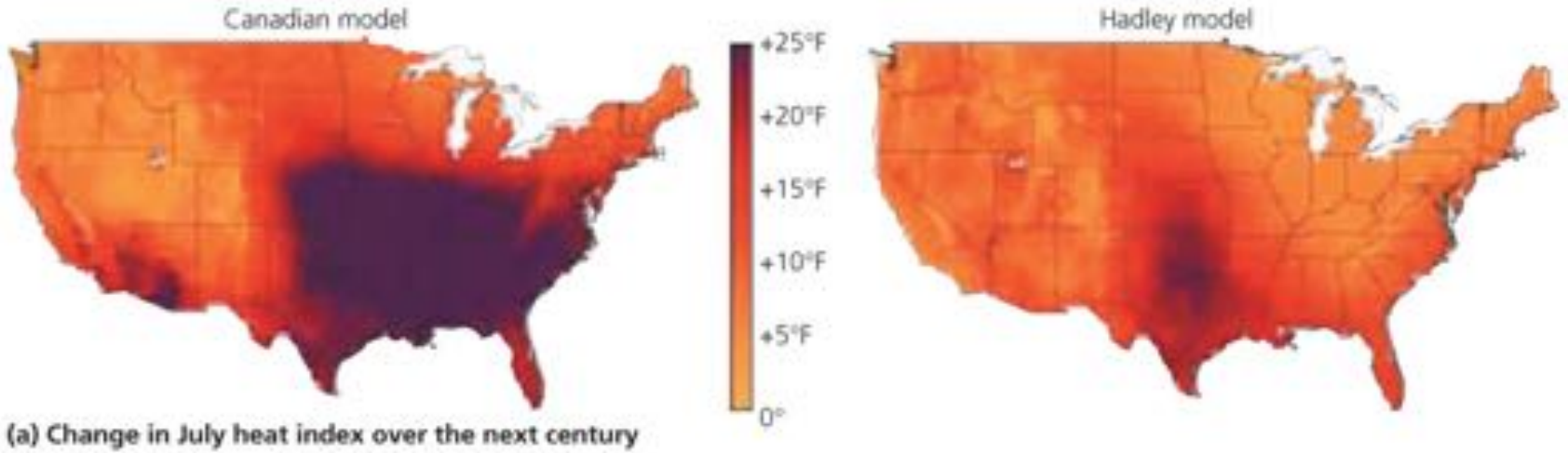
Climate Change Affects Organisms and Ecosystems

- Organisms are adapted to their environments, so they are affected when those environments change
- Global warming modifies temperature-dependent phenomena
  - Timing of migration, breeding
- Spatial shifts in the range of organisms
  - Animals and plants will move towards the poles or upward in elevation
  - 20-30% of all species will be threatened with extinction
- Plants act as carbon sinks; fewer plants means more CO_2 in the atmosphere

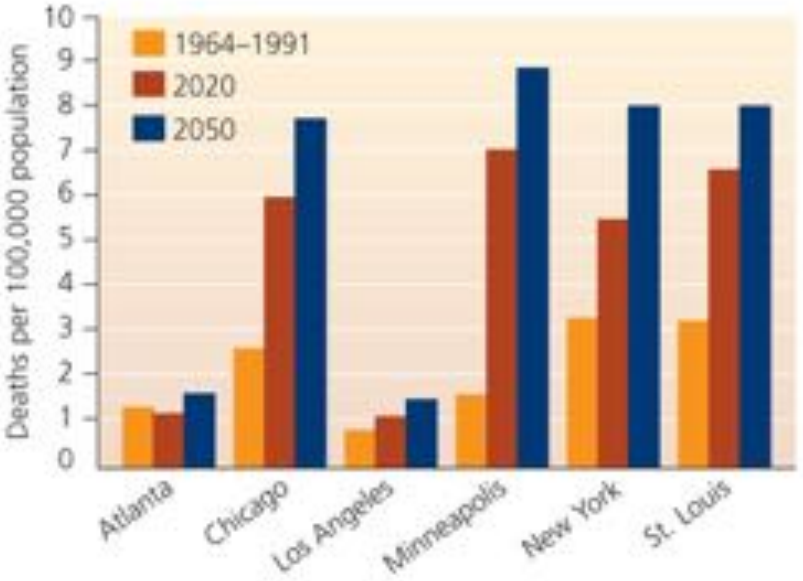
Climate Change Exerts Societal Impacts

- Human society is beginning to feel the impacts of climate change
- **Agriculture:** growing seasons shortened, crops more susceptible to droughts and failure; crop production will decrease, worsening hunger
- **Forestry:** increased insect and disease outbreaks, increased chance of forest fires (especially in rainforests)
- **Health:** heat waves and stress can cause death, respiratory ailments, expansion of tropical diseases, increased chance of drowning if storms become intense, hunger-related ailments

