



# Sustainable Forests Education Cooperative

- Home
- Upcoming Events
- Past Events
- Camp 8 Podcast
- About SFEC
- Continuing Education Credits
- Cloquet Forestry Center

## 2017 Forestry and Wildlife Research Review



SFEC's 13th Annual Forestry and Wildlife Research Review was held January 10, 2017 at the Cloquet Forestry Center. This year we welcomed a number of new speakers and had a great agenda. Talks addressed timber sale auction methods, techniques for UAV imagery acquisition, determining the origins of migrating wildlife, timber salvage and much more. This year's event again included 20-minute presentations, 5-minute lightning talks, and posters.

- Date:** Tuesday January 10, 2017
- Location:** Cloquet Forestry Center, 175 University Rd, Cloquet MN 55720 ([map](#))
- Speakers:** 15+ researchers discussing the applied results and implications of their work

[RR17 flyer](#) (.pdf)

### Content

- [Handout packet](#) (.pdf) including agenda and abstracts
- [Download presenters' slides here](#)

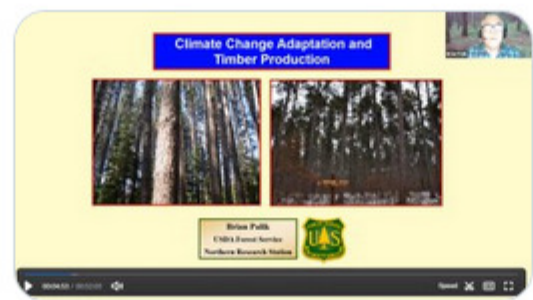
### Contact Us

Eli Sagor, SFEC Program Manager  
[esagor@umn.edu](mailto:esagor@umn.edu) | 218-409-6115

### Tweets from @MNForestEd [Follow](#)

 **UMN SF...** @MNFores... · Sep 21  
 Brian Palik gave a great talk yesterday called Adaptive Silviculture for Climate Change: Lessons for timber-oriented managers.

If you missed it, here's the recording:  
[sfec.cfans.umn.edu/2022-webinar-s...](http://sfec.cfans.umn.edu/2022-webinar-s...)



1

 **UMN SF...** @MNFores... · Sep 20  
 Starting in 15 minutes: Adaptive Silviculture for Climate Change



Eli Sagor, SFEC Program Manager | [esagor@umn.edu](mailto:esagor@umn.edu) | 218-409-6115



UNIVERSITY OF MINNESOTA  
Driven to Discover™

Sustainable Forests Education Cooperative

# 2017 Forestry & Wildlife Research Review



**Tuesday January 10, 2017**  
**8:45am - 3:45pm**  
**Cloquet Forestry Center**  
**Cloquet, MN**

## Table of Contents

Agenda.....	4
Welcome and Overview .....	6
Block 1 .....	7
Characterizing timber salvage operations on public forests in Minnesota and Wisconsin.....	7
⚡ Factors affecting soil mercury, carbon and nitrogen distributions in seasonal pond basins within a northern hardwood forest.....	8
A summary of factors affecting timber sale prices in Minnesota.....	9
⚡ SFEC's 2016 needs assessment results.....	10
Effects of biomass removal and soil compaction on soil properties over a 20 year period across a soil texture gradient.....	11
Block 2 .....	12
Quantifying white-tailed deer browse impacts with forest inventory data across the Lake States region of the United States .....	12
Management for drought susceptibility of northern Minnesota forests under future climate change.....	13
⚡ Effect of average growing season temperature on seedling germination, survival and growth in jack pine ( <i>Pinus banksiana</i> L.) .....	14
LiDAR for assessing age-height relationships in young aspen forests .....	15
Drones and data in forest resource management.....	16
Block 3 .....	17
⚡ In-field drying of biomass for energy, regeneration impacts.....	17
Nest & brood survival of ring-necked ducks in the forest: Trade-offs in wetland benefits for breeding hens .....	18
⚡ A history of beaver ( <i>Castor canadensis</i> ) management in salmonid streams in the Western Great Lakes region.....	19
The impact of management on forest bird communities .....	20
⚡ Plan for pollinators: Increasing flowering diversity in Aitkin County, MN.....	21
Identifying migrant origins using stable isotopes, citizen science data, and habitat suitability: Bat and bird examples.....	22

Block 4.....	23
Artificial regeneration of hybrid aspen.....	23
Examining factors associated with private forest landowner behaviors and intentions to treat invasive forest species.....	24
Utilizing real-world adaptive solutions in the Lakes States: Examples from Florence County Wisconsin & Superior National Forest Minnesota .....	25
Poster Only.....	26
Effectiveness monitoring of stream simulation design road-stream crossings yields unexpected ecological benefits.....	26
Acknowledgements .....	27
SFEC Member Organizations for 2016-2017 .....	28
Keeping in Touch.....	28

