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Springtime Temperature Swings Attack Northeastern Forests
Seasonal Weather Related to Large-Scale Climate Pattern

BOULDER—Forest dieback in the northeastern United States and neighboring areas in Canada has been more frequent, more persistent, and more severe during recent decades, research has shown. Now scientists have found springtime temperature swings have intensified in that region during the same period. A new study links these escalating freeze-thaw episodes, which are known to harm trees, to an atmospheric pressure imbalance over the North Atlantic. The research, by scientists at the National Center for Atmospheric Research (NCAR) and the University of Washington, is published in the December 15 issue of the *Journal of Climate*, a publication of the American Meteorological Society (AMS).

The new study focuses on two regions, New England and Quebec. The authors found the southern region has experienced higher maximum temperatures more frequently in winter in recent decades, while the northern region has been hit with extreme low temperatures more often. Researchers believe both trends are the result of the North Atlantic Oscillation (NAO), an ocean-scale seesaw in atmospheric pressure. The NAO is strongest in winter, when the atmosphere is most active, though evident throughout the year.

The NAO produces extreme low temperatures and greater temperature variation during springtime. This may help explain the increasing loss of trees in the heavily forested region around Quebec. Though average temperatures in spring appear unaffected by the NAO, the extreme daily lows and accompanying freezes, followed by quick thaws, are occurring more often, according to the study. Such swings are hard on trees.

"If you looked only at average temperatures and thought nothing is happening to the extremes, you'd be dead wrong," says NCAR scientist Linda Mearns, who conducted the statistical analysis with Justin Wettstein, a former visitor to NCAR, now at the University of Washington.

During the NAO's "positive phase," a broad region of low pressure hovers throughout the Arctic, centered near Iceland, while abnormally high surface pressure stretches across the Atlantic from the Azores to the Iberian Peninsula. (In the "negative phase," the pressures flip-flop.)

During the positive phase, warm, moist westerly winds blow over Europe and Asia, warming land surfaces. Meanwhile, stronger than usual north winds bluster over Greenland and northeastern Canada, carrying cold air south and chilling both land and sea. A stronger-than-usual clockwise flow cools North Africa and the Middle East, while warming North America.
The NAO has been stuck in a positive phase for most of the past two decades. Recent research attributes this holding pattern to a warming of tropical ocean waters, possibly due to the buildup of greenhouse gases in the atmosphere.

Previous research has shown that the positive phase of the NAO triggers warmer winters in New York and southern New England and colder ones in Quebec on average. Mearns and Wettstein extended the research gaze beyond average temperatures to include extremes and daily variations. Temperature variations, rather than averages, says Mearns, showed the greatest effect on how often extreme lows occurred in the Canadian segment of the study area. During NAO positive years, that daily variance is high.

"Regional extreme events can have severe consequences," says Mearns, deputy director of NCAR's Environmental and Societal Impacts Group. "It's very useful if we can understand such events in the context of large-scale climate variability."

NOAA's Office of Global Programs funded Mearns and Wettstein's analysis. NCAR's primary sponsor is the National Science Foundation. The AMS (http://www.ametsoc.org/ams) is the nation's leading professional society for scientists in the atmospheric and related sciences.

-The End-

Note to Editors: PDF or faxed copies of the paper, "The Influence of the North Atlantic–Arctic Oscillation on Mean, Variance, and Extremes of Temperature in the Northeastern United States and Canada," are available to journalists from Stephanie Kenitzer, AMS press office (tel. 425-432-2192) or kenitzer@dc.ametsoc.org.

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