Climate Changes and their Effects on Northwest Forests

By KEN SCHLICHTE

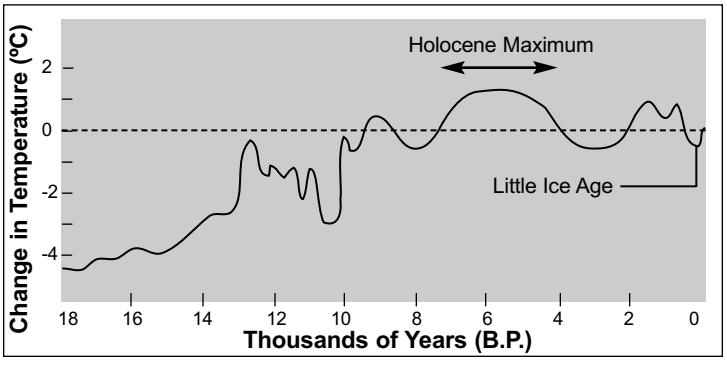
Climate changes are always occurring, for a variety of reasons. Climate changes were responsible for the melting and retreat of the Vashon Glacier back north into Canada at the beginning of the post-glacial Holocene Epoch around 11,000 years ago. Climate changes were also responsible for the warmer temperatures of the Holocene Maximum from around 10,000 to 5,000 years ago, the warmer temperatures of the Medieval Warm Period around 1,000 years ago and the coldest temperatures of the Little Ice Age during the Maunder Minimum around 300 years ago. These climate changes, the reasons for them and their effects on our Northwest forests are discussed below.

Forests soon became established on the glacial soil deposits left by the retreat of the Vashon Glacier, but some of these forests were later replaced by prairies and oak savannahs as temperatures increased during the Holocene Maximum. The Washington Department of Fish and Wildlife has reported that, "Western Washington is generally known for its forests; it is less well known that the South Puget Sound area historically had large expanses of prairie and oak savannahs. These prairies and woodland communities developed during a warm-dry period from 10,000 to 7,000 years ago on the droughty, gravelly soils deposited by the Vashon Glacier." Earth scientist Dr. Cathy Whitlock has reported that precipitation was 40-50 percent less and annual temperatures were 1-3 degrees Centigrade (approx. 2-5 degrees Fahrenheit) warmer at Battleground Lake in southwest Washington during the Holocene Maximum from about 9,500 to 4,500 years ago. Changes in the earth's axial tilt and orbit around the sun have been identified as the probable causes of the warmer temperatures of the Holocene Maximum.

The much warmer temperatures of the Holocene Maximum are illustrated in Figure 1. Globally, the timing and the maximum temperature increases of the Holocene Maximum varied from region to region. This figure also illustrates the warmer temperatures of the Medieval Warm Period around 1000 A.D. and the colder temperatures of the Little Ice Age around 300 years ago.

Forests began advancing into the South Puget Sound area prairies and replacing them as temperatures began decreasing following the Holocene Maximum. Native Americans began burning these prairies in order to maintain them against the advancing forests for their camas-gathering and game-hunting activities. Forest replacement of these and other Northwest prairies has proceeded rapidly since the late-1800s in the absence of these burning activities.

Figure 1. Variations in regional surface temperatures for the last 18,000 years, estimated from a variety of sources. Shown are changes in °C, from the value for 1900. Note that B.P. refers to Before Present.
COMPILED BY R. S. Bradley and J. A. Eddy based on J. T. Houghton et al., Climate Change: The IPCC Assessment, Cambridge University Press, Cambridge, 1990 and published in EarthQuest, vol. 5, no. 1, 1991.



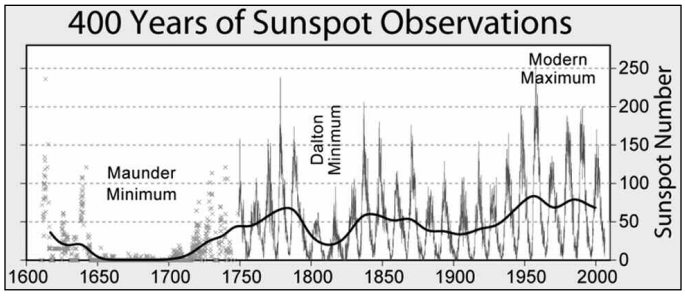
Dr. Cathy Whitlock has also reported that Northwest temperatures were warmer, natural wildfire activity was higher and drought conditions were more severe during the Medieval Warm Period, around 1,000 years ago, than they are today. These warmer conditions occurred during a period of increased solar activity known as the Medieval Maximum.

The warmer temperatures and increased solar activity of the Medieval Warm Period were followed by a period of cooler temperatures and reduced solar activity known as the Little Ice Age. The coldest temperatures and lowest solar activity of the Little Ice Age both occurred during the Maunder Minimum from 1645 to 1715, shown in Figure 2 that illustrates 400 years of variations in sunspot numbers and solar activity. Solar activity and global temperatures have both been trending generally upward to the Modern Maximum since the end of the Maunder Minimum in 1715. The Dalton Minimum was a period of lower solar activity and colder temperatures from 1790 to 1820. Mount Rainier's Nisqually Glacier reached a maximum extent in the last 10,000 years during the colder temperatures of the Maunder Minimum and the Dalton Minimum and then began retreating as Northwest temperatures warmed following the mid-1820s and the Dalton Minimum. Beginning in 1950 and continuing through the early 1980s the Nisqually Glacier and other major Mount Rainer glaciers advanced in response to the relatively cooler temperatures and higher snowfalls of the mid-century, according to the National Park Service.

