

GENERAL SESSION 1

45 Years of Vision, Mentorship, and Inspiration for Wildlife Conservation

Presenter: Carrol Henderson, DNR Nongame Wildlife Supervisor

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8:00 am – 8:50 am



Carrol Henderson grew up on a small farm in central Iowa where he developed an early interest in the outdoors including hunting and trapping. He has a B.S. in zoology from Iowa State University (1968) and a Master of Forest Resources degree in ecology from the University of Georgia (1970). In 1974, Henderson was hired by the Minnesota DNR as assistant manager of the Lac qui Parle Wildlife Refuge. He was subsequently hired to become the first supervisor of the new DNR Nongame Wildlife Program in 1977 and has continued in that role to the present.

During the past 41+ years, Henderson has developed a statewide program for the conservation of nongame wildlife that has received national and international recognition. He has helped plan and implement restoration of peregrine falcons, bald eagles, eastern bluebirds, river otters and trumpeter swans and assisted five other states with the reintroduction of bald eagles.

Henderson initiated early studies of lead poisoning in bald eagles in western Minnesota in 1978. He has been involved in “Get the Lead Out” efforts with the Minnesota Pollution Control Agency to encourage use of nontoxic jigs and sinkers, and he has been actively promoting nontoxic ammo for deer hunting to avoid lead poisoning of bald eagles that scavenge on deer gutpiles.

Henderson is the author of 13 books including Woodworking for Wildlife, Landscaping for Wildlife, Wild About Birds: the DNR Bird Feeding Guide, and Field Guide to the Wildlife of Costa Rica. He is co-author of The Traveler’s Guide to Wildlife in Minnesota, Lakescaping for Wildlife and Water Quality, and Feeding Wild Birds in America. Other books include Oology and Ralph’s Talking Eggs, Birds in Flight: The Art and Science of How Birds Fly, a 2009 revision of Woodworking for Wildlife, and three new field guides on the wildlife of Costa Rica.

The Effect of Sediment Removal on Restored Agricultural Wetlands **Presented by: Sarah Winikoff, University of Minnesota, St. Paul, Dept. of Ecology**

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8:50 am – 9:15 am

Rising recognition of wetland ecosystem services has led to a substantial increase in the number of wetland restorations. In agricultural areas, drained wetlands, can fill with eroded sediment from the surrounding landscape. Restorations often includes some sediment excavation to increase water storage capacity, and improve restoration outcomes. However, few studies have examined the effects of accumulated sediment on ecosystem structure and function. In collaboration with the United States Fish and Wildlife Service (USFWS), we examined soil nutrient content and surface water quality in 55 restored agricultural wetlands across western Minnesota. All wetlands were enrolled in the USFWS adaptive management program through the Minnesota Private Lands Office. In all of the wetlands, hydrology was restored by removing drainage tile, plugging drainage ditches, and re-establishing groundwater connectivity (Business As Usual treatment). In half of the wetlands, accumulated sediment was removed from the basin and redeposited on the surrounding landscape (Excavated treatment). Preliminary results suggest that sediment removal in restored wetlands significantly decreases the availability of nutrients in soils and in the water column. Soil organic matter, percent nitrogen, and percent phosphorus were all higher in the Business As Usual (BAU) wetlands, compared to Excavated (EXC) basins. Likewise, in the water column dissolved organic carbon, total dissolved nitrogen, and total dissolved phosphorous were higher at BAU wetlands. In addition, we found that semipermanent wetlands had consistently lower concentrations of dissolved nutrients compared to seasonal wetlands. Our results suggest that removing accumulated sediment may significantly impact nutrient availability in the water column.

GENERAL SESSION 1

Combining UAS/UAVs, camera traps and ground data to assess the effect of deactivated logging roads in the boreal, Caribou Mosaic forests of northern Ontario.

Presenter: Ryan Wilkie, Natural Resources Management, Lakehead University

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9:30 am – 9:55 am

Growing concern for the protection of vulnerable (Gunn 2016) woodland caribou (*Rangifer tarandus caribou*) has encouraged the Ontario forestry industry to explore the feasibility and efficacy of resource road deactivation and decommissioning. Boreal caribou populations have been declining since 2002 (Whittington et al. 2011), despite efforts to maintain them. With recent successes in road reclamation in western Canada (Switalski et al. 2004; Hunt and Hupf 2014) industry in Ontario is exploring the effects of varying levels of road deconstruction aiming to reduce the long-term impacts and regenerate ecosystems and the wildlife therein.