## Agenda

# 2017 Forestry & Wildlife Research Review



January 10, 2017 from 8:45am – 3:45pm, Cloquet Forestry Center

8:15am	Check-in opens	
8:45am	Welcome and agenda review	Eli Sagor, <i>UMN-SFEC</i>
8:50am	<b>Block 1</b> Characterizing timber salvage operations on public forests in Minnesota and Wisconsin  Factors affecting soil mercury, carbon, and nitrogen distributions in seasonal pond basins within a northern hardwood forest ⚡  A summary of factors affecting timber sale prices in Minnesota  SFEC's 2016 needs assessment results ⚡  Effects of biomass removal and soil compaction on soil properties over a 20 year period across a soil texture gradient	Matt Russell, <i>UMN-FR</i>  Randy Kolka, <i>USFS-NRS</i>  Mike Kilgore and Charlie Blinn, <i>UMN-FR</i>  Eli Sagor, <i>UMN-SFEC</i>  Rob Slesak, <i>MFRC</i>
10:00am	Break and poster session	
10:30am	<b>Block 2</b> Quantifying white-tailed deer browse impacts with forest inventory data across the Lake States region of the U.S.  Management for drought susceptibility of northern Minnesota forests under future climate change  Effect of average growing season temperature on seedling germination, survival and growth in jack pine ( <i>Pinus banksiana</i> L.) ⚡  LiDAR for assessing age-height relationships in young aspen forests  Drones and data in forest resource management	Stephanie Patton, <i>UMN-FR</i>  Bill Sea, <i>BSU</i>  Andy David, <i>UMN-CFC</i>  George Host, <i>UMD-NRRI</i>  Dan Heins, <i>UMN-FR Remote Sensing Lab</i>
12:00pm	Lunch and poster session	

1:00pm	<p><b>Block 3</b></p> <p>In-field drying of biomass for energy, regeneration impacts ⚡</p> <p>Nest and brood survival of ring-necked ducks in the forest: Trade-offs in wetland benefits for breeding hens</p> <p>A history of beaver (<i>Castor canadensis</i>) management in salmonid streams in the Western Great Lakes region ⚡</p> <p>The impact of management on forest bird communities</p> <p>Plan for pollinators: Increasing flowering diversity in Aitkin County MN ⚡</p> <p>Identifying migrant origins using stable isotopes, citizen science data, and habitat suitability: Bat and bird examples</p>	<p>Brad Jones, <i>ICC</i></p> <p>Charlotte Roy, <i>MN DNR</i></p> <p>Sean Johnson-Bice, <i>UMD</i></p> <p>Alexis Grinde, <i>UMD-NRRI</i></p> <p>Jacob Olbrich, <i>UMN</i></p> <p>Joseph K. Bump, <i>UMN</i></p>
2:15pm	Break and poster session	
2:45pm	<p><b>Block 4</b></p> <p>Artificial regeneration of hybrid aspen</p> <p>Examining factors associated with private forest landowner behaviors and intentions to treat invasive forest species</p> <p>Utilizing real-world adaptive solutions in the Lakes States: Examples from Florence County WI &amp; Superior National Forest MN</p>	<p>Andy David, <i>UMN-CFC</i></p> <p>Stephanie Snyder, <i>USFS-NRS</i></p> <p>Donald Peterson, <i>SRI</i></p>
3:45pm	Adjourn	

⚡ Denotes a Lightning Talk

## **Welcome and Overview**

Welcome to SFEC's 2017 Forestry and Wildlife Research Review.

The Research Review is one of our most important events. Each year it brings together a large and diverse group of natural resource professionals for updates on research relevant to their work. The presentations, questions, and discussion from wildlife managers, foresters, ecologists, water resource specialists, outreach professionals, students, and others bring us all up to speed on new developments and how they can inform our work on the ground.

While there is not much time for Q&A during the presentation sessions, we have designed the event with conversation in mind. The generous breaks and Stine Room layout are intended to create opportunities to ask questions of presenters and peers, challenge what you've heard, and explore ways to improve the resource conservation and management work that you do every day.

This year's Review includes a large group of presenters. You will hear 20-minute presentations and 5-minute lightning talks throughout the day. The lightning talks are a brief way to get the big ideas across so that you can fill in the details during the breaks and poster sessions.

We're glad you joined us and we hope you enjoy the day!

-Eli Sagor and Julie Hendrickson

## **Block 1**

### **Characterizing timber salvage operations on public forests in Minnesota and Wisconsin**

Matt Russell\*; Mike Kilgore, UMN Forest Resources; Charlie Blinn, UMN Forest Resources

Despite the common management practice and benefits of salvage logging in disturbed forests, little is known about the contribution salvage logging operations make to wood markets. From 2010 through 2014, salvage wood made up 10% of the volume offered from a total of 7.5 million cords sold on state lands (MN) and state and county lands (WI). The percentage of total salvage volume was similar to the total percent of forest area on state and county land that was disturbed by insects, disease, weather damage, or some other agent over the same time period. The characteristics of salvage sales are different from non-salvage sales: state and county salvage sales offered more volume per sale and were larger in size compared to non-salvage sales, but only if a widespread forest disturbance was observed (e.g., the 2011 St. Croix Valley blowdown). This presentation will discuss the importance of public timber sales to inform a range of ecological and economic impacts associated with forest disturbances.

\*University of Minnesota - Forest Resources Department  
russellm@umn.edu

## **⚡ Factors affecting soil mercury, carbon and nitrogen distributions in seasonal pond basins within a northern hardwood forest**

Randy Kolka\*; Mikayla Boche, North Dakota State University; Tom DeSutter, North Dakota State University

Forests are sites for mercury deposition, where accumulation in aquatic environments can occur. Soil total mercury (THg), carbon (C) and nitrogen (N) to 15 cm soil depth were studied in ten seasonal pond basins in a northern hardwood forest (Minnesota, USA). Pools and concentrations of THg were lower in uplands than in ponds, indicating downslope transport or differential deposition. In uplands, THg concentrations were the same in 0-2 and 2-5 cm depths and then decreased, whereas density peaked in 2-5 cm, highlighting the importance of bulk density on mass. Carbon and N trends were similar to THg. Apart from pond centers, strong positive relationships between THg and C were observed. Upland slope length, graminoid cover, basin area and tree height accounted for over half of THg variance at the pond edge. Understanding the distribution, trends and contributing factors of soil THg can further efforts toward immobilization and sequestration, thus minimizing the potential for bioaccumulation.

