Reading Suggestions for Reports (in no particular order):
1. The Climate of Mars, Scientific American, May 1986, 54-62. *It started out much like the Earth’s early climate, but it evolved differently.* Once warm enough to support flowing water, Mars is now so cold that carbon dioxide freezes at the poles every winter. What happened? This would be a good article to compare with findings from more recent missions to Mars. How has thinking about Mars changed?

2. Climate modeling – two articles: (a) The Science of Climate-Modelling and a Perspective on the Global-Warming Debate by S.H. Schneider, in Global Warming: The Greenpeace Report, edited by Jeremy Leggett, Oxford University Press, 1990, p. 44-67. (b) The use and abuse of climate models by K. E. Trenberth (1997), Nature, 386, 131-133. *Climate models are the best tool we have for forecasting the changes that may lie ahead – yet they are far from perfect, especially from the point of view of trying to make policy.* These prominent climate scientists each discuss the challenges and uncertainties of climate modeling and draw implications for policy-making.

3. Climate and Civilization: A Short History, Chap 3, in Earth in the Balance by Al Gore, 192, p. 56-80. *Then Senator Gore documents how climate changes in the past have been associated with major political and social upheavals, including the French Revolution and the Irish potato famine.*

4. Opposing views on the risk of global warming: (a) Budda’s Breath, Chap. 4 of Earth in the Balance by Al Gore, 1992, p. 81-98. *Then Senator Gore discusses global warming as a long-term strategic threat to the United States – as well as the rest of humanity.* (b) Global Warming, Chap 2 of Environmental Overkill by Dixy Lee Ray, p. 12-27. *The former Washington State Governor and UW Zoology Professor examines the diversity of opinions among scientists and concludes that uncertainties are too great to justify policy decisions at that time.*


7. Modeling the geochemical carbon cycle, Scientific American, March, 1989, p.74-81. *Natural geochemical processes that result in the slow buildup of atmospheric carbon*
dioxide may have caused past geologic intervals of global warming through the greenhouse effect.


10. Summary for Policymakers and Technical Summary in *Climate Change, 2001, The Scientific Basis*, Intergovernmental Panel on Climate Change (IPCC), Cambridge University Press. *The “executive summary” of the consensus report by climate scientists from around the world, 2001 update. IPCC reports are the most authoritative documents available on the state of scientific understanding of climate and potential human-induced climate change and are the basis for international negotiations and treaties on how to respond (e.g. the Kyoto Protocol). The have also generated considerable controversy. Here you can see what the scientists themselves are able to agree on. An excellent project would be to compare this latest report to the 1990 and 1995 editions.*

11. The ice-core record: Climate sensitivity and future greenhouse warming, *Nature*, 1990, vol. 347, p. 139-145. *What trapped bubbles in Antarctic ice tell us about air composition and temperature over the past 160,000 years. Considerably more data are available now. This is article is an excellent starting point for understanding this topic.*

12. Milankovich theory and climate, *Reviews of Geophysics*, 26, p.624-657, 1988. *Sediment cores from beneath the oceans indicate that ice ages came and went with a cyclical pattern over the last few million years. This appears to be related to subtle changes in the Earth’s orbit.*

13. Hansen, J. et al. (1993) How sensitive is the world’s climate, *National Geographic Research and Exploration*, 9(2), 142-158. *Discusses the concept of climate sensitivity (essentially, how much warming can we expect as a result of doubling the CO2?), how it can be estimated from both computer models and paleoclimate data, and what the current range of estimates are. Very readable, informative, and well-illustrated.*


16. Sulfate aerosol and climate change – two readings:  (a) Charlson, RJ, Langner, J., and Rodhe, H. (1990), Sulfate aerosol and climate, Nature, 348, 22.  (b) Charlson, RJ and Wigley, TML. (1994), Sulfate aerosol and climate change, Scientific American, 270, 48-57.  Industrial era emissions of sulfur form particles that may be reflecting solar radiation back to space, thereby masking the greenhouse effect over some parts of the earth.  The first article (one page) presents a simple, back-of-the-envelop calculation.  The second describes the theory in more detail and gives the scientific context.

