A *Superior* Research Reader

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Photo Credit: Jordan Mead (UMD), Andy Levar (MN DNR) , Derrick Passe (Lake County SWCD)

Greetings and welcome to A *Superior* 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: 1st Annual Superior National Forest Research Slam!

For those of you who couldn't make it, the first annual Superior NF Research Slam was a huge success. The event, held November 10th at the Great Lakes Aquarium in Duluth, was an opportunity for researchers with approved research permits on the Forest to interact with Superior NF staff. The "Slam" format allowed each researcher 5 slides and 5minutes to summarize their project work on the Superior. Presentations were followed by an afternoon of round table and one-on-one conversations between attendees.

With nearly 20 research teams attending and presenting, the 'Slam' was able to connect researchers with Forest Service staff , giving Superior NF employees the opportunity to express research needs and learn about the wide array of research occurring on the Forest. Thank you to all the staff who attended. Your willingness to engage is what made the event a success. For those of you who couldn't make it, this issue is dedicated to highlighting the information that was presented at the event. Check out some of the great research happening on the Forest! Enjoy and be sure to RSVP early next year if you'd like to attend—the house was packed!

Happy reading,

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BWCA Lake Monitoring Partnership

Jesse Anderson. Minnesota Pollution Control Agency

ABSTRACT: A cooperative water quality monitoring program on three heavily used lakes in the BWCA. This project was a partnership between Superior National Forest, the MPCA, and instructors and students from Vermilion Community College.

Assessing the acarological risk of human exposure to tickborne pathogens in Minnesota

Jenna Bjork. Minnesota Department of Health

ABSTRACT: Ixodes scapularis, the blacklegged (deer) tick, is the primary vector of several pathogens causing human disease in the United States. Over the last two decades, I. scapularis-borne diseases have increased in incidence as well as geographic distribution. We are developing an acarological risk model for Minnesota that can be used to identify areas of elevated abundance of host-seeking I. scapularis and areas of future range expansion. Preliminary results indicate that 73 (87%) of 84 sites visited in 2015 yielded at least one I. scapularis tick, including a site within the Superior National Forest.

Results and Implications of the Minnesota Biological Survey on the Superior National Forest

Lawson Gerdes. Minnesota Biological Survey

ABSTRACT: Initial assessment for sites of biodiversity significance by the Minnesota Biological Survey (MBS) is nearing completion statewide, with field surveys remaining primarily in northern Minnesota, including portions of the Superior National Forest (Forest). MBS field surveys on the Forest in 2015 were conducted primarily in the Border Lakes and the Little Fork-Vermilion Uplands ECS Subsections of St. Louis Counties, and included targeted plant & animal species searches, vegetation plot sampling, documentation of high quality native plant communities, landscape characterizations within MBS preliminary sites of statewide biodiversity significance, and monitoring of select rare species populations. Results of the MBS are incorporated into several databases maintained by the MN Department of Natural Resources. MBS results from the Forest include the discovery of species new to the state, documentation of compositional variation with NPCs across landforms, and the interpretation of multi-scaled factors, such as disturbance, influencing the assessment of biodiversity significance. The application of MBS data on the Forest have been applied to many aspects of land and resource management on the Forest and is expected to expand, as long-term vegetation monitoring is enhanced to measure the degree to which adaptive management strategies are successful at improving the ability of a species, native plant community or ecosystem to absorb or adapt to change.

Will evolution rescue populations from climate change?

Katie Winkler. University of Minnesota Duluth

ABSTRACT: Project Baseline is a new research-grade seed bank that will provide an unprecedented opportunity for researchers to study plant evolution in response to environmental change over the next 50 years using the resurrection approach. In this is presentation, I will provide information about the extent of this new resource that is available to the scientific community and explain how researchers can access the materials. This living genome bank will permit experiments that extend beyond the rare cases where propagules (e.g., stored seeds, seeds preserved in tundra soils, or eggs in lake sediments) have been fortuitously available in a condition to be revived and grown side-by-side with their contemporary descendants. We are intentionally collecting seeds by maternal line from populations across geographical ranges of a diverse group of species, including sister taxa, and storing these propagules using best practices that will preserve their viability and diversity. The overall goal of this project is to provide representative samples of historical populations for future studies using the resurrection approach.