\*USDA Forest Service Northern Research Station  
rkolka@fs.fed.us

## **A summary of factors affecting timber sale prices in Minnesota**

Mike Kilgore\* and Charlie Blinnψ

Various studies have been conducted to evaluate the effect that site and stand factors and timber harvesting guidelines have on stumpage prices received by selected public land management agencies in Minnesota. We will present an overview of those studies and their findings to help land managers better understand how decisions made during the sale design process impact stumpage prices.

\*University of Minnesota - Department of Forest Resources  
mkilgore@umn.edu

ψUniversity of Minnesota - Department of Forest Resources  
cblinn@umn.edu

## SFEC's 2016 needs assessment results

Eli Sagor\*

In October 2016, the Sustainable Forests Education Program and University of Minnesota Extension Forestry team gathered responses to an educational program needs assessment survey. The purpose of the survey was to elicit feedback from our target audiences about topics of greatest interest to them for future educational offerings. Learner preferences are one type of data to inform program offerings.

The survey was open access and online through the UMN Qualtrics system. Respondents were recruited exclusively using email sent to the SFEC and MyMinnesotaWoods email lists. The survey assessed level of interest in each of seven broad categories: silviculture and forest management, timber sale design and forest management guidelines, forest dependent wildlife; forest health and invasives; tree and plant identification; economics and human dimensions; and agroforestry and bioenergy. Survey questions then probed for detail on topics in which the respondent was “very interested” from section 1, first by ranking a randomly ordered list of subtopics based on interest, then by indicating up to two preferred formats to learn about all of the related subtopics.

We received 178 usable responses. About 53% of respondents were natural resource professionals, about 34% family woodland owners, and the rest were master volunteers or “others.” The three broad topics with the highest levels of interest are forest health and invasives; silviculture and forest management; and forest dependent wildlife. Within forest health and invasives, the most popular subtopics were disease ID and management and silvicultural options to mitigate forest health threats. Within silviculture and forest management, the most popular subtopics were advanced or ecological silviculture and forest management to benefit wildlife. Within forest dependent wildlife, the most popular subtopics were forest management to promote nongame and game species (two separate subtopics).

Across all broad topics, the most popular continuing education program formats were one-day workshops and webinars.

SFEC will use these results, along with input from event evaluation forms, attendance data, and input from our member representatives and educational advisory committee to inform future program development. We always welcome input from participants about how to ensure continuous improvement in our offerings.

\*University of Minnesota - Sustainable Forests Education Cooperative  
esagor@umn.edu

## **Effects of biomass removal and soil compaction on soil properties over a 20 year period across a soil texture gradient**

Robert A. Slesak<sup>\*</sup>, Brian J. Palik<sup>ψ</sup>, and Anthony W. D'Amato<sup>α</sup>

Soil functions that control plant resource availability and site productivity can be altered by increased biomass removal and soil compaction that may occur during forest harvesting, but the effects are likely to vary depending on site conditions. Here we report on the effects of increasing biomass removal and soil compaction on soil properties across three aspen sites located in the Lake States region. Biomass removal treatments included stem-only harvests (SOH), whole tree harvests (WTH), and WTH plus forest floor removal (FFR); compaction treatments included low, intermediate, and high levels of compaction. Effects of biomass removal were primarily associated with the extreme FFR treatment, and generally limited to the lower productivity sand and clay texture sites. At the sand texture site with low initial pools of carbon and nutrients, FFR resulted in soil carbon and calcium reductions over the 20 year period which were associated with reductions in aspen growth. Soil bulk density increased with increasing compaction, but only at the silt loam and sand texture sites. Bulk density in surface soil had fully recovered from harvest- and treatment-induced increases after 20 years, but remained elevated at greater depths. These findings highlight the soil-specific response to biomass removal and soil compaction, with coarse-textured, poorly buffered sands more susceptible to the effects of biomass removal, and finer-textured, well-structured loams being more susceptible to soil compaction. Management practices should be customized to a given set of soil and site conditions to minimize the potential for soil degradation and maintain site productivity.

\*Minnesota Forest Resources Council  
raslesak@umn.edu

ψUSDA Forest Service, Northern Research Station  
bpalik@fs.fed.us

αUniversity of Vermont, Rubenstein School of Environment and Natural Resources  
awdamato@uvm.edu

## Block 2

### **Quantifying white-tailed deer browse impacts with forest inventory data across the Lake States region of the United States**