In collaboration with *Resolute Forest Products*, roads within the study area were monitored using trail cameras and high-resolution satellite imagery, vegetation attributes were measured in ground-based surveys and low-level aerial imagery using unmanned aerial systems (UASs) was collected to map and model the effects of the different deactivation methods on the regrowth of forest vegetation and the cumulative effects on wildlife movement. Preliminary results show significant differences in percent total ground cover between road types while Large Scale Photo Sampling (LSPS) methods (No 1997) with automated image classification showing the same correlations. Trail cameras have shown high levels of wildlife road-use across several species including moose, black bear, lynx, fox and wolf over all road types within the study. Trends show that though the act of deactivation/reclamation may reduce continued anthropomorphic effects, the methods used may not necessarily meet the ecological requirements to promote/restart vegetation re-growth on the road surface, limiting resultant short/long-term ecological benefits to the area.

Northwest Minnesota elk: Normative approach to management acceptability

Presenter: Eric Walberg, MN Cooperative Fish and Wildlife Research Unit, U of MN – St. Paul

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9:55 am – 10:20 am

Elk (*Cervus elaphus*) populations were historically abundant across much of Minnesota, but were extirpated by the early 20th century. A small elk population currently exists in northwest Minnesota due to restoration efforts and migration from other herds but population size has been limited to minimize human-wildlife conflict. Long-term viability of elk populations in Minnesota depends on landowner tolerance and public support for elk. The Minnesota DNR uses strategies such as harvest manipulation, habitat acquisition and development, and public/private land food plots to manage elk populations. The acceptability of these management tools can be evaluated using a normative approach, along with helping to explain why actions are judged to be unacceptable. Normative beliefs are influenced by situational variables and human values. We used mail surveys of 3,000 private landowners in northwest Minnesota to identify landowner attitudes toward elk and to determine preferences for future elk population management. We proposed several management alternatives based on severity of elk impacts and we were able to compare management preferences based on attitudes toward elk, past negative experiences with elk, and other characteristics. We found management acceptability to be significantly influenced by landowners' attitude toward elk. Recreational hunting and food plots on private and public lands were the preferred management methods among all respondent groups. Lack of information about landowner attitudes toward elk in Minnesota and management preferences makes management difficult. There are strong attitudes toward elk in northwest Minnesota and survey results can help identify ways to address private landowners' concerns.

The Influence of Density Dependence and Extrinsic Variables on Beaver Population Dynamics in Northern Minnesota

Presenter: Sean Johnson-Bice, University of Minnesota Duluth

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10:20 am – 10:45 am

Beaver (*Castor canadensis*) populations often exhibit density dependent patterns that are regulated by the interaction of habitat quality and territoriality among neighboring colonies, though extrinsic variables can also influence population dynamics. Human exploitation can suppress beaver populations below carrying capacities, and wolf predation is likewise thought to influence beaver population sizes. Weather can also affect beaver populations, and it is likely that the cumulative effects from these extrinsic factors influence short-term beaver population fluctuations. The relative influence that extrinsic factors have on population fluctuations remains poorly understood. Using nearly 30 years of colony survey data (1975–2002), we evaluated the relative influence that density dependence and extrinsic covariates had on inter-annual beaver colony fluctuations across 15 survey routes in northern Minnesota. We combined a density dependent population growth model with extrinsic covariates (weather variables, human exploitation, wolf predation), lagged 1–3 years to account for delayed effects. Here, we present the preliminary results from our time-series analysis, and highlight areas for further research into beaver population ecology.

GENERAL SESSION 2

Individual detection and plot-wide estimation of coarse woody debris density and volume using airborne LiDAR

Presented by: Michael J. Joyce, Integrated Biosciences Grad Program, U of MN, Duluth