Geologic Mapping in the Arrowhead Region

Mark Jirsa. Minnesota Geological Survey

ABSTRACT: The Minnesota Geological Survey—a research and service branch of the University of Minnesota, Twin Cities—is conducting geologic mapping in the arrowhead region of the state. Specifically, we are in the process of creating County Geologic Atlases for St. Louis and Lake Counties that enclose parts of Superior National Forest lands. Atlas products typically include maps depicting bedrock, surficial sediments, depth to bedrock, and subsurface sediment layers; and the data sets used to construct them. Because these are two of the largest counties in the state, we've divided them for mapping purposes into 3 subareas referred to here as the Central, Southern, and Northern Arrowhead. Work in the Central Arrowhead subarea is currently underway. Mapping in this region is particularly relevant at this time, as these counties host areas under consideration for new mining ventures for iron, industrial minerals, and precious metals. The resulting map products may also play a role in the management of Superior National Forest, as they are designed to address issues related to surface and ground waters, among others. In addition, they may help inform wilderness managers about some of the natural wonders (in this case, geologic ones) that attract visitors to the BWCAW. Preliminary products for the Central Arrowhead subarea will be available digitally in July, 2016.

Taking on Climate Change in Northern Minnesota: Adapting Forestry Practices Using Two Native Oaks

Laura Kavajecz. University of Minnesota Duluth

ABSTRACT: In northern Minnesota traditional forest management goals and strategies are expected to encounter significant challenges under warmer, drier conditions. "Traditional" restoration goals for Great Lakes forests have focused almost entirely on reintroducing historically abundant boreal conifers to the landscape, as conifers have been selectively reduced, and are an important contributor to habitat diversity for wildlife. However, multiple lines of evidence suggest declines in boreal tree species viability due to changes in climate, which calls into question our ability to attain historical forest community composition. I evaluated proposed new "climate- smart" tactics to favor diverse suites of tree species best-suited to thrive under changed climate conditions. Specifically, within the mixed boreal, mesic pine, dry mesic pine and hardwood forests of northeastern Minnesota, certain tree species are predicted to do better than others in the climate of the future. Two of these species are red oak (Quercus rubra) and bur oak (Quercus macrocarpa). Both native oaks were planted in the four distinct forest types, with detailed monitoring of survival, growth, spring bud phenology and fall leaf phenology data of planted oak seedlings during their second growing season. I will discuss highlights and some of the striking trends in the early lives of these young seedlings.

Fire and People in the Forests of the Boundary Waters

Evan Larson. University of Wisconsin -Platteville

ABSTRACT: We completed the second year of field work in a three-year effort, funded by the National Science Foundation, to document the fire history of red pine stands throughout the BWCAW in order to seek a better understanding of how Ojibwe landuse influenced the fire history and forests of the Border Lakes Region of northern Minnesota. In all, we surveyed the shorelines and islands of 211 lakes across the wilderness, collected samples from 303 fires-scarred stumps and logs, inventoried over 930 trees to quantify forest structure and demography, and documented 28 locations throughout the wilderness where culturally-modified trees provide direct evidence of landuse during the fur trade era. In this research slam, we will be describing the context of previous fire history work in the BWCAW in which we are conducting this project, our preliminary findings from tree-ring analyses that includes 400+ years of fire history information, and the connections of this work to management.

Geochemical Signatures of transport processes in lake sediments in Northern Minnesota

Emily Mellicant. Kansas State University

ABSTRACT: Lakes are complex natural environments that interact with both their terrestrial catchments and the atmosphere. Although it is well known that lake sediments are mixtures of components derived from multiple sources, the relative difference in magnitude of different abiotic alterations on lakes sediment geochemistry is unknown. My proposed research will contribute to improved understanding of these archives by studying the spatial linkages among catchment, water and sedimentary geochemistry.