Stephanie Patton\*; Matthew Russell, UMN Department of Forest Resources

White-tailed deer (*Odocoileus virginianus* Zimmerman) are known to consume buds and twigs of young trees as well as many understory herbaceous plants. Deer populations in the Midwestern United States have increased recently due to the removal of predators and an increase in human development, presenting challenges in many regions to successfully regenerate tree species. This analysis used deer browse impact measurements (ranging from very low to very high) from the new tree regeneration indicator from the U.S. Forest Service Forest Inventory and Analysis (FIA) program. Seedling and sapling abundance and other plot-level characteristics were analyzed across Michigan, Minnesota, and Wisconsin. Surrogate datasets were used in conjunction with FIA data to determine their predictive power in estimating deer browse impacts by county. These included Center for Disease Control Lyme disease data, vehicle-collision data, and Quality Deer Management Association deer density estimates. Predictions from random forests models indicate that using these surrogate datasets and forest inventory information correctly predicted deer browse impact approximately half of the time (80 of 164 FIA plots in the Lake States). Deer collisions per county scored as the highest importance variable in the random forests for predicting deer browse impacts in all 3 states. Lyme disease cases ranked high in importance for the full model and for Minnesota and Wisconsin, separately. Results show the importance of quantifying deer browse impacts using a suite of forest inventory and other socio-environmental datasets.

\*University of Minnesota - Department of Forest Resources  
patt0373@umn.edu

## **Management for drought susceptibility of northern Minnesota forests under future climate change**

William Sea\*; Priya Setlur, Bemidji State University; Ryan Ness, Bemidji State University; Jillian Walechka, Bemidji State University

We assess water use efficiency changes for tree seedlings under a future warmer and drier regional climate in northern Minnesota. Our ongoing research examines the physiological response of red and ponderosa pine seedlings and two broadleaf species (quaking aspen and bur oak) seedlings subject to drought stress. Through controlled environmental conditions, including using high intensity LED growth lamps in our laboratory, we make use of the newest photosynthesis system, the LI-COR LI-6800, to examine leaf light-response curves under ambient (400 ppm) and elevated (800 ppm) carbon dioxide concentrations, with and without drought and heat stress. Preliminary results suggest that red pines are significantly more drought-prone than ponderosa pine. We also find that bur oak may be better adapted than quaking aspen subject to drier and warmer conditions. We discuss implications for forest management and anticipate that future work will be expanded to other common species relevant to adaptively managing regional forests under future climate change.

\*Bemidji State University – Center for Environmental Studies  
bsea@bemidjistate.edu

## **⚡ Effect of average growing season temperature on seedling germination, survival and growth in jack pine (*Pinus banksiana* L.)**

Andrew David\* and Egon Humenberger

Because jack pine (*Pinus banksiana*) is serotinous it retains multiple years of cones until environmental conditions are favorable for releasing seed. These cones, which contain seed cohorts that developed under a variety of growing seasons, can be accurately aged using bud scale scars on twigs and branches. By calculating the average daily temperature for June through August for the past 15 years in Grand Rapids, Minnesota, USA and comparing them to the published 30 year average we identified three years that could serve as a warmer (2006), cooler (2009) and control (2014) growing season. From three mature jack pine we collected cones that could be dated to these three years and sowed the seeds in a greenhouse with minimal water and temperature control throughout the growing season. We scored germination rates for each tree/year combination and at the end of the growing season calculated percent survival and height. Germination rates for each tree/year seed combination ranged from 35 to 59%. Seedling survival in the warm greenhouse conditions for the warm summer of 2006 was 104% of control while seedlings from the cold summer of 2009 survived at 98% of control seedlings. A similar trend was observed for seedling height. The 2006 seedling cohort grew at 129% of the control while seedlings from cold 2009 grew at 98% of the average control height. These results suggest that there is an epigenetic effect in jack pine between growing season temperature experienced during seed development and future seedling survival and height growth. Although based on a single year of data in an artificial environment these findings represent the first data that suggest that jack pine, an ecologically and economically important boreal species, possesses some inherent ability to adapt to a warming climate.

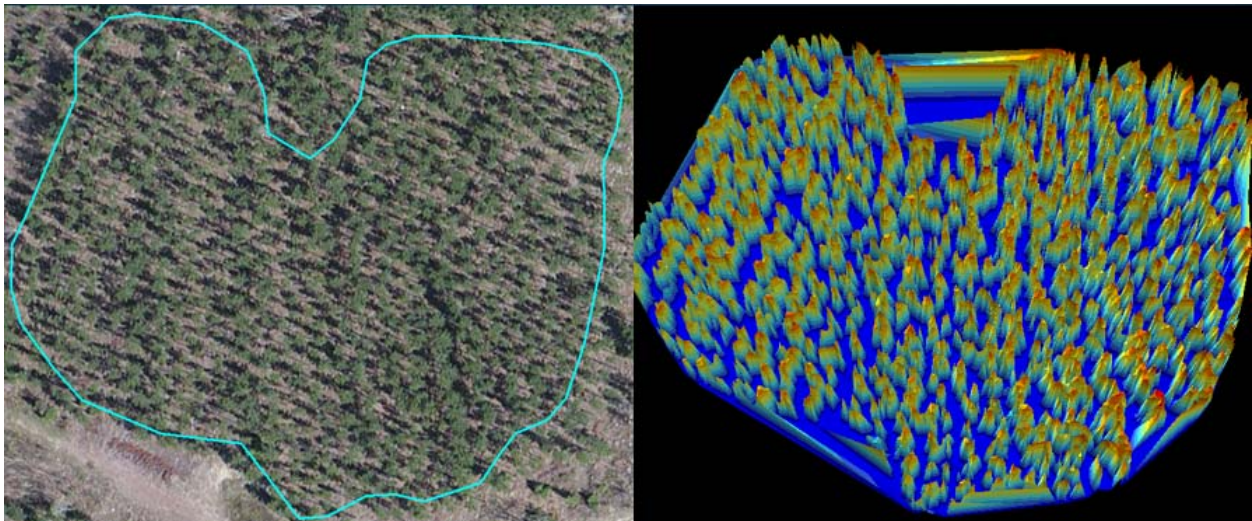
\*University of Minnesota - Department of Forest Resources, North Central Research and Outreach Center  
adavid@umn.edu