17. Historical foundation of greenhouse gas theory of climate change – two readings: (a) Arrhenius, S. (1896), On the influence of carbonic acid in the air upon the temperature of the ground, Philos. Mag., 41, 237-276.  (b) Crawford, E., Ambio, Feb. 1997, p.6-11.  The original greenhouse article, written over a hundred years ago, and a historian’s view of it.  The 19th century chemist, Svante Arrhenius, was able to formulate a model of the global climate and make a remarkably accurate prediction of its response to changes in carbon dioxide concentration.  The original article is fairly long and in some places hard to follow for technical reasons, although the prose is very clear (and charming).  Crawford’s analysis is helpful on the technical details and provides an excellent historical context as well.

18. Cicerone, RJ et al. (2001) Climate Change Science, An Analysis of Some Key Questions, National Research Council, National Academy Press, 29 pages.  Shortly after the 2001 IPCC Report was issued, the Bush Administration asked the U. S. National Academy of Sciences for an assessment of the IPCC assessment.  Here is the document they produced in about 1 month of “cramming”.  The panel consisted of prominent climate scientists including some of the leading skeptics in the global warming debate.  Does this report support or undermine the IPCC report?  (see 10, above)

19. Mote, Phil et al. (1999) Impacts of Climate Variability and Change in the Pacific Northwest, Report of the Pacific Northwest Regional Assessment Group for the U.S. Global Change Research Program, 109 pages.  The UW Climate Impacts Group summarizes how climate changes effect the ecosystems and economy of our region.  Phil Mote will be giving a couple guest lectures, by the way.  See me for a copy if you cannot find it in the library.

20. Guns, Germs and Steel by Jared Diamond (1997), Random House, 480 pages.  A biologist/anthropologist discusses the environmental causes of the overall patterns of human history for the past 10,000 years.  Select some portion related to climate and human history and analyze using concepts developed in this course.

**Additional list of possible topics:**

**Climate of the present**
- Describe the climate of some state or country (web, etc)
- Describe climate trends during the 20th century
- Evaluate the Gaia hypothesis (read the book by Lovelock)
- Are El Nino events good or bad for the U.S. economy? (web, etc)
- Seasonal climate forecasting: how is it done? who uses it?
- Compare climates of the east coast and west coast at the same latitude
- Compare the climates of the U.S. west coast and New Zealand
- Hurricanes – causes, effects on humans, becoming more common?
- Deep ocean currents (or thermohaline circulation) and climate

**Climate of the past**
- What role did climate play in the demise of the Anasazi or other civilizations?
- Historical or artistic accounts of climate (e.g., frozen canals in Holland)
- Read "Floods, Famines, and Emperors" and describe the role that El Nino and other climate variations have played in human history
- The Little Ice Age: What effect did it have on 18th-19th century civilization? Was it global?
- The Younger Dryas event at the end of the last ice-age: was it global?
- Chronicle the gradual acceptance of one or more once-radical scientific ideas:
  - massive glaciations,
  - massive floods in Eastern Washington
  - human influence on climate.
- The American Dust Bowl

**Climate change/ climate of the future**
- What is the expected impact of global climate change on water resources, ecosystems, coastal zones, human settlements, insurance, or human health? (each of these is covered in one chapter of the report by the Intergovernmental Panel on Climate Change)
- Discuss the moral and ethical dimensions of climate change.
- What are the prospects for renewable energy? You could focus on solar energy, wind energy, tidal energy, fuel-cell vehicles, biofuels, ...
- Are trends in weather-related insurance claims related to climate change?
- Describe the role of chemical companies (which manufactured CFCs) in creating policies to eliminate CFCs.
- Shrinking tropical glaciers – evidence of global warming?