WILDLAND FIRE DOES NOT AFFECT MERCURY LEVELS IN FISH

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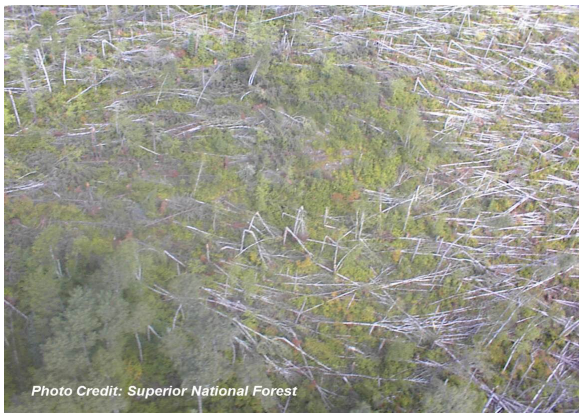
Wildland fire is a natural part of forest ecosystems in the Great Lakes region. In wilderness areas like Boundary Waters Canoe Area Wilderness (BWCAW) of the Superior National Forest, managers use prescribed fire to mimic this natural process. Prescribed fire is also used as a tool to mitigate wildfire risk.

This mitigation approach was used in northern Minnesota after a derecho event on July 4, 1999. The straight line winds toppled trees, damaged buildings, and blocked roads across North Dakota, northern Minnesota, southern Ontario and Quebec, and into New England. In response, the USDA Forest Service implemented a plan to treat areas impacted by the blowdown using prescribed fire. The objective of the prescribed fires was to consume some of the newly available fuel, thereby reducing the severity and spread of any wildfires that started in the affected region.

Fire (prescribed fire or wildfires) also has broader effects on an ecosystem, including impacting nutrient and biogeochemical cycles. For example, mercury (Hg) stored in the soil can be volatilized as a gas and become part of a larger global cycle, emitted and either re-deposited locally throughout the landscape in smoke particulates, or transported in runoff to lakes and streams following the fire. The release of Hg from the soil and into waterways has been shown to lead to an increase in Hg present in fish. And, given the concern over human exposure to Hg through the consumption of fish, it is important to understand how fire influences bioaccumulation of Hg in the food chain.

To determine if wildland fires in the region were influencing Hg cycling, data were collected from watersheds of two small lakes in the BWCAW, MN from 2004 to 2012. The lakes, Ev-



Impact of blowdown on the Boundary Waters Canoe Wilderness Area following a straight-line wind event on July 4, 1999. As a result, the Superior National Forest initiated a prescribed program to address the additional fuel loads but also had concerns about mercury pollution to the lakes.

MANAGEMENT IMPLICATIONS

- To prevent mercury from bioaccumulating in fish, use low to moderate intensity prescribed fire to decrease fuel loads.
- Low to moderate intensity prescribed fire leaves behind considerable forest floor which limits mercury in runoff from entering lakes.
- Other management techniques that limit or slow runoff following fire will lessen the amount mercury from entering lakes.

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erett and Thelma, have similar watersheds and surrounding topography. The Everett Lake watershed experienced two fire events during the study period, a low-severity prescribed fire in 2004, and a moderate severity wildfire in 2007.

Through the course of the study, researchers collected soil, water, and fish data. Samples of the soil organic horizon (O horizon) were analyzed for carbon content, organic matter, and total Hg content. For both lakes throughout the study, water was measured pH, dissolved oxygen, temperature, and Secchi disk depth. Water samples were also analyzed for P, N, total organic C, and Hg. Lake water levels were also monitored. Fish were sampled in the spring each year, and the authors report data for yellow perch. The mass, length, and age of fish were determined and were analyzed for Hg content.

The authors report that the two watersheds had similar soil C and Hg levels before the fires. After the wildfire in 2007 at Everett Lake, the watershed soils C in the O horizon decreased by approximately 26% and soil Hg by approximately 19%. And although lake productivity and nutrients increased in the growing season after the 2007 wildfire, this increase was observed in both lakes and was, therefore, unrelated to the wildfire event.

Throughout the study, fish size and Hg concentrations fluctuated. The highest levels of Hg concentration were observed at Everett Lake in 2006, 2010, and the lowest in 2012. The 2010 increase was significant, but again, this trend occurred in both lakes and the researchers concluded it was not an effect of fire. The authors determined fish Hg levels throughout this study were driven by other factors, such as the air temperature during spring hatching, and lake water levels.

While this study did not find wildland fire to have impacts on fish Hg levels, that does not mean fire in this region will never impact lake chemistry or fish Hg concentrations. These two fires captured by this study were low to moderate severity. In the event of a high severity wildfire, or a fire that burned a greater proportion of the watershed and surrounding landscape, the release of Hg from soil could be much higher and lead to an increase in fish Hg concentration.

Continued monitoring, of both fire severity and fish populations, may reveal conditions under which fish Hg concentrations increase post-fire. But at this point, there is no evidence that low to moderate severity prescribed fires or wildfires will have a negative impact on waterways or fish Hg concentrations in the BWCAW.

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