Moose and Deer in Minnesota: Using Behavior to Predict Habitat Use and Biologically Significant Interspecies Interactions

Amanda McGraw, Ron Moen. Natural Resources Research Institute

ABSTRACT: Moose (Alces alces) and white-tailed deer (Odocoileus virginianus) occur together in regions along the southern boundary of moose range. Interactions between these species are of interest because of the potential for deer to negatively affect moose populations through resource competition and disease transmission, which is particularly important in light of moose population declines in Minnesota. Like deer, moose use young forest as primary foraging habitat and management to create these habitats for moose is occurring in Minnesota. Because moose and deer forage on similar vegetation, there is concern that restored habitat could lead to increased contact between the two species. We are using activity data from GPS radio collared moose (n = 54) and deer (n = 53) to examine movement patterns and to infer behavior across multiple spatio-temporal scales. Behavior-specific habitat use will allow us to identify interactions that may serve as mechanisms for competition and disease transmission between species. We predict the highest probability of moose and deer interaction is in young forests that provide abundant forage. We also predict that older forests with open canopies function as moose foraging habitat more often than expected. We are using remotely sensed landscape data, including LiDAR, to characterize moose foraging habitat. Preliminary analyses suggest moose use of young forests is less than expected (17% ± SE 1% of the year). Moose tended to be non-migratory, whereas deer were migratory (43%) and non-migratory (57%). Migratory deer moved 8.5 km (range: 2.9-18.0 km), and did not leave moose range. Deer in interior northeast Minnesota may pose a risk to moose throughout the year in terms of resource competition and disease transmission regardless of whether or not they migrated. Minnesota may pose a risk to moose throughout the year in terms of resource competition and disease transmission regardless of whether or not they migrated.

Adaptive Restoration of White Pine: Effect of Seed Source, Site Attributes, and Earthworms

Jordan Mead. University of Minnesota Duluth

ABSTRACT: We are investigating the impact of seed source and site attributes on the fitness and growth of planted white pine (Pinus strobus) in recently logged Minnesota forests. We are interested in how temperature, soil, and competition influence restoration efforts and recovery of disturbed forest ecosystems. Specifically, I will focus on the density of non-native earthworms in both disturbed and intact forests, the impacts of these worms on soil organic structure, and possible implications for regenerating forests.

Biological Monitoring and the Superior National Forest

Nathan Miekle. Minnesota Pollution Control Agency

ABSTRACT: In 2008, the Minnesota Pollution Control Agency (MPCA) undertook the intensive watershed monitoring (IWM) effort of Minnesota's 81 major watersheds. In this effort, the agency has been monitoring and assessing all of Minnesota's major watersheds on a 10 year cycle for the support of aquatic life, recreation, and consumption. This strategy utilizes a nested watershed design, allowing the sampling of streams within watersheds from a coarse to a fine scale. Information provided from this strategy allows agency staff to identify areas that need additional work (impaired reaches) and/or additional protections (exceptional reaches). The agency also conducted other work on the forest, including: the national Environmental Monitoring & Assessment Program (EMAP), which monitors the condition of the nation's waters; and the MPCA's Long-Term Biological Monitoring (LTBM) program, which tracks biological trends throughout time

Rusty Crayfish Infestations (and Research) in the International Rainy-Lake of the Woods Watershed

Derrick Passe. Lake County Soil and Water Conservation District

ABSTRACT: Rusty Crayfish (Orconectes rusticus) have been in Northeastern Minnesota since the Late 80s (Shagawa, Moose Lakes). Trapping by the USFS showed that they were in the White Iron Chain in 2003. More recently (2012) they have been found to be moving into the BWCAW from White Iron Chain. This project is attempts to determine the efficacy of trapping and alteration of fishing practices on reducing the proliferation of rusty crayfish into the Boundary Waters on the North and South Branches of the Kawishiwi River.

Lymnaeid snails and trematode cercariae from northeastern Minnesota

J. Trevor Vannatta and Ron Moen. Natural Resources Research Institute

Abstract: Lymnaied snail surveys were conducted across St. Louis and Lake Counties in Minnesota from June – September 2015. Captured snails were kept in aquaria and monitored for cercarial shedding until death. Lymnaea megasoma, L. stagnalis, L. elodes, L. catascopium, and Fossaria spp. were all found in the study area. L. megasoma was most common and was often infected with trematode parasites. This species warrants more research as a trematode parasite vector.

