# A *Superior* Research Reader

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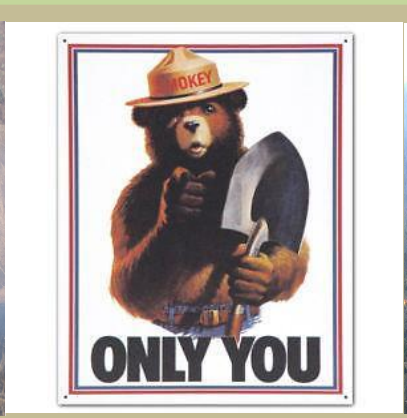


Photo Credit: USFS Forest Service

Greetings and welcome to A *Superio*r Research Reader, a monthly reader on what we believe is current and relevant research to science and resource management on the Superior.

**This Month's Edition: Fire**

With fire season in full force we thought it would be timely to highlight some recent research related to fire. Whether you are out on the line fighting fires, an organism adapting to new environments after a burn, or on a district trying to educate campers about the importance of fire prevention(as this recent newspaper article describes with the Box Elder fire in Utah), fire has a wide array of impacts in forested landscapes.

In this month's fire issue we highlight articles that explore fire history derived from red pine in the Boundary Waters Canoe Area Wilderness, the concept of Pyrodiversity and how that relates to plant-pollinator communities, understory recovery in black spruce forests after prescribed burning, and the incorporation of anthropogenic influences into fire probability models.

If you want to stay up to speed on the current status of national wildfires, take a look at this active fire mapping program from the Remote Sensing Applications Center. Stay safe, friends.

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1. Our friends Lane Johnson and Kurt Kipfmueller explore fire history derived from red pine in the BWCAW by digging into spatial and temporal fire patterns, fire strength and fire frequencies.

2. A study out of Yosemite National Park explores Pyrodiveristy, the diversity of fires within a region, and its impacts on plant-pollinator ecological communities.

3. Recent research conducted in Eastern Canada examines understory recovery in black spruce forests after both prescribed burning and different types of harvesting.

4. Michael Mann and his team of researchers assess the effects of human activity, the role of climate and anthrogenic influences on the state of California's fire regime.

## A fire history derived from Pinus resinosa Ait. for the Islands of Eastern Lac La Croix, Minnesota, USA

Johnson and Kipfmueller. 2016. Ecological Applications.

ABSTRACT: We reconstructed fire occurrence near a fur-trade era canoe travel corridor (used ca. 1780–1802) in the Quetico-Superior region west of Lake Superior to explore the possibility of human influence on pre-fire suppression rates of fire occurrence. Our research objectives were to (1) examine the spatial and temporal patterns of fire in the study area, (2) test fires' strength of association with regional drought, and (3) assess whether reconstructed fire frequencies could be explained by observed rates of lightning fire ignition over the modern period of record. We developed a 420-year fire history for the eastern portion of Lac La Croix in the Boundary Waters Canoe Area Wilderness (BWCAW). Seventy-one fire-scarred samples were collected from remnant Pinus resinosa Ait. (red pine) stumps and logs from thirteen distinct island and three mainland forest stands. Collectively these samples contained records of 255 individual fire scars representing 79 fire events from 1636 to 1933 (study area mean fire intervals [MFI] = 3.8 yr). Our results suggest a high likelihood that indigenous land use contributed to surface fire ignitions within our study area and highlights the importance of examining the potential effects of past indigenous land use when determining modern approaches to fire and wilderness management in fire-adapted ecosystems.

## Pyrodiversity begets plant–pollinator community diversity.

Ponsito et al. 2016. Global Change Biology

ABSTRACT: Fire has a major impact on the structure and function of many ecosystems globally. Pyrodiversity, the diversity of fires within a region (where diversity is based on fire characteristics such as extent, severity, and frequency), has been hypothesized to promote biodiversity, but changing climate and land management practices have eroded pyrodiversity. To assess whether changes in pyrodiversity will have impacts on ecological communities, we must first understand the mechanisms that might enable pyrodiversity to sustain biodiversity, and how such changes might interact with other disturbances such as drought. Focusing on plant–pollinator communities in mixed-conifer forest with frequent fire in Yosemite National Park, California, we examine how pyrodiversity, combined with drought intensity, influences those communities. We find that pyrodiversity is positively related to the richness of the pollinators, flowering plants, and plant–pollinator interactions. The heterogeneity of community composition is a primary determinant of the total species diversity present in a landscape, and thus, lower pyrodiversity may negatively affect the richness of plant–pollinator communities across large spatial scales.

## Prescribed burning of harvested boreal black spruce forests in eastern Canada: effect on understory vegetation.

Faivre, et al. 2016. Canadian Journal of Forest Research

ABSTRACT: Ecosystem-based management advocates that forestry disturbances should aim to emulate natural disturbances to mitigate the landscape-level impact of forest management. This study compares the impact of clear-cuts followed by a prescribed burn (CCPB) with clear-cuts alone (CC) and current careful logging practices (CLAAG: "careful logging around advanced growth") on understory composition within black spruce (Picea mariana Miller (BSP)) paludified forest stands at the plot, site, and treatment levels using a functional-type approach. Vascular and nonvascular taxa showed significant differences in composition at the plot level among treatments. We found that pioneer taxa occurred mainly in CCPB sites, while late-successional taxa characterized CC sites. CLAAG sites had higher taxa richness than CCPB and CC sites, and we found that CCPB treatments were most likely to promote vascular taxa compositions that are more similar to those observed after natural disturbances. Additionally, the relative abundance of Sphagnum spp., responsible for paludification, was significantly reduced in sites treated by prescribed burning. This study therefore presents results suggesting that prescribed burning might represent a sustainable alternative to current harvesting techniques in the Clay Belt of eastern Canada that could help in preserving biodiversity (in terms of understory species assemblage) while maintaining or even enhancing forest productivity.

## Incorporating Anthropogenic Influences into Fire Probability Models: Effects of Human Activity and Climate Change on Fire Activity in California

Mann et al. 2016. PLOS One.

ABSTRACT: The costly interactions between humans and wildfires throughout California demonstrate the need to understand the relationships between them, especially in the face of a changing climate and expanding human communities. Although a number of statistical and process-based wildfire models exist for California, there is enormous uncertainty about the location and number of future fires, with previously published estimates of increases ranging from nine to fifty-three percent by the end of the century. Our goal is to assess the role of climate and anthropogenic influences on the state's fire regimes from 1975 to 2050. We develop an empirical model that integrates estimates of biophysical indicators relevant to plant communities and anthropogenic influences at each forecast time step. Historically, we find that anthropogenic influences account for up to fifty percent of explanatory power in the model. We also find that the total area burned is likely to increase, with burned area expected to increase by 2.2 and 5.0 percent by 2050 under climatic bookend. Our two climate models show considerable agreement, but due to potential shifts in rainfall patterns, substantial uncertainty remains for the semiarid inland deserts and coastal areas of the south. Given the strength of human-related variables in some regions, however, it is clear that comprehensive projections of future fire activity should include both anthropogenic and biophysical influences. Previous findings of substantially increased numbers of fires and burned area for California may be tied to omitted variable bias from the exclusion of human influences. The omission of anthropogenic variables in our model would overstate the importance of climatic ones by at least 24%. As such, the failure to include anthropogenic effects in many models likely overstates the response of wildfire to climatic change.