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8:50 am – 9:15 am

Coarse woody debris (CWD) is an important habitat component for many forest wildlife species. CWD also plays an important role in nutrient cycling in forest ecosystems and serves as potential fuel for wildfires. CWD detection and mapping would enhance forestry and wildlife research and management, but field-based CWD inventories are not practical for mapping CWD over large areas. Light detection and ranging (LiDAR) is an active remote sensing technology that provides detailed information on three-dimensional vegetation structure over large spatial extents. Previous attempts to map CWD using LiDAR have been limited to estimating plot-wide CWD volume using the full set of non-ground LiDAR returns (i.e., returns from the canopy, sub-canopy, and understory). Our objectives were to evaluate the ability of LiDAR to detect individual pieces of CWD and to create statistical models using LiDAR to estimate plot-wide CWD density and volume. We acquired high-density (8 pulses/m²) LiDAR data in 2014 and measured 1,968 pieces of CWD at 189 field plots from 2015-2016. We evaluated whether filtering out canopy and sub-canopy returns improved model accuracy compared to previous attempts to model CWD using LiDAR. The height threshold used to filter out overstory returns was determined based on field measurements of CWD. We detected 21% of the individual pieces of CWD. We will present results of statistical analyses, including how CWD and site-level characteristics influence the probability of detecting individual pieces of CWD and models for plot-wide estimation of CWD density and volume.

The relationship between shrub patch characteristics and the breeding bird community in Minnesota fire-dependent lowland brush ecosystems.

Present by: Anna Hawkinson, U of MN, St. Paul,

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9:30 am – 9:55 am

Lowland brush ecosystems (LBEs) in Minnesota provide habitat for over 80 species on the Minnesota Department of Natural Resources list of Species in Greatest Conservation Need (SGCN). Several SGCN bird species utilize LBEs during the breeding season and in Minnesota, LBEs support bird communities that are equally or more diverse than forest habitats. Studies have suggested that wildlife diversity in LBEs is related to a heterogeneous mix of shrub and herbaceous cover. This characteristic patchiness has historically been maintained with burns occurring in spring, summer and fall months. Yet, most current management consists of spring burns and winter shearing. Varying shrub heights and densities, and landscape level patchiness contribute to avian diversity in other systems because they benefit a range of species with different foraging and cover preferences. Additionally, studies on fire-dependent systems have found that burn season impacts these vegetative characteristics. This collaborative study with the MN DNR looks at how burning during different seasons affects the plant and bird communities of LBEs. Before we analyze the burn treatment effects, we are interested in describing the baseline relationship between shrub patch characteristics and avian species abundance, richness, and diversity. Here we present preliminary findings from a characterization of LBE sites sampled using point counts (birds) and fixed radius plots (vegetation). Models will relate avian species counts and the height, stem density, and percent cover of shrubs measured at point count locations. We hypothesize that metrics used to assess the breeding bird community will be significantly related to shrub characteristics.

GENERAL SESSION 2

Secretive Marshbird response to long-term vegetation management in west central Minnesota

Presented by: Nina Hill, U of MN – St. Paul

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9:55 am – 10:20 am

Many secretive marshbirds are difficult to detect, and existing avian survey methods (e.g., Breeding Bird Surveys) do not provide reliable estimates of population size or trends. Recently developed standardized survey protocols provide a framework for evaluating responses of this group of birds to vegetation management and for assessing their distribution and abundance. In 2015 and 2016 we used the Standardized North American Marsh Bird Monitoring Protocol to evaluate differences in marshbird abundance and occurrence associated with different management strategies to control invasive wetland vegetation on public lands in west-central Minnesota. We conducted 2 marshbird surveys each year, and characterized vegetation structure and composition, at wetlands with varying frequencies of fire and grazing in their management histories. We detected 596 birds of the 6 species for which we broadcasted vocalizations; sora (*Porzana carolina*) detections comprised 41% of all detections. Some species of marshbirds were associated with higher frequency of management actions, indicating that a combination of fire and grazing influenced marshbird habitat quality. However, marshbird abundance is likely more strongly related to site- and landscape-level characteristics of wetlands, than to management with fire and grazing. Overall, site-level characteristics were related to abundance of soras and Virginia rails (*Rallus limicola*), whereas landscape-level characteristics were related to abundance of American bitterns (*Botaurus lentiginosus*) and pied-billed grebes (*Podilymbus podiceps*).

I Tink Therefore I Am: Distribution and Abundance of Secretive Marshbirds in Voyageurs National Park

Presented by: Bryce Olson, Voyageurs National Park

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10:20 am – 10:45 am

Secretive marshbirds are indicators of wetland quality due to their sensitivity to water level regulation, disturbance, and vegetation composition. We conducted three rounds of call-back surveys in wetlands (N=64) of Voyageurs National Park during the breeding season of 2017. American Bitterns, Soras, and Virginia Rails were common throughout the survey sites. Least Bitterns and Yellow Rails were thought to be rare in the region but were detected at multiples sites. Red-necked Grebes, Pied-billed Grebes, and Black Terns were only found on Kabetogama Lake. Potential factors for observed distribution patterns will be discussed. We also discuss potential impacts of a multi-year invasive cattail removal and wetland restoration project on marshbirds in the park.