## **LiDAR for assessing age-height relationships in young aspen forests**

George Host\*, Kristi Nixon, Paul Meysembourg, Bill Berguson and Dan Buchman, Natural Resources Research Institute, University of Minnesota Duluth

Minnesota's recent statewide LiDAR imagery collection, coupled with satellite-based forest cover classification and existing field inventory data, has the potential to map the size class and potentially stocking of red pine and aspen forest lands across public and private ownerships. Understanding the distribution of these forest resources is essential as the development of a new bioeconomy focused on biofuels and biochemical emerges in parallel with expansions in more traditional forest products industries.

We analyzed aspen stand data from St. Louis County, focusing on stands that were harvested between 6 and 40 years ago. Statewide LiDAR were clipped to stand boundaries and numerous metrics were derived from the LiDAR data. Relations between stand age and height-related metrics were confounded by within-stand heterogeneity cause by inclusions of roads, wetlands, power-lines and other non-canopy features within the stand boundary. Extracting homogeneous canopy patches greatly improved the model fit. Current work is focusing on individual tree detection routines in aspen and red pine systems to estimate tree density. Understanding height and density patterns in these forest types will contribute to quantifying availability of timber resources across public and private ownerships.



Testing individual tree detection routines in red pine forests

\*Natural Resources Research Institute, University of Minnesota Duluth  
ghost@d.umn.edu

## **Drones and data in forest resource management**

Dan Heins\*

Unmanned Aircraft Systems (UAS) are democratizing many aspects of remote sensing data acquisition previously reserved for satellite, manned-aircraft, or in-situ field collection. The flexible, responsive, on-demand nature of UAS operations can empower users and address a spectrum of geospatial, environmental, and societal challenges.

This discussion will provide an overview of UAS operations and data acquisition in the University of Minnesota's Forest Resources Department, with a focus on applications, techniques, and real-world examples. In addition to a brief overview, topics will include the costs and benefits of UAS collection relative to more traditional means, spatial resolution, collection techniques appropriate for the forest scene, challenges with UAS data acquisition, the UAS collection workflow, employing ground control, and the use of various first and second-order data products.

\*Remote Sensing and Geospatial Analysis Lab, University of Minnesota - Department of Forest Resources  
hein0041@umn.edu

## Block 3

### **⚡ In-field drying of biomass for energy, regeneration impacts**

Evan Becker, Katie Haag, and Brad Jones\*, Itasca Community College, Natural Resource Program

The regeneration impact assessment is part of a larger project designed to demonstrate European models for in-woods drying of biomass fuels utilized for thermal energy. This study site is located in S34-T49N-R17W-4PM on the Cloquet Forestry Center. Biomass piles at this site were constructed in January 2014 in conjunction with an aspen clearcut on 14.8 acre site. A sample grid was established adjacent to the roads and piles, to evaluate the impact of piled material and pile removal. The grid was sufficiently large to cover the entire area potentially impacted by a standard biomass removal chipping operation. A 20' x 20' grid was established in the area of potential impact, and covered 2.08 acres. Plots were established post-harvest in early May 2014. Sample plots, 1/1000th acre, were placed at the intersection of the grid. Species of all trees, as well as height and ground line diameter on the first tree from north was recorded on these plots. We revisited site to evaluate growth after the first growing season to establish baseline growth. The piles were removed in May 2016. Final measurements were taken in October 2016 to evaluate the response to damage by the piling and biomass removal. This poster will identify the impact of long-term storage and removal of woody biomass on the regeneration of an aspen harvest.

Project Funded by Fond du Lac Band of Lake Superior Chippewa, Office of Indian Energy and Economic Development, Division of Energy & Mineral Development

Cooperators:

Fond du Lac Resource Management Division, Bruno Zagar and Steven Olson  
University of Minnesota – Forest Resources, Rachael Olesiak and Kyle Gill  
Itasca Community College – Natural Resources & Engineering Programs

\*Itasca Community College  
brad.jones@itascacc.edu

## **Nest & brood survival of ring-necked ducks in the forest: Trade-offs in wetland benefits for breeding hens**

Charlotte Roy\*

The boreal forest region of Minnesota is facing increasing anthropogenic influence in areas that have traditionally been remote and inaccessible. Although these forests are recognized as important to breeding waterfowl, breeding season vital rates and the influence of anthropogenic development on these rates are largely unexplored. We examined nest survival and brood survival of ring-necked ducks (*Aythya collaris*) in the forest of north-central Minnesota using 115 ring-necked duck nests and 32 broods located during 2008-2012. We examined the influence of houses, distance to roads, and road-surface types, as well as wetland characteristics and other variables that have been important in other studies of waterfowl. Nest survival was higher near paved roads than gravel roads, and at wetlands with greater nesting habitat area and less open water area. Brood survival increased with brood age and was higher at wetlands with more open water area and less nesting habitat area. Our findings indicate that roads may impact nest survival and that wetland attributes associated with higher nest survival for ring-necked ducks are attributes associated with lower brood survival. Thus, different wetlands are needed for various stages of the breeding season. This finding demonstrates the importance of conserving diverse wetlands in spatial proximity in the forest to meet the changing needs of ring-necked ducks. Furthermore, wildlife professionals should consider the full life cycle, and not assume that information collected during one stage (e.g., pairing, nesting, broodrearing, migration, winter habitat) or season will adequately capture habitat requirements throughout the year.

