A *Superior* Research Reader

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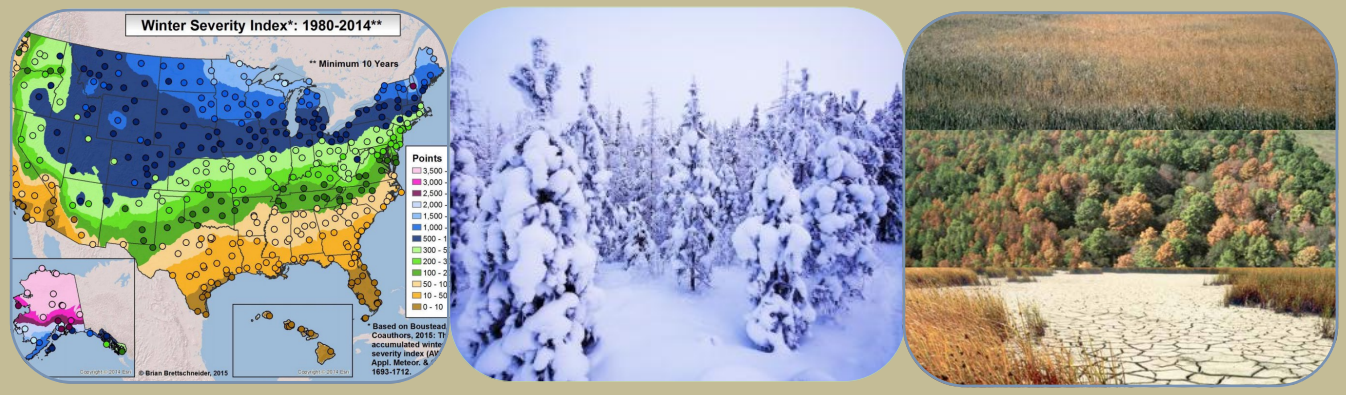

Photo Credit: Midwestern Regional Climate Center, Boreal.org, US Forest Service

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: Climate Change Monitoring

As part of the new Planning Rule, National Forests are now required to incorporate climate change monitoring into their Forest Plans. On May 9, 2016 the Superior National Forest officially incorporated two new questions into its monitoring program to track how climate change will impact the resources on our Forest:

1. How are timing and duration of winter weather conditions changing across the plan area on an annual basis? How is this affecting the plan area?
2. How are drought duration, severity, geographic extent and timing changing across the planning area on an annual basis? How is this affecting the plan area?

These questions were developed as a result of a Great Lakes Climate Change Monitoring meeting where the Superior, Chippewa, Chequamegon-Nicolet, Ottawa, Hiawatha and Huron-Manistee National Forests all got together to discuss how to best track climate change in the Great Lakes. While the Superior and Ottawa NFs are the first to adopt these questions, our hope is that all Forests in the Great Lakes will eventually monitor this information so we are able to detect broader trends across the area. In this month's issue of the *Reader,* take a look at the science that helped to inform this monitoring!

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1. The Accumulated Winter Season Severity Index (AWSSI) will be the basis for how we track the change in winter weather conditions on the Superior NF.

2. A study in Wisconsin shows how changing winter conditions can impact the timber industry. On the Superior, we plan to compare Winter Severity with the number of timber operability days lost and the number of self-issued BWCAW permits each year. This will help us track how both timber harvest and recreation use is changing on the Forest with warmer winters.

3. The Drought Monitor will be the tool we use to track changes in moisture and precipitation on the Forest.

4. As this new Forest Service GTR shows, comparing stocking survey information to documented drought conditions will help to inform future reforestation efforts on the Forest.

The Accumulated Winter Season Severity Index (AWSSI)

Boustad et al. 2015. Journal of Applied Meteorology and Climatology.

ABSTRACT: The character of a winter can be defined by many of its features, including temperature averages and extremes, snowfall totals, snow depth, and the duration between onset and cessation of winter-weather conditions. The accumulated winter season severity index incorporates these elements into one site-specific value that defines the severity of a particular winter, especially when examined in the context of climatological values for that site. Thresholds of temperature, snowfall, and snow depth are assigned points that accumulate through the defined winter season; a parallel index uses temperature and precipitation to provide a snow proxy where snow data are unavailable or unreliable. The results can be analyzed like any other meteorological parameter to examine relationships to teleconnection patterns, determine trends, and create sector-specific applications, as well as to analyze an ongoing winter or any individual winter season to place its severity in context.

Changes in winter conditions impact forest management in north temperate forests

Rittenhouse and Rissman 2015. Journal of Environmental Management.

ABSTRACT: Climate change may impact forest management activities with important implications for forest ecosystems. However, most climate change research on forests has focused on climate-driven shifts in species ranges, forest carbon, and hydrology. To examine how climate change may alter timber harvesting and forest operations in north temperate forests, we asked: 1) How have winter conditions changed over the past 60 years? 2) Have changes in winter weather altered timber harvest patterns on public forestlands? 3) What are the implications of changes in winter weather conditions for timber harvest operations in the context of the economic, ecological, and social goals of forest management? Using meteorological information from Climate Data Online and Autoregressive Integrated Moving Average (ARIMA) models we document substantial changes in winter conditions in Wisconsin, including a two- to three-week shortening of frozen ground conditions from 1948 to 2012. Increases in minimum and mean soil temperatures were spatially heterogeneous. Analysis of timber harvest records identified a shift toward greater harvest of jack pine and red pine and less harvest of aspen, black spruce, hemlock, red maple, and white spruce in years with less frozen ground or snow duration. Interviews suggested that frozen ground is a mediating condition that enables low-impact timber harvesting. Climate change may alter frozen ground conditions with complex implications for forest management.

The drought monitor

Svoboda et al. 2002. Bulletin of the American Meteorological Society.

ABSTRACT: The Drought Monitor was created with the goal of tracking and displaying the magnitude and spatial extent of drought and its impacts across the United States. The Drought Monitor is produced weekly and classifies drought severity into four major categories, with a fifth category depicting "abnormally dry" conditions. The category thresholds assigned to locations on a map are determined from a number of indicators, or tools, blended with subjective interpretation. The Web site for the drought monitor is maintained at the University of Nebraska.

Effects of drought on forests and rangelands in the United States: A comprehensive science synthesis

Voss et al. 2016. Forest Service GTR WO-93b

ABSTRACT: This assessment provides input to the reauthorized National Integrated Drought Information System (NIDIS) and the National Climate Assessment (NCA), and it establishes the scientific foundation needed to manage for drought resilience and adaptation. Focal areas include drought characterization; drought impacts on forest processes and disturbances such as insect outbreaks and wildfire; and consequences for forest and rangeland values. Drought can be a severe natural disaster with substantial social and economic consequences. Drought becomes most obvious when large-scale changes are observed; however, even moderate drought can have long-lasting impacts on the structure and function of forests and rangelands without these obvious large-scale changes. Large, stand-level impacts of drought are already underway in the West, but all U.S. forests are vulnerable to drought. Drought-associated forest disturbances are expected to increase with climatic change. Management actions can either mitigate or exacerbate the effects of drought. A first principal for increasing resilience and adaptation is to avoid management actions that exacerbate the effects of current or future drought. Options to mitigate drought include altering structural or functional components of vegetation, minimizing drought-mediated disturbance such as wildfire or insect outbreaks, and managing for reliable flow of water.