GENERAL SESSION 3

Assessing the Distribution and Concentration of Neonicotinoids across Minnesota's Prairie Pothole region.

**Presented by: Nate Williams, Biological Sciences, North Dakota State University,
Nathan.b.williams@ndsu.edu,
8:50 am – 9:15 am**

The use of neonicotinoid pesticides is widespread throughout agricultural regions, including the Prairie Pothole Region of North America. In recent years, there have been growing concerns regarding the use of these pesticides and their impacts to non-target organisms, particularly bees and other pollinators. Neonicotinoids, being highly water soluble, have been found to occur widely in wetlands within the Prairie Pothole Region, and may also have critical impacts on these ecosystems, particularly through their potential impacts on aquatic insects. Prairie pothole wetlands are important ecological resources, and are best known for producing over half of North America's duck populations. Understanding the fate of neonicotinoids across the landscape will be important for effective management. We conducted a survey to assess the distribution and concentrations of neonicotinoids in a set of 40 wetlands in western Minnesota, located on Waterfowl Production Areas (WPAs) in the US Fish and Wildlife Service's Morris Wetland Management District. Wetlands were selected based on the intensity of agricultural-use within their catchments and were sampled on three separate occasions throughout the early part of the growing season. Preliminary results indicate that wetlands surrounded by native grassland vegetation, with low agricultural intensity had lower neonicotinoid concentrations, and the number of detections increased throughout the planting season.

Insects as Wildlife: Understanding the effect of climate on dragonfly phenology and the potentially broad ecological impacts

**Presented by: Ami Thompson, University of Minnesota - Monarch Lab
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9:30 am 9:55 am**

Dragonfly nymphs are top-level predators in ponds without fish and the phenological timing of their maturity has cascading trophic impacts. They predate upon anything they can catch including tadpoles, other macroinvertebrates, and each other. As ectotherms, their growth rates and population dynamics are dictated by temperature. Climate change is expanding the Minnesota growing season and dragonfly nymphs are being exposed to cumulatively more degrees days, likely altering their phenology. To begin to understand these effects, I've observed the phenology of the common green darner dragonfly (*Anax junius*) weekly in 2016 and 2017 and recorded water temperature hourly with Digit USB data loggers in 2017 at three prairie potholes within Crow Hassan Park Reserve, near Rogers, MN; I executed a controlled experiment rearing over 120 common green darners in growth chambers at different temperatures and measured their growth rate to build a species-specific temperature response curve; and I anticipate building a degree-day model capable of both back-casting when a wild-collected dragonfly nymph was laid as an egg, and forecasting to predict when a wild-caught nymph will metamorphose into an adult. Broader wildlife implications of changing dragonfly phenology can include impacts on both freshwater communities and on migrating bird populations. Migrating dragonflies are a vital food for early arriving migrating birds, like purple martins, as well as for small raptors during fall migration. Dragonfly migration is facultative and the timing and abundance of migrators may be changing with climate.

GENERAL SESSION 3

Do wolves ambush beavers from downwind hunting beds?

Presented by: Tom Gable, University of Minnesota

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9:55 am – 10:20 am

Beavers can be important prey for wolves in boreal ecosystems but little is known about wolf-beaver interactions. Wolves actively hunt beavers by bedding down and waiting near beaver habitat features (e.g., feeding trails, dams), however, there is almost no information on how wolves choose where to wait for beavers. Because beavers rely predominantly on olfaction to detect predators, we hypothesized that an effective strategy for a wolf to hunt beavers is to wait in areas where beavers cannot detect wolf scent. From 2015 to 2017 in Voyageurs National Park, we searched clusters of locations from wolves fitted with Global Positioning Systems collars to identify likely hunting attempts of beavers. We determined whether beavers could have detected wolves during hunting attempts based on the wind direction and speed during a hunting attempt, and the direction of the wolf relative to beaver habitat features and water. We identified 137 hunting attempts from 11 wolves. During these attempts, wolves bedded down 2.7 ± 2.6 m (SD) from beaver habitat features and 3.9 ± 4.1 m from water. We estimated wolves were undetected by beavers at more hunting attempts than they were detected at (110 attempts undetected vs. 8 detected; $\chi^2=88.17$; $p<0.001$). Overall, this result supports the idea that wolves understand that beavers use olfaction to detect predators and to avoid being detected wolves wait downwind when hunting beavers. This provides valuable insight into how a predominantly cursorial predator uses ambush hunting strategies to exploit abundant alternate prey.