\*Minnesota Department of Natural Resources  
charlotte.roy@state.mn.us

## **⚡ A history of beaver (*Castor canadensis*) management in salmonid streams in the Western Great Lakes region**

Sean Johnson-Bice\*; Kathryn Renik, Bemidji State University; Steve Windels, Voyageurs National Park and University of Minnesota-Duluth; Andrew Hafs, Bemidji State University

Following the near extirpation of beavers in the Western Great Lakes region by the early 20th century, state agencies in Michigan, Minnesota, and Wisconsin enacted closed and/or limited harvest seasons to facilitate population recovery efforts. Consequently, beaver distribution and abundance expanded rapidly in response to the harvest restrictions. Beaver impoundments expanded alongside the population, however, creating an increase in conflicts with foresters, anglers, and landowners alike. Each state enacted similar beaver management plans aimed at reducing human-beaver conflicts without compromising the recovery process. In particular, beaver-salmonid relationships were examined by each state, and a brief history of regional beaver-salmonid studies is presented here. Results from these studies indicate variable effects at the regional, watershed, and even stream levels, however certain trends appear to be consistent, based primarily on stream gradient and hydrologic characteristics. It is recommended that watershed-specific research should be conducted prior to implementing a beaver management program within salmonid streams. While the removal of beaver and beaver impoundments from the landscape reduces human-beaver conflicts, it also displaces the wildlife communities associated with beaver-influenced wetlands. With healthy beaver populations in all three states now, current beaver management plans aim to strike a balance between the many stakeholders involved in beaver-impacted communities. Future research objectives are introduced here, with a primary focus on evaluating beaver population trends, and beaver-salmonid interactions in northeast Minnesota.

\*University of Minnesota Duluth  
joh13659@d.umn.edu

## **The impact of management on forest bird communities**

Alexis Grinde\*; Gerald Niemi, Natural Resources Research Institute, University of Minnesota Duluth

Forest structure, age, and landscape characteristics influence the composition of forest bird communities. We established nine large forest blocks (approximately 1 square mile each) across northern Minnesota to determine the influence of habitat and landscape characteristics on forest birds. Forest plots were originally sampled in the mid-1990's and have recently been resampled to determine changes in forest characteristics and forest bird composition over time. A combination of succession, natural disturbances, and forest management have altered forest composition over the 20-year time period. We use this dataset to characterize changes that have occurred in the forest plots and determine the impacts of forest management on forest bird communities.

\*Natural Resources Research Institute  
agrinde@d.umn.edu

## **⚡ Plan for pollinators: Increasing flowering diversity in Aitkin County, MN**

Jacob Olbrich\*

Honey bees directly or indirectly contributed to over \$19 billion of crops in 2010 (FWS, 2015). In recent years, the population of pollinator species plummeted, reducing several of these species into endangered status. To combat this, Aitkin County Minnesota designated 11 open grasslands for habitat assessment to determine their suitability for pollinators. Vegetative surveys were conducted on 1 m<sup>2</sup> plots over two blooming periods to determine what were established species. Species evenness was calculated to evaluate how close in number species in plots and sites were. Shannon's Diversity Index was used to estimate diversity of plots and sites weighted on evenness and richness. Because of the array of site landscapes, different strategies were suggested to be implemented with each site. Notable established species includes *A. syriaca*, *A. umbellatus*, *A. patens*, *M. fistulosa*, and *S. altissima*. In total, seven sites were given recommendations for treatments. Larger sites were often designated with prescribed burns while smaller sites or sites with specific problematic areas could benefit from spot mowing, disking, or tilling. Once sites are opened up, seed mixes can be introduced, bringing new species to these sites. To encompass the capacity for sustaining healthy populations, at least three distinct species in three blooming periods are required. The seed mixes in combination with established species are designed to provide this encompassing, sustaining flowering diversity. Aitkin County began two token programs in Fall 2016 to till quarter acre islands for on-site sources of biodiversity.

Citation:

United States Fish and Wildlife Service. 2015. Pollinators.  
<https://www.fws.gov/pollinators/>

\*University of Minnesota Twin Cities / Undergraduate Research  
olbri003@umn.edu

## **Identifying migrant origins using stable isotopes, citizen science data, and habitat suitability: Bat and bird examples**

Joseph K. Bump\*

The goal of this presentation is to illustrate how stable isotope techniques in combination with other data layers can be used to determine the origins of migrating, forest-based wildlife. First I will present how stable isotopes can be used to delineate bat hibernacula catchment areas in the upper Great Lakes region. Second, I will show how citizen science data combined with stable isotope analysis reveals migratory connectivity in a secretive bird species, the Virginia rail. I will include additional examples of the applied value of stable isotope techniques that are relevant to the management of Minnesota's forest wildlife.