The National Climatic Data

Center (Figure 3) indicates that annual temperatures in the Northwest Region (Washington, Oregon and Idaho) trended upward at a rate of 0.06 degrees Fahrenheit per decade from 1900 to 2000 for a total increase of 0.60 degrees Fahrenheit during the 20th century. The National Climatic Data Center also indicates that during the 20th century the Northwest Region's annual precipitation increased by 10 percent and the summer precipitation increased by 28 percent.

Figure 2. 400 Years of Sunspot Obervations.
SOURCE: Wikipedia article Maunder Minimum at http://en.wikipedia.org/wiki/Maunder_Minimum



The National Climatic Data Center (Figure 4) indicates that annual temperatures in the Northwest Region have trended downward at a rate of 0.95 degrees Fahrenheit per decade during the 10 years from 2000 to 2009.

Impacts of Climate Change on Washington's Economy, published in 2006 for the Washington Department of Ecology and the Washington Department of Community, Trade and Economic Development, predicted that the Northwest will continue to warm approximately 0.50 degrees Fahrenheit each decade over the next several decades and that forest acres burned annually during the 2040s will be double the forest acres burned during an average 20th century year. This 2006 prediction contrasts with the National Climatic Data Center figure indicating that Northwest annual temperatures have actually been trending downward at a rate of 0.95 degrees Fahrenheit per decade during the 10 years from 2000 to 2009.

Wildfire problems and mountain pine beetle outbreaks increased significantly in Northwest forests during the 20th century and some have suggested that climate change is responsible, despite the fact that Northwest annual temperatures increased by only 0.60 degrees Fahrenheit during the 20th century and have been trending downward since 2000. Western Forest Health and Biomass Energy Potential, published in 2001 by the Oregon Department of Energy, gives the primary responsibility for increasing wildfire problems to 20th century fire control activities that allowed development of forest communities that are overstocked and too dense for the moisture and nutrient conditions of a particular site. These forest communities are also highly susceptible to mountain pine beetle outbreaks. Forest thinning experiments that began back in the 1960s in response to increasing mountain pine beetle outbreaks have indicated that thinning of dense overstocked stands minimizes the potential for outbreaks.

Figure 3. Annual Temperature Northwest Region.
Annual 1900-2000 Average = 46.70 degrees F
Annual 1900-2000 Trend = 0.06 degrees F/decade

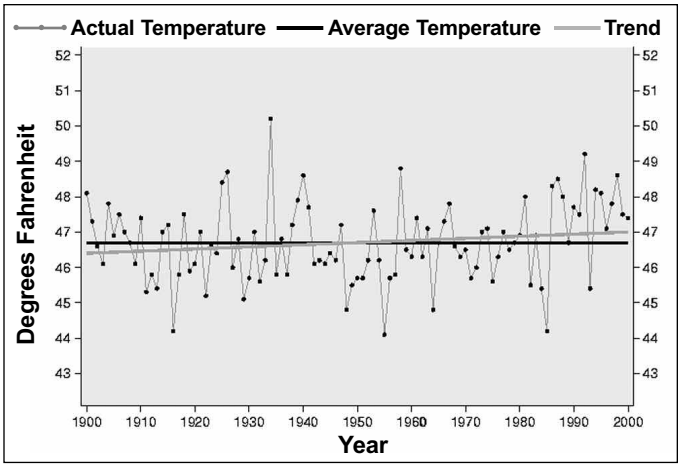
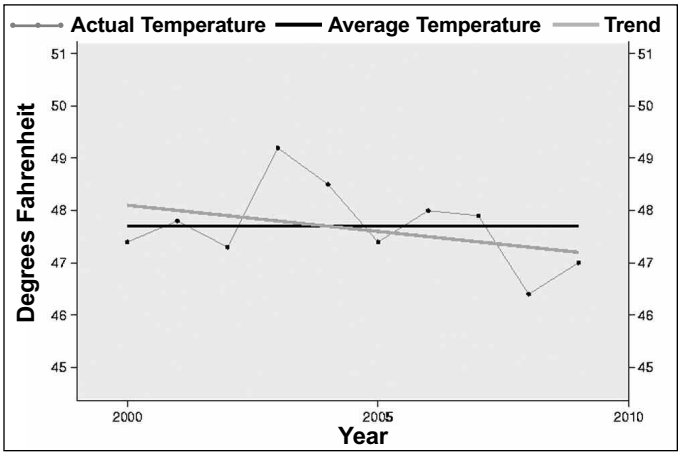


Figure 4. Annual Temperature Northwest Region.
Annual 2000-2009 Average = 47.68 degrees F
Annual 2000-2009 Trend = -0.95 degrees F/decade



In summary, climate changes are always occurring for a variety of reasons, and Northwest forests have experienced a wide range of temperatures in the 11,000 years of the Holocene Epoch. Temperatures have been trending upward since the end of the Maunder Minimum in 1715, but Northwest annual temperatures trended upward only 0.60 degrees Fahrenheit during the 20th century. Fire control activities in the 20th century have been given primary responsibility for the dense overstocked forest stand conditions that have led to the increasing wildfire problems and mountain pine beetle outbreaks in Northwest forests. ■

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