A *Superior* Research Reader

Volume 19, November 2016

Photo Credit: Minnesota Department of Natural Resources

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: Minnesota's Native Plant Communities

Many of the folks who work on the Superior are likely very familiar with the Ecological Land Types (ELTs) that are described in the Forest Plan. But how often do you use the Land Type Phase (LTP) mapping that we have on the Forest? The LTP polygons are smaller, more refined units meant to provide information about the soils and vegetation of a small area of the Forest. And while this map layer *should* be very useful for all of the management activities we conduct on the Forest, it is extremely underutilized because the information does not currently provide the level of plant community detail that many people need. In fact, most folks on the Forest have expressed a greater interest in utilizing the Native Plant Community (NPC) classification produced by the DNR. That is why this past year we partnered with the MN DNR to pilot a project where the Superior NF will attempt to crosswalk our Forest LTP classification with the MN DNR's NPC classification. Between Superior NF staff and Minnesota Biological Survey staff we sampled nearly 100 vegetation plots this past summer and have an agreement in place to complete the same amount of plots next field season. If all goes well, our LTP map layer on the Forest will soon be translated into Minnesota's Native Plant Communities! In case you're unfamiliar with the NPC system, we're providing some background information in this month's issue of the Reader. Take a look and get acquainted with the great work our partners at the State have been producing for more than a decade. Soon the Forest and the State will be speaking the same language when it comes to classifying Minnesota's plant communities.

Enjoy this issue of the Reader!
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1 & 2. A description of the NPC classification process and methods and information about the historic dataset used to inform the project.

3. A field guide to the Laurentian Mixed Forest Province, the area the Superior National Forest calls home. Familiarize yourself with the plants and geologic history that make this area unique and distinguish the "arrowhead" region from the rest of the state.

4. This recent study uses data collected by MN DNR staff on MN native plant communities (on the Superior National Forest!) to draw conclusions about the effects of nitrogen deposition on plant diversity worldwide. Local information scaled up globally.

Minnesota's native plant community classification: A statewide classification of terrestrial and wetland vegetation based on numerical analysis of plot data

Aaseng et al. 2011. Biological Report No. 108, Minnesota County Biological Survey.

ABSTRACT: The Minnesota Department of Natural Resources completed a new classification of native plant communities for the state of Minnesota in 2003. Researchers used numerical tools, including ordination, cluster analysis, and indicator species analysis, to guide classification of 5,224 vegetation plots spanning most of the range of terrestrial and wetland vegetation in Minnesota. Analyses of plant species data were supplemented with interpretation of soils data and other site data in defining and delineating classification entities. The plant community classification was integrated with Minnesota's ecological land classification system. The resulting plant community classification is hierarchical, with six levels. Among the upper levels is the Ecological System, which groups plant communities according to influence by ecological processes such as flooding or fire. Ecological systems are well suited for biodiversity conservation and forest resource mapping and planning at the landscape scale. The Floristic Region, another important upper level, is based on geographic patterns of plant distribution that became apparent only after numerous rounds of analysis of plot data and development of lower levels of the classification. In some instances these patterns correlate strongly with paleovegetation patterns. The lowest levels of the classification correlate with local gradients of moisture and nutrients for terrestrial communities and with water chemistry and water-level fluctuations for wetland communities, and are being applied to site-scale conservation and management activities. The Minnesota Department of Natural Resources has developed a series of tools for use of the classification, including field guides for identification and interpretation of plant communities, and forest management tools centered around native plant community classes.

Minnesota's Bearing Tree Database

Almendinger, John C. 1996. Minnesota Department of Natural Resources.

ABSTRACT: Survey records and notes from the rectangular survey of public lands (PLS) in the United States can provide ecologists with valuable information about trees and vegetation. These historical data predate widespread settlement by Europeans and thus, are especially valuable where the vegetation has been altered greatly in the past century. The fact that the PLS predates settlement is no accident. The survey was prerequisite for the public sale of lands in what was then the western territory. The PLS started in 1847 in Minnesota with the westward extension of standard parallels from the fourth principal meridian. Bearing trees are a special kind of witness tree which the surveyors notched, blazed, and scribed in a standard way to facilitate the relocation of the survey corner should the wooden corner post or corner stone be lost or moved. The surveyor was required to note for each bearing tree: 1) its type (~species), 2) its diameter, 3) its distance to the corner, and 4) its azimuth or "bearing" from the corner and hence its applied name. These are the actual data associated with an individual bearing tree that ecologists use.

Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province

Ecological Land Classification Program, Minnesota Department of Natural Resources. 2003.

ABSTRACT: The Laurentian Mixed Forest (LMF) Province traverses northern Minnesota, Wisconsin, and Michigan, southern Ontario, and the less mountainous portions of New England. In Minnesota, the LMF Province covers a little more than 23 million acres (9.3 million ha) of the northeastern part of the state. In Minnesota, the Province is characterized by broad areas of conifer forest, mixed hardwood and conifer forests, and conifer bogs and swamps. The landscape ranges from rugged lake-dotted terrain with thin glacial deposits over bedrock, to hummocky or undulating plains with deep glacial drift, to large, flat, poorly drained peatlands. Precipitation ranges from about 21 inches (53 cm) annually along the western border of the Province to about 32 inches (81 cm) at its eastern edge in Minnesota. Normal annual temperatures are about 34°F (1°C) along the northern part of the Province in Minnesota, rising to 40°F (4°C) at its southern extreme. Under influence of climate, the overall pattern of vegetation change across the Province in Minnesota is from warm and dry habitats in the southwest to cooler and moister ones in the northeast. Linked to climate are several other factors with southwest to northeast gradients that have important influence on vegetation and species ranges. Most notable are growing-degree days, evapotranspiration, and the depth and duration of snow cover.

Conditional vulnerability of plant diversity to atmospheric nitrogen deposition across the United States

Simkin et al. 2016. Proceedings of the National Academy of Sciences.

ABSTRACT: Atmospheric nitrogen (N) deposition has been shown to decrease plant species richness along regional deposition gradients in Europe and in experimental manipulations. However, the general response of species richness to N deposition across different vegetation types, soil conditions, and climates remains largely unknown even though responses may be contingent on these environmental factors. We assessed the effect of N deposition on herbaceous richness for 15,136 forest, woodland, shrubland, and grassland sites across the continental United States, to address how edaphic and climatic conditions altered vulnerability to this stressor. In our dataset, with N deposition ranging from 1 to 19 kg N·ha^{-1}·y^{-1}, we found a unimodal relationship; richness increased at low deposition levels and decreased above 8.7 and 13.4 kg N·ha^{-1}·y^{-1} in open and closed-canopy vegetation, respectively. N deposition exceeded critical loads for loss of plant species richness in 24% of 15,136 sites examined nationwide. There were negative relationships between species richness and N deposition in 36% of 44 community gradients. Vulnerability to N deposition was consistently higher in more acidic soils whereas the moderating roles of temperature and precipitation varied across scales. We demonstrate here that negative relationships between N deposition and species richness are common, albeit not universal, and that fine-scale processes can moderate vegetation responses to N deposition. Our results highlight the importance of contingent factors when estimating ecosystem vulnerability to N deposition and suggest that N deposition is affecting species richness in forested and nonforested systems across much of the continental United States.