\*Michigan Technological University; University of Minnesota (August 2017)  
jkbump@mtu.edu

## Block 4

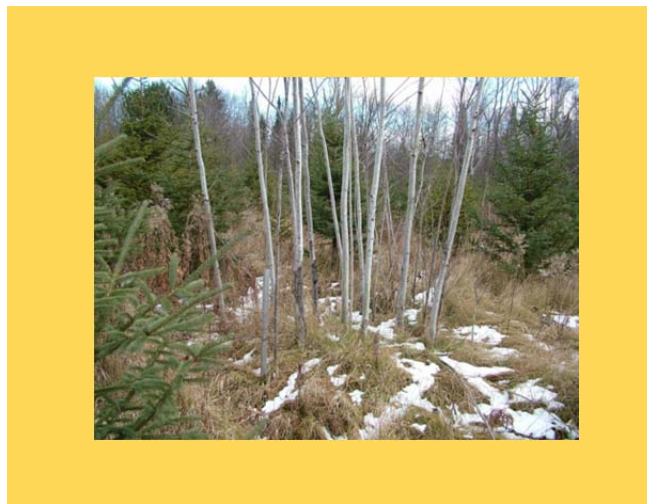
### Artificial regeneration of hybrid aspen

Andrew David\* and Egon Humenberger

Typically aspen stands are regenerated naturally via harvesting when the trunks are sheared close to the ground. The loss of the apical meristem causes the roots to send up suckers that quickly capture the site and regenerate the stand in aspen. Although natural regeneration is quick, easy and effective, artificial regeneration – creating an aspen stand *de novo* with seedlings – is much more difficult. Here we present a novel method for artificial regeneration of aspen that takes advantage of several aspen traits, e.g. tolerance of intraspecific competition, production of roots suckers at an early age and fast sucker growth. This method utilizes small groups or ‘dense packs’ of aspen that are planted at high density (1ft x 1ft) and grown to a minimum size before being sheared. Similar to natural regeneration the resulting suckers then capture the stand.

Dense pack groups ranging in size from 16 to 100 seedlings were planted at 1ft x 1ft spacing in a replicated fashion on an abandoned hay field in Itasca County, Minnesota. Survival, height and dbh were measured annually through the 10<sup>th</sup> growing season and the seedlings sheared the following winter. Twenty foot (6 m) radius plots were established on the dense pack centroids and sucker stem number and height were measured after three growing seasons. Results indicated that dense pack sizes of 36 to 49 seedlings were the minimum needed to generate the approximately 5,000 stems/ac (12,500 stems/ha) required to ensure successful regeneration, and that prior to shearing the average dense pack stem should be 13 ft (4 m) in height and 1.25 in (3 cm) dbh. This novel method of establishing aspen from seedlings could be used in ecological restoration where aspen was present historically, in phytoremediation to ameliorate soil pollution or hold tailings dust in place, or to establish short rotation plantations of hybrid aspen.

\*University of Minnesota - Department of Forest Resources, North Central Research and Outreach Center  
adavid@umn.edu



## **Examining factors associated with private forest landowner behaviors and intentions to treat invasive forest species**

Stephanie Snyder\*; Michael Kilgore, UMN Dept. of Forest Resources

Invasive species, which are species that aren't native to particular ecosystems, are a growing problem in the forests of the Northwoods, posing threats to the integrity of native plant communities and the benefits that flow from them. Conservative estimates place the national economic impacts of invasive species at \$120 billion/year, with annual impacts of \$3 billion to the people of MN for lost productivity and increased management costs. Invasive species pose landscape-scale problems that require efforts across ownership boundaries to make progress. Given this, private forest landowners have an important role to play in identifying and treating invasive species on their lands. Little is known, however, about the extent to which private forest landowners are aware of, concerned about, and/or willing to undertake actions to remove invasive forest species. To begin to answer this question, we analyze data from a national survey of private forest landowners administered by the U.S. Forest Service (National Woodland Owner Survey). We focus on respondents in MN, WI and MI and examine factors associated with past invasive species treatment actions and future intentions to treat forest invasives. Survey responses indicate that 20% of respondents in the Northwoods had undertaken some form of activity to eliminate or reduce invasive forest species in the past 5 years, while 26% indicate an intention to do so in the coming 5 years. Factors associated with these behaviors, such as demographics and other land management practices are examined within the context of these invasive species treatment behaviors.

\*USDA Forest Service  
stephaniesnyder@fs.fed.us

## **Utilizing real-world adaptive solutions in the Lakes States: Examples from Florence County Wisconsin & Superior National Forest Minnesota**

Donald Peterson\*; Marcella Windmuller-Campione, University of Minnesota

This presentation will highlight two projects exploring strategies to mitigate impacts from climate change. The first project was implemented on approximately 400 acres of scrub oak forest of the Florence County Forest located in Florence County, Wisconsin. The Adaptation Workbook was used to design the project. The stands included in the project area had already experienced significant (90%) mortality due to a combination of drought and other factors, and these stressors are expected to become more intense in the future. This project involves planting a wide variety of tree species that are projected to be favored under a range of future climates. Additionally, the project includes a first-ever demonstration of soil amendment with wood ash and biochar in a forest ecosystem in the region. Discussion will include techniques used to apply the wood ash and biochar and initial results of the monitoring activities. This project is a collaborative effort between the Sustainable Resources Institute, the Northern Institute of Applied Climate Science, Michigan Technological University, Florence County Forest, Wisconsin Department of Natural Resources and Verso Paper. The second project was implemented on the Superior National Forest in northern Minnesota. The project is exploring impacts of additions, including biochar, on growth and survival of jack pine seedlings. Exploring these alternative silvicultural strategies will hopefully add another tool in our “tool box” for adapting to climate change.

