

TESTIMONY SUBMITTED BY DR. ANTHONY WESTERLING FOR THE HOUSE SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES' OVERSIGHT HEARING ON ENERGY POLICY AND CLIMATE CHANGE ON PUBLIC LANDS

March 20, 2007, 2:00 PM

I thank Congressman Jim Costa and the members of the subcommittee on Energy and Mineral Resources for this opportunity to testify on recent research regarding the impact of climate change on public lands. I have a PhD in Economics from the University of California, San Diego. I currently hold joint appointments as Assistant Professor of Environmental Engineering and Assistant Professor of Geography at the new University of California campus in Merced, California. Prior to taking these appointments, I worked as a research scientist in Scripps Institution of Oceanography for six years, focussing primarily on climate and wildfire. I am a principal investigator in the NOAA Regional Integrated Science and Assessment (RISA) Program for California and in the California Energy Commission-supported California Climate Change Center, both centered at Scripps Institution of Oceanography. The research I will present in my testimony today was conducted at Scripps Institution of Oceanography supported by the NOAA RISA program, the USDA Forest Service, and the California Energy Commission.

WILDFIRE HAS GREATLY INCREASED IN WESTERN FORESTS.

Since the 1970s and early 1980s, the frequency of large forest wildfires (those greater than 1000 acres) has increased roughly 300 percent. The area burned in these fires has increased more than 500 percent. That is, there has been a substantial shift toward larger wildfires in western forests since the mid-1980s. (Westerling et al 2006).

The length of time individual fires burn on average has increased from one week to five weeks. The wildfire season itself has also lengthened by about two thirds. (Westerling et al 2006).

The greatest increase in forest wildfire has occurred in the Northern Rockies, between 6000 and 8000 feet in elevation. (Westerling et al 2006).

MOST OF THIS INCREASE IN WILDFIRE IS DUE TO WARMING AND EARLIER SPRINGS.

A trend towards warmer temperatures that has intensified in recent decades has resulted in a trend toward earlier Spring snowmelts (which are now occurring 1 - 4 weeks earlier than they did 50 years ago), and this has led to more large wildfires in western forests. (Mote et al 2005, Stewart et al 2005, Westerling et al 2006)

Since 1970, 56% percent of large forest wildfires and 72% of area burned in large forest wildfires occurred in years with early Spring snowmelts, while only 11% of large wildfires and 4% of area burned in large wildfires occurred in years with late spring snowmelt. (Westerling et al 2006)

In years with warm temperatures and early springs, the snow has melted out earlier from mid-elevation forests. Snow carries over a significant portion of the winter precipitation that falls in western mountains, releasing it more gradually in late spring and early summer, providing an important contribution to spring and summer soil moisture (Sheffield 2004). An earlier snowmelt can lead to an earlier, longer dry season, providing greater opportunities for large fires due both to the longer period in which ignitions could potentially occur, and to the greater drying of soils and vegetation. Consequently, it is not surprising that the incidence of large forest fires is strongly associated with snowmelt timing (Westerling et al 2006)

It is true that 20th Century fire suppression and land use have lead to increased fuel loads in some western forests, such as dry ponderosa pine forests in the Southwest and parts of the Sierra Nevada (Allen et al 2002, Covington et al 2000). However, the greatest increase in forest wildfires has occurred in more moist and naturally more dense forests of the Northern Rockies where plentiful fuel loads and the risk of large fires have not been significantly increased by the cumulative effects of fire suppression and land use (Schoennagel et al 2004, Schoennagel et al 2005, Whitlock 2004). Furthermore, even in forests that grew thicker over the 20th Century due to fire suppression and land uses such as grazing, large forest wildfires still tend to occur in warm years with early springs.

AS HUMAN-CAUSED CLIMATE CHANGE CONTINUES, WE WILL SEE MORE VERY ACTIVE FOREST WILDFIRE SEASONS.

The results of this research have important implications for resource management on federal lands in a warmer climate. They demonstrate that warmer temperatures result in more (and larger) large forest wildfires.

The increased frequency of large forest wildfires observed in recent decades, considered in isolation, is not by itself evidence of climate change. However, we know from other research that human activity is warming the climate (IPCC 2007), and increased forest wildfire due to warming and earlier springs is an effect we expect to see in a world with a warming climate.

