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Using Satellite Observations to Investigate "Greening" Trends Across Canada and Alaska

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Recent research results from scientists at the Woods Hole Research Center suggest that 'greening' has begun to decline in the high latitude forested areas of North America. The work, which represents an important advance by incorporating the full extent of the latest satellite observational record to document unique vegetation responses to climatic warming, and then projecting those trends forward in time, is now being extended to circumpolar forests. The research will be highlighted in upcoming issues of Proceedings of the National Academy of Sciences (PNAS) and in Geophysical Research Letters.

Generally, satellite observations of plant growth across the high latitudes of North America -- in Canada and Alaska -- indicate that tundra vegetation experienced an increase in both peak photosynthesis and growing season length, whereas forests experienced a decline in photosynthetic activity between 1981 and 2003. Climatic warming occurred across the entire region, but the change in the forest response indicates that long-term changes may not be predictable from initial, short-term observations. Fire disturbance has also increased with the warming but does not explain the decline in forest photosynthetic activity.

According to Scott Goetz, a senior scientist with the Center, "We believe this is some of the first evidence that high latitude forests may be in decline following an initial growth spurt associated with warming. The reasons for this decline are not certain, but related work points to increased drying as a likely cause. The observed warming and drying are consistent with climate model predictions for the region."

More specifically, Center researchers analyzed trends in a time series of photosynthetic activity across boreal North America over 22 years, from 1981 to 2003. Nearly 15 percent of the region displayed significant trends, of which just over half involved temperature-related increases in growing season, length and photosynthetic intensity, mostly in tundra. In contrast, forest areas unaffected by fire during the study period declined in photosynthetic activity and showed no systematic change in growing season length. Stochastic (random) changes across the time series were predominantly associated with a frequent and increasing fire regime. These trends have implications for the direction of feedbacks to the climate system and emphasize the importance of longer-term synoptic observations of arctic and boreal biomes.

According to Andrew Bunn, a postdoctoral fellow at the Center, "These studies are important because they describe how vast areas of forest are changing and how those changes are related to climate. They are supported by a variety of field studies from other researchers that show rapid changes in vegetation in response to climate variability."

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