\*Sustainable Resources Institute  
don@sustainableinc.org

## Poster Only

### **Effectiveness monitoring of stream simulation design road-stream crossings yields unexpected ecological benefits**

Sue Eggert\*

As seen in the July 2016 storm events in northern Wisconsin and Minnesota, increasing storm magnitudes and frequencies and undersized culverts are resulting in major flooding, more failed road-stream crossings, economic losses due to closed transportation routes, and impaired aquatic communities. Stream simulation design is a geomorphic and ecologically-based approach to designing road-stream crossings that mimic natural channel structure, sediment characteristics, water velocity, and depths. Research examining habitat and food web responses associated with road-stream crossing restorations using stream simulation design in the northern Great Lakes region has demonstrated improvements in basal food resources (algae, fine and very fine particulate organic matter, leaf and small wood standing crops) within redesigned culverts following restoration. Improved habitat as a result of the shift from no substrate or sand/silt substrate in unrestored culverts to predominantly cobble and pebble substrates in stream simulation culverts has led to increased invertebrate and fish abundance (brook trout and sculpin) within restored road-stream crossings. Additional food resources along with improved habitat available to invertebrates and fish may result in increased biological productivity of amphibians and mammals in aquatic and riparian ecosystems near road-stream crossings. Although aquatic organism passage and flood resiliency has been the primary design priorities of stream simulation design, our work in northern Great Lakes streams has demonstrated unexpected ecological benefits of improved food web function associated with stream simulation design road-stream crossings.

\*USDA Forest Service, Northern Research Station  
seggert@fs.fed.us

## **Acknowledgements**

We are grateful to everyone who helped to make this year's Forestry and Wildlife Research Review a success.

The Research Review planning committee consisting of Paul Dubuque, George Host, Mike Kilgore, Mike Larson, Brian Palik, and Rob Slesak helped to identify topics and speakers and provided valuable input on the format.

Speakers and poster presenters Charlie Blinn, Joseph Bump, Andy David, Sue Eggert, Alexis Grinde, Dan Heins, George Host, Sean Johnson-Bice, Brad Jones, Mike Kilgore, Randy Kolka, Jacob Olbrich, Stephanie Patton, Donald Peterson, Charlotte Roy, Matt Russell, Bill Sea, Rob Slesak, and Stephanie Snyder generously developed and delivered presentations translating their research into relevant, practical results that we hope you can use. Cloquet Forestry Center staff Simon Clark, Zachary Crow, Andy David, Chuck Kramer, Stephanie Oberg, Joe Ulsby, and Denise Volk contributed to the event. Meals were provided by Jim n Jo's Northland Katering of Cloquet.

As an educational cooperative, the SFEC depends on the continued investment of our member organizations and individuals, whose contributions enable us to offer events like this one. We are also supported by the University of Minnesota College of Food, Agriculture, and Natural Resource Sciences and the Cloquet Forestry Center.

And finally, without your registration and participation, the event would have been significantly less interesting. Thank you for joining us today.

-Eli Sagor and Julie Hendrickson

## SFEC Member Organizations for 2016-2017

Aitkin County Land Department  
Aitkin County SWCD  
Beltrami County Natural Resource Mgmt  
Bureau of Indian Affairs, Midwest Region  
Camp Ripley Natural Resources  
Carlton County Land Department  
Carlton County SWCD  
Cass County Land Department  
Chequamegon-Nicolet National Forest (USFS)  
Chippewa National Forest (USFS)  
Clearwater County Land Department  
Crow Wing County Land Department  
Fond Du Lac Reservation  
Grand Portage Band of Chippewa  
Hubbard County Natural Resource Mgmt  
Itasca Community College  
Itasca County Land Department  
Itasca County SWCD  
Koochiching County Land & Forestry  
Lake County Land Department  
Mille Lacs Band of Ojibwe  
MN Association of County Land Commissioners  
MN DNR - Division of Forestry  
MN DNR - Forest Stewardship Planwriters  
MN DNR - Division of Ecological & Water Resources  
MN DNR - Section of Wildlife  
MN Forest Resources Council  
Minnesota Forest Industries  
Molpus Timberland LLC  
Pine County SWCD  
Potlatch Corporation  
Red Lake Tribal DNR  
Sappi Fine Paper  
South St. Louis County SWCD  
St. John's University Arboretum  
St. Louis County Land Department  
Superior National Forest (USFS)  
The Nature Conservancy – MN Chapter  
UMD Natural Resources Research Institute  
UMN Extension Forestry  
UMN Dept. of Forest Resources  
UPM Blandin Paper Company  
Wadena County SWCD  
White Earth Tribal Forestry  
WI DNR Division of Forestry  
Vermilion Community College

## Keeping in Touch

**View SFEC's Calendar of Events:** <http://z.umn.edu/SFECevents>

### Join our mailing lists:

To receive our monthly email newsletter, subscribe at <http://sfec.cfans.umn.edu/>

To receive our calendar of events by mail, contact Julie ([hendr065@umn.edu](mailto:hendr065@umn.edu))

### Contact us:

Eli Sagor  
SFEC Manager  
[esagor@umn.edu](mailto:esagor@umn.edu)  
218-409-6115

Julie Hendrickson  
SFEC Program Assistant  
[hendr065@umn.edu](mailto:hendr065@umn.edu) or [sfec@umn.edu](mailto:sfec@umn.edu)  
218-726-6403