Where Wolves Kill White-tailed Deer Fawns

Presented by: Austin Homkes, Northern Michigan University

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10:20 am – 10:45 am

White-tailed deer (*Odocoileus virginianus*) fawns are important summer prey for wolves (*Canis lupus*) in southern boreal ecosystems. Fawn parturition is synchronized from late May through early June and wolves must adapt their foraging strategies rapidly to use the abundant new prey source. Although wolves rely heavily on deer fawns during the summer, how wolves hunt fawns is unknown because of the difficulty of observing predation events or finding evidence of wolf-killed fawns. We fitted wolves with GPS collars during spring 2016 and 2017 in Voyageurs National Park, Minnesota and visited clusters of GPS locations to identify fawn kill sites. We determined the vegetative cover type and estimated percent cover using cover boards at 56 kill sites and 68 random locations during summers of 2016 and 2017. Discriminant function analysis revealed significant differences between cover characteristics (cover type and percent visibility) at kill sites and random locations (Wilks' $\lambda =0.820$ Chi-square=22.824 df=8, $p=0.004$). Additionally, the maximum visible distance was significantly less at kill sites than at random locations (5.97 ± 3.3 m SD vs 8.67 ± 3.6 m SD). Generally, these results provide valuable insight into habitat use by white-tailed deer fawns and summer hunting behavior of wolves in a southern boreal ecosystem. Though descriptive in nature, our results also allow us to test the hypothesis that wolves preferentially hunt in cover types where fawns kills are most likely to occur.

GENERAL SESSION 4

Engagement, Consensus and Execution: a closer look at the true meaning of partnership **Presented by: Nicole Bernd, District Manager, West Polk Soil & Water Conservation District**

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8:00 am – 8:25 am

As professionals, we are expected to utilize a range of networks to implement economically and environmentally successful projects which meet not just our own mission, but those of our partners as well. The definition of “natural resources” may have many interpretations which can be as diverse as fluvial geomorphology on a section of stream to who to call to get a skunk out of an outhouse. Varied mission statements greatly influence on-the-ground benefits and may be highly dependent upon interpretation of “natural resources” encountered within any project goal. The challenges of interpretation and consequent alignment of partners’ goals are engagement, consensus and execution. Once these goals are met it will provide a competitive advantage when seeking funding to implement the management strategies that hold the same belief or mission of preserving, restoring, protecting and enhancing our natural resources. The purpose of this talk is to spur attendees to lower barriers, see everyone as a potential partner, and sustain those partnerships to benefit natural resources.

Results of the Minnesota Breeding Bird Atlas: Species distribution models and population estimates

Presented by: Nicholas Walton, Natural Resources Research Institute, U of MN, Duluth

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8:25 am – 8:50 am

The Minnesota Breeding Bird Atlas (MNBBA) was a 5-year project (2009–2013) completed by >800 volunteers and paid researchers with the goal of documenting the distribution and abundance of Minnesota’s breeding birds. We used MNBBA point counts and volunteer atlas data to derive spatially explicit species distribution models for 115 breeding bird species. We included 3 modeling strategies: 1) we estimated density using General Linear Models (GLMs) with detection probability for species with >75 detections of singing males (66 species), 2) we estimated individuals per 10-min point count using GLMs for species with >75 observations that are not typically detected as singing but are still reliably surveyed by point count (28 species), and 3) for species that did not fit the first two methods (21 species), we used Maxent to model relative habitat suitability. In each case, we used a suite of GIS variables including land use/land cover (e.g., LANDFIRE Existing Vegetation Type), disturbance (e.g., road density), land cover structure (e.g., vegetation height), landscape metrics (e.g., patch richness), and climate (e.g., annual precipitation). We based model selection on Bayesian information criterion using branching forward selection and bootstrap aggregation. After selection, we derived statewide predictive distribution maps for each species. We also estimated statewide breeding populations for the 66 species that used detection probabilities. Results of these models are available online at the MNBBA website (<https://mnbirdatlas.org/>). We anticipate the results will be useful for a variety of applications including land management, conservation, bird watching, planning, and consideration on climate change issues.