Heat Waves Will Increase



(a) Change in July heat index over the next century

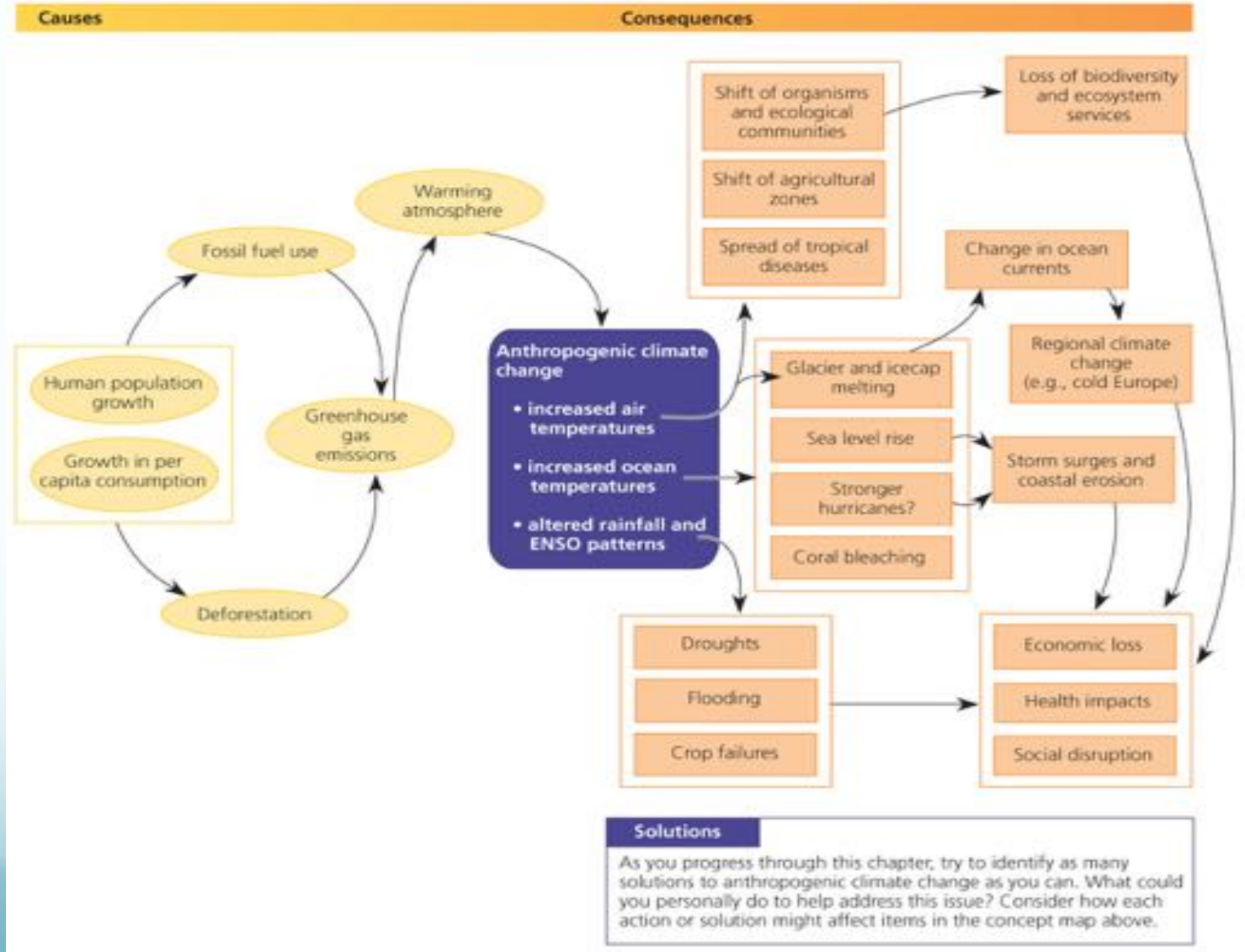


(b) Average summer mortality rates attributed to hot weather episodes

Climate Change Affects Economics

- Costs will outweigh benefits
- Widen the gap between rich and poor
- Will cost 1-5% GDP on average globally
  - Poor nations will lose more than rich ones
  - Climate change could cost 5-20% of GDP by 2200 (the *Stern Review*)