The very substantial increase in large wildfire frequency, in area burned, in the length of time fires burn, and in the length of the fire season in western forests have been associated with an increase in average spring and summer temperatures of less than 1 degree Celsius since the 1970s (Westerling 2006). This is less than half the IPCC's consensus range of temperature increase by 2040 to 2069 for western North America (Running 2006).

Thus, it is likely that forest wildfire activity will continue to intensify over the coming century. However, the full effects are difficult to anticipate, because we expect there will also be changes in the structure and species composition of western forests due to changes in climate and in wildfire, and these are likely to have feedback effects on wildfire. Assessments of the synergistic effects of changes in vegetation, wildfire, and other disturbances like insects in a warming climate are urgently needed.

FIRE SUPPRESSION, FUELS MANAGEMENT AND ECOLOGICAL RESTORATION ALL HAVE A ROLE TO PLAY. THERE IS NO SINGLE POLICY THAT IS LIKELY TO REVERSE THE TREND TOWARD MORE WILDFIRES.

Western forests are diverse, and the risk of a large fire burning in these forests is the result of complex interactions between climate, ecosystems, and past wildfire and management. Different forest ecosystems can have different responses to climate change and to management policies. Policies need to be tailored to the needs of diverse ecosystems.

Thinning forests that have been “thickened” by past management practices may help to reduce fuel loads that have led to more severe fires in some places (for example, Ponderosa pine forests in the Southwest).

However, thinning naturally dense forests (such as lodgepole pine in mid-elevation Northern Rockies forests) is a very different matter: it amounts to introducing an additional disturbance to forests already stressed by warming and earlier springs. It is not necessarily the case that such thinning would make these ecosystems more resilient to climate change, nor reduce the likelihood of large fires.

Fuels management around structures and communities in the wildland/urban interface will continue to be an important means of protecting property at risk.

Increased fire suppression efforts in forests where in the past such efforts have resulted in increased fuel loads might, if effective in actually suppressing fires, further increase the vulnerability of these forests to climate change by preventing the reduction of (or further increasing) fuel loads. Appropriate use of natural and management fires might reduce fuel loads and the risk of large, severe fires in these forests.

Further intensification of fire suppression efforts may not be very effective. Federal land management agencies devote considerable resources to suppressing wildfires, and the technologies employed have developed in sophistication over the last century. However, fire suppression technologies are still not very effective under climatic conditions that foster the rapid spread of wildfires.

CONCLUSION

Warming and earlier springs have led to increases in forest wildfire, including more large fires, more area burned in large fires, longer burning fires, and a longer fire season.

Human-caused climate change will lead to additional warming in future decades, and this will lead to further increases in forest wildfire in the western US.

There is no single, simple management policy that will reverse this trend: complex problems don't always have simple answers.

Policies that mitigate climate change by reducing the rate at which greenhouse gasses accumulate in the atmosphere will help to mitigate future increases in wildfire.

REFERENCES

Allen, C.D. et al. 2002 Ecological Restoration of Southwestern Ponderosa Pine Ecosystems: A Broad Perspective. *Ecol. Appl.* 12, 1418-1433 .

Covington, W.W. 2000. Helping western forests heal. *Nature* 408, 135-136.

IPCC 2007 Climate Change 2007: The Physical Science Basis: Summary for Policymakers.

Mote, P. W. et al., *Bull. Am. Meteorol. Soc.* 86, 39 (2005).

Running, S. W. 2006 "Is Global Warming Causing More, Larger Wildfires?" *Science*, 313: 927 - 928.

Schoennagel, T., Veblen, T.T. & Romme, W.H. 2004. The Interaction of Fire, Fuels, and Climate across Rocky Mountain Forests. *BioSci* 54, 661-676.

Schoennagel T., Veblen, T.T., Romme, W.H., Sibold, J.S. & Cook, E.R. 2005. ENSO and PDO variability affect drought-induced fire occurrence in Rocky Mountain subalpine forests. *Ecol. Appl.* 15, 2000–2014.

J. Sheffield, G. Goteti, F. H. Wen, E. F. Wood, J. 2004 *Geophys. Res.* 109, D24108

Stewart, I.T., Cayan, D.R., Dettinger, M.D., 2005 Changes toward earlier streamflow timing across western North America. *J. Clim.* 18, 1136-1155.

A.L. Westerling et al 2006: "Warming and Earlier Spring Increases Western U.S. Forest Wildfire Activity" *Science*, 313: 940-943.

Whitlock, C. 2004 Land management: Forests, fires and climate. *Nature* 432, 28-29.