FOREST CHANGE

June 2004

UNDERSTANDING CLIMATE HISTORY ALLOWS SCIENTISTS TO BETTER ANTICIPATE FOREST RESPONSE TO FUTURE CLIMATE VARIABILITY AND CHANGE

Summary Points

- Climatic reconstructions indicate that climate changes at a variety of temporal scales.
- Forest species have responded to climate change individually rather than as intact communities.
- In the past, the effects of climate change on forests have been mediated by changes in disturbance regimes, such as fire.

Climate Impacts Group
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FOREST ECOSYSTEM CHANGE

Records of forest history indicate that vegetation changes at almost all temporal and spatial scales in response to climate change.

Many forest communities on the present landscape are recent additions, and many communities of the past have no modern-day counterparts.

- Species we see on the landscape today evolved under widely varying climatic conditions.
- Our understanding of species response to climate comes from the narrow range of possible conditions from data collected in the recent past.

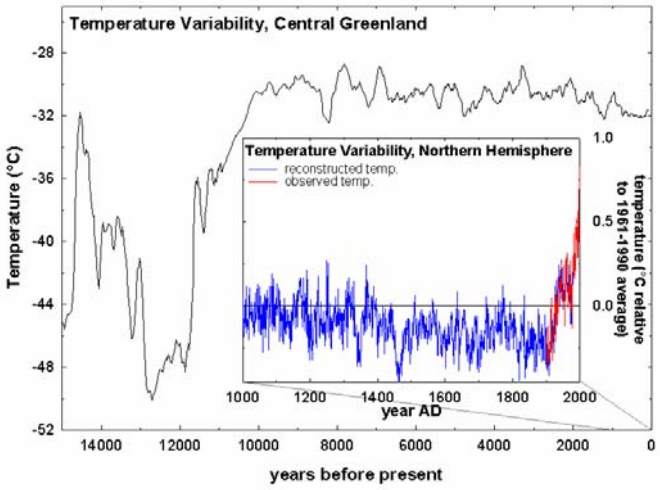


Figure 1. Ice cores, lake-sediments, and tree rings provide continuous records of past environmental change to help place predicted climate change in a historical context. Since the last glaciation, temperatures in central Greenland[1] reconstructed with oxygen isotopes from an ice core indicate temperature variability at a variety of temporal scales. More recently, temperature reconstructions (blue line)[2] indicate that recent warming (red line) is unprecedented within the last 1,000 years.

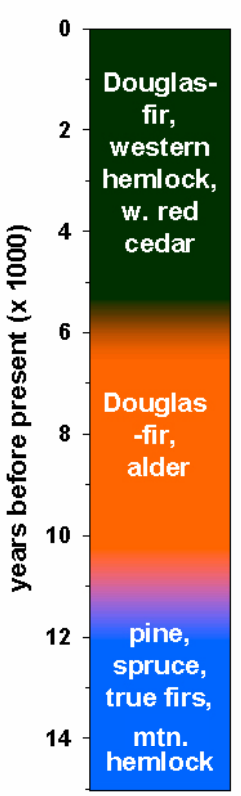
LESSONS FROM THE PAST: VEGETATION

With past climate change, individual species within a community responded uniquely to new climatic conditions.

This implies that future forest communities could be composed of novel species assemblages with little or no precedent.

Douglas-fir/western hemlock old-growth forests developed in the region around 6,000 years ago.

Pacific Northwest Lowland Forest History Timeline:



PNW FOREST CHANGE: Understanding the past to anticipate the future

LESSONS FROM THE PAST: DISTURBANCE

Disturbances such as fire are important components of forest ecosystems, and disturbance regimes have also changed with past climate.

Disturbance regimes respond directly to climate variability, and the ultimate effects on forests depend on interactions between climate, vegetation, and site-specific factors.

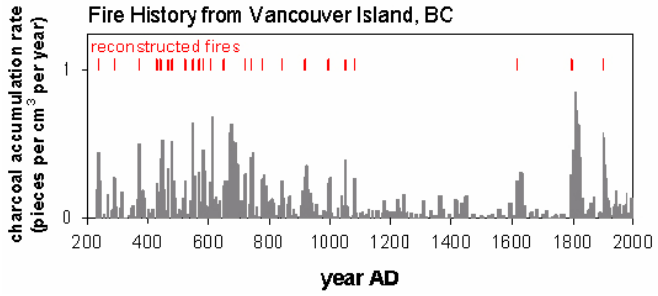


Figure 2. Fire history records from lake sediments, such as this from a coastal temperate rain forest[3], indicate that fire occurrence has varied in the past, partially in response to climate variations. Changes in fire regimes will play an important role in determining how forests respond to future climate change.

FUTURE CHANGE

While environmental change has been a constant in the past, future climate change is of concern because of its predicted *rate*.

Estimates of future temperature increases are for > 2 degrees C in the next 100 years (IPCC, 2001: www.ipcc.ch).

This rate of future climate change may outpace the ability of species to adapt and/or migrate. As a consequence, in some places future forests may have little resemblance to the modern landscape.

Altered species distribution and abundance may affect productivity, carbon cycling, and wildlife habitat.

IMPLICATIONS

1. Forest communities are dynamic and will change at a variety of spatial and temporal scales in response to climate changes.
2. The range of past variations in climate and forests can be used to provide a context in which to view future change and management options.

[1] Alley, R.B. 2004. GISP2 Ice Core Temperature and Accumulation Data. IGBP PAGES/World Data center for Paleoclimatology. Data Contribution Series #2004-013. NOAA/NGDC Paleoclimatology Program, Boulder CO, USA.
[2] Mann, M.E., Bradley, R.S., Hughes, M.K. 1999. Northern Hemisphere Temperature Reconstuction for the Past Millennium, IGBP PAGES/World Data Center-A for Paleoclimatology. Data Contribution Series # 1999-014. NOAA/NGDC Paleoclimatology Program, Boulder CO, USA.
[3] Gavin, D.G., Brubaker, L.B, Lertzman, K. 2003. An 1800-year record of the spatial and temporal distribution of fire from the west coast of Vancouver Island, Canada. Canadian Journal of Forest research. 33: 573-586.

For More Information

For more information on the impacts of climate variability and change on Pacific Northwest forest resources, please contact the Climate Impacts Group. *Photo credits: Linda Brubaker, Chris Earle.*

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