Causes and Consequences of Climate Change

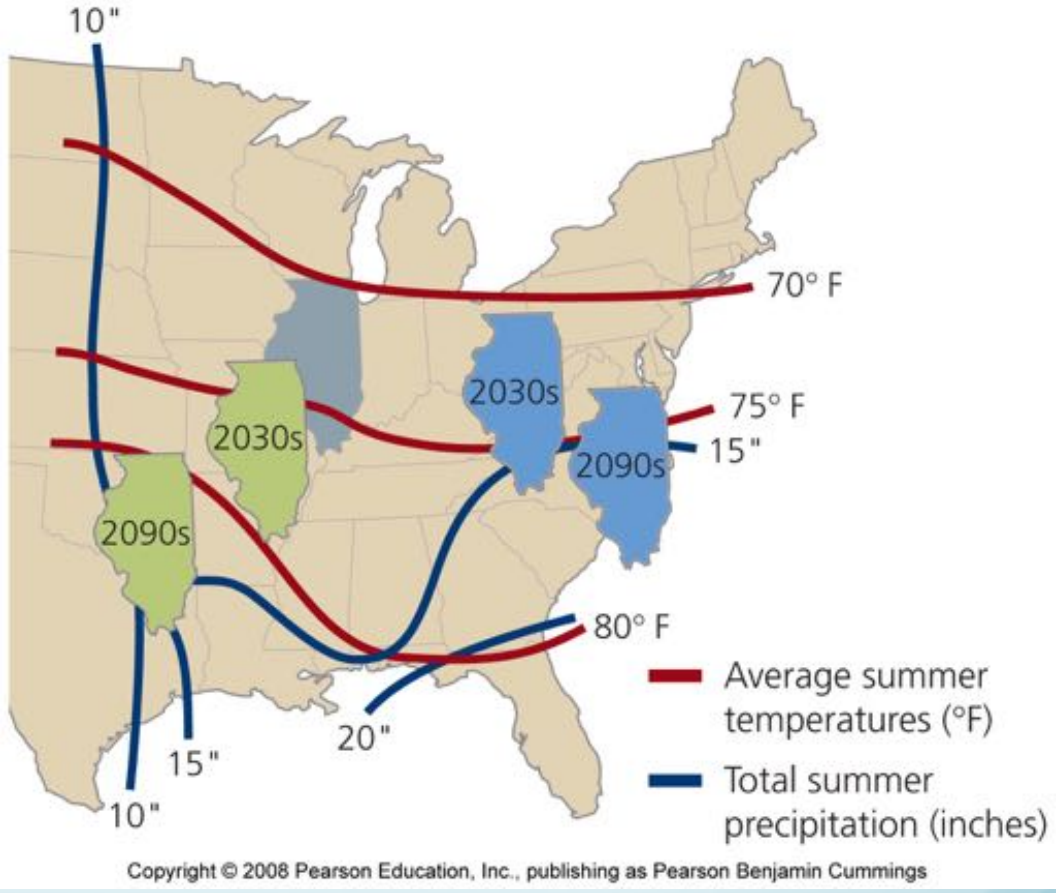


U.S. Global Change Research Program (1990)

- **Predicted:**
  - Temperature increases
  - Worse droughts and flooding
  - Decreased crop yields (but some increases) and water shortages
  - Health problems and mortality
  - Altered forest ecosystems
  - Lost coastal areas
  - Undermined Alaskan buildings and roads

Predictions From Two Models

- *By 2030, Illinois will have a climate like Missouri's.*
- *By 2090, it will have a climate like Oklahoma's (Canadian model). The Hadley model predicts that Illinois will be like West Virginia in the 2030s, and in the 2090s, like North Carolina.*
- **Green = Canadian model**
- **Blue = Hadley model**



The USGCRP Was Suppressed

- Climate change is politically divisive:
  - It challenges entrenched and powerful interests
- Some forest types will decline; others will expand (oak-hickory, oak-pine).
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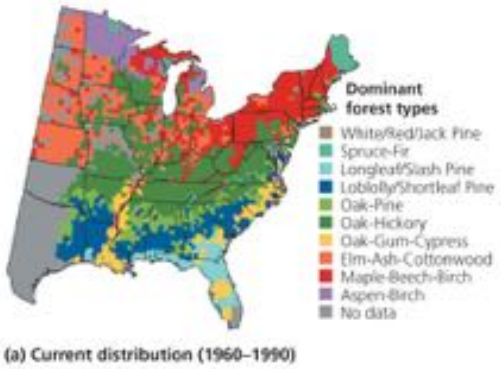


(a) Current distribution (1960–1990)


(b) Canadian scenario (2070–2100)


(c) Hadley scenario (2070–2100)

Are We Responsible for Climate Change?