Geoarchaeology of the Knife Lake Siltstone Quarry District: 2015 Exploration of the U.S. Quarries

Dave Wendt and Susan C. Mulholland. Duluth Archaeology Center/Independent Research

ABSTRACT Geoarchaeological research on the Knife Lake siltstone quarries on the U.S. side of the international border was conducted each year from 2012 to 2015 to understand the geological context of Knife Lake siltstone. The quarry bedrock is very complex in origin, with varied sedimentary deposition of volcanics subjected to folding by later metamorphic events. Regional metamorphic folding and faulting makes it difficult to predict outcrops but we now know that KLS outcrops occur across a broad area on the U.S. side of Knife Lake. High quality, finer texture siltstone occurs in lenses within some layers and was targeted for toolstone across the U.S. Quarry District. Widespread evidence of exploration and testing of outcrops exists across the region even on ridge tops far from lakes. Workshop sites with evidence of primary reduction activities are associated with utilized outcrops across the surveyed portions of the district. Workshops on shorelines of Knife Lake exhibit a wider range of secondary reduction and artifact preforms. Shoreline sites exhibit intensive utilization of lake bench-like features about 18 feet above the current lake level where rounded sediments accumulated at some time in the past and today support a dense regeneration of jack pines.

Implications of climate change for a rare arctic plant

Katie Winkler. University of Minnesota Duluth

ABSTRACT: Euphrasia hudsoniana var. ramosior is an arctic plant restricted in Minnesota to the rocky shoreline of Lake Superior. We studied traits and natural selection in four populations along the North Shore and found that plants at the coldest site were the most robust and fit, which may suggest climate change could negatively impact fitness for this species. We are currently studying the population genetics of E. hudsoniana in Minnesota and intend to repeat the natural selection study to determine if the patterns observed in 2014 hold over time.

Coniferous canopy bulk density modeling in the Superior National Forest in support of fire behavior modeling

Peter T. Wolter. Iowa State University

ABSTRACT: LANDFIRE geo-spatial data products are of insufficient detail and accuracy to calibrate fire growth and behavior models for northeast Minnesota. A salient biophysical forest parameter needed to model fire behavior is canopy bulk density (CBD), which is defined as all burnable foliage and twigs greater than three mm in diameter. In Minnesota balsam fir (Abies Balsamea) is arguably the most abundant coniferous species present, but seldom occupies a dominant or co-dominant canopy position. Because of its lower canopy position, this conifer is a significant latter fuel for propagation of canopy wildfires. To date, however, detection and quantification of key physical attributes (especially CBD) for understory balsam fir has been a challenge for optical remote sensing technologies. In this pilot project, we aim to use independent, passive in situ canopy gap fraction (CGF) measurements coupled with both non-destructive and destructive canopy fuel measurements to calibrate CBD estimation models. These CGF data will then be used as a dependent variable for calibration with satellite-measured reflectance data. Together, these relationships with be used to extrapolate spatially explicit estimates of CBD in northeast Minnesota to improve forest fire behavior modeling.

Population trends of breeding birds in the Superior and Chippewa National Forests of Minnesota, 1995-2015

Edmund Zlonis, Gerald Niemi. Natural Resources Research Institute

ABSTRACT: We determined population trends for 74 breeding bird species in the Superior and Chippewa National Forest of Minnesota, 1995-2015. A total of 326 forest stands were surveyed for breeding birds including 135 and 191 stands (953 survey points) in the Chippewa and Superior National Forests (NFs), respectively in 2015. The Superior National Forest had 17 species that increased significantly, 11 that decreased, and 35 species that were relatively stable from 1995 to 2015. Hence, 83 % of the species (52/63 species) with adequate trend information were estimated to be stable or increasing over the past 21 years.

Before-After impacts of wildfire on breeding birds in the Superior National Forest

Edmund Zlonis, Gerald Niemi. Natural Resources Research Institute

ABSTRACT: We conducted bird surveys at control and treatment areas before and after the Pagami Creek Fire in the Superior National Forest, 2010-2015. Three pre-fire and four post-fire samples were completed at 24 point count locations affected by the fire and 48 unburned locations. Bird community response was moderated by the severity of the fire. Areas with low fire severity were similar to unburned areas in total numbers of individuals and species, whereas areas of high fire severity had substantially lower numbers of individuals and species richness.