- The IPCC concluded that it is more than 90% likely that most global warming is due to humans
- At the "G8" summit in 2005, national academies of 11 nations issued a joint statement urging political leaders to take action
- Despite broad scientific consensus that climate change is a pressing issue, it remains mired in an outdated debate
  - Is global warming real? Are humans to blame?
- The debate was fanned by skeptics-funded industry
  - Aimed to cast doubt on the scientific consensus
  - Today, the debate is largely over

The Debate Over Climate Change is Over

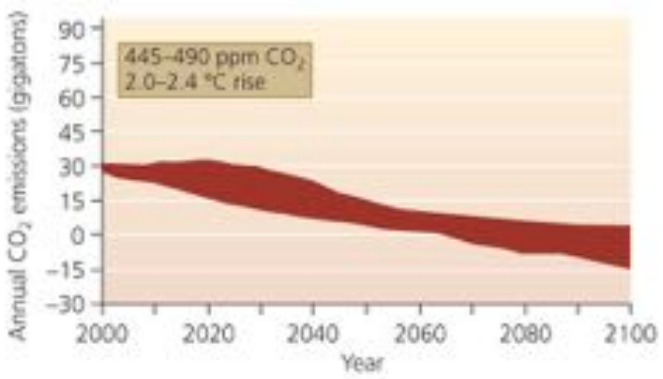
- Most Americans accept that fossil fuel consumption is changing the planet
- *An* **Inconvenient Truth** helped turn the tide
  - 84% of people surveyed thought that humans contribute to global warming
  - Many corporations offer support for greenhouse gas reductions

Shall We Pursue Mitigation or Adaptation?

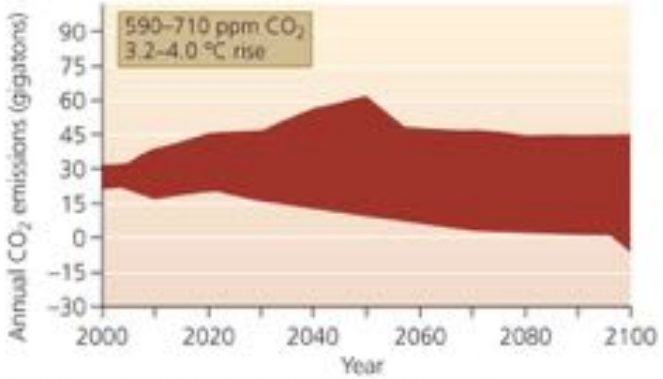
- **Mitigation:** Pursue actions that reduce greenhouse gas emissions, in order to lessen severity of future climate change
  - Renewable energy sources, farm practices to protect soil integrity, preventing deforestation
- **Adaptation:** Accept climate change is happening and pursue strategies to minimize its impacts on us
  - Criticized as sidestepping
- Both are necessary

We Need to Act Fast

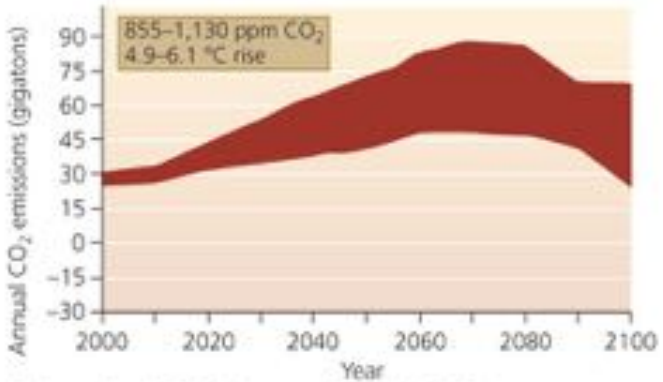
The faster we reduce our emissions, the less we will alter climate



(a) Scenario 1: Emissions peak soon



(b) Scenario 2: Emissions peak in 2020–2060



(c) Scenario 3: Emissions peak in 2060–2090

Essay Question:
Turn & Talk

1. List five major trends in climate that scientists have documented so far.
2. Now list five future trends or impacts that they are predicting.

Essay Question:
Turn & Talk

1. Describe how rising sea levels, caused by global warming, can create problems for people.
2. How may climate change affect marine ecosystems.

Essay Question:
Turn & Talk

1. How might a warmer climate affect agriculture?
2. How is it affecting distributions of plants and animals?
3. How might it affect human health?