GENERAL SESSION 4

Are Bald Eagles Out-competing Osprey? **Presented by: Steve Windels, Voyageurs National Park**

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8:50 am – 9:15 am

Top predator recovery has been linked to multiple ecosystem benefits including the suppression of over-abundant mesopredators and prey, and the re-establishment of landscapes of fear. Bald Eagles and Osprey have been recovering across North America following the banning of harmful pesticides, including DDT. However, at Voyageurs National Park in northern Minnesota, nesting Ospreys have declined in recent decades, while nesting Bald Eagles have continued to increase in numbers. We explore whether, following their simultaneous recovery in the 1970s and 1980s, Bald Eagles began to out-compete Ospreys for nesting sites and food resources or whether Osprey declines were more strongly related to other extrinsic factors such as fish productivity, habitat availability, and adverse weather. We quantified changes in Osprey nest-site selection, nest success and productivity in relation to changes in competition (e.g., Bald Eagle abundance and proximity) and environmental variability.

Developing a Framework to Prioritize Invasive Species Management Actions **Presented by: Bruce Anderson, Retired DNR-Cloquet and US Forest Service- Superior NF**

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9:15 am – 9:40 am

Tens of thousands of acres of Minnesota's forests, grasslands and wetlands are plagued with terrestrial and aquatic non-native invasive species (NNIS) that have altered ecological, recreational and economic resource values. Public land managers, conservation groups, private land owners and others have been aware of and attempted to manage non-native invasive species for decades. Yet limited resources and the continued proliferation of invasive plants and animals have hampered these managers and parties from achieving desired outcomes and management direction.

However, hundreds of thousands if not millions of acres of the state's resource base are not yet or minimally infested. The glass is still half full but meaningful management strategies must be implemented soon. The alternative is an extensive irretrievable loss of natural habitats.

This presentation attempts to provide a framework to prioritize NNIS management actions to better achieve desired outcomes in a more effective and efficient manner. The presentation will discuss the extent of the problem at multiple scales, resources affected, NNIS management components and a suggested management priority strategy to assist managers and the public.

GENERAL SESSION 4

Climate-driven changes in future Minnesota mammal species

Presented by: Ron A. Moen, Natural Resources Research Institute and Department of Biology, University of Minnesota Duluth

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10:05 am – 10:30 am

Climate change is projected to increase mean annual temperature and precipitation in the Midwest. This will affect the distribution and abundance of mammal species in Minnesota. We used past trends in population size, climate envelope modelling, and recent observations to predict species responses to climate change in Minnesota. Because Minnesota is on the southern edge of the boreal forest and at the transition of prairie, northern hardwoods, and boreal forest, we will probably see more changes in mammal species than other areas. About half of current mammal species should still be present 50 years in the future. Example species include the short-tailed shrew, woodchuck, deer mouse, beaver, and white-tailed deer. About 20% of species will probably no longer be present, including Canada lynx, moose, American marten, and northern flying squirrel. About 20% of species should show a larger change in distribution within Minnesota; example species include the opossum, gray squirrel, skunk, and bobcat. Among the caveats to these predictions are that dispersal rates of smaller mammals could be limiting and that the magnitude of future climate change is unknown. Over the last 200 years we have already seen changes in the distributions and abundances of the other 10% of mammal species in Minnesota, and we are entering a future without a historical analog with respect to rate of climate change.

Trends in age of primiparity of American black bears in Minnesota over 6 decades: effects of food but not density

Presented by: Andrew N. Tri, Minnesota Department of Natural Resources

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10:30 am – 10:55 am

Female American black bears begin to reproduce at 3–10 years old. When food availability is low, young bears grow more slowly and their age of primiparity is delayed. The Minnesota Department of Natural Resources collected teeth (1st premolar) from bears shot by hunters during 1975–2016, from which we ascertained age at death and age of primiparity by examining the number and spacing of cementum annuli. We tested 2 hypotheses: (1) ages of primiparity varied through time, commensurate with changes in bear density, and (2) ages of primiparity varied spatially across Minnesota, related to consistent differences in availability of foods. We calculated an unbiased, mean age of primiparity using a Kaplan-Meier estimator for each decade from 1960s–2010s in each of Minnesota's 13 bear management units (BMU). We found no support for our hypothesis that age of primiparity was affected by bear density. Reproductive age remained remarkably stable over nearly 6 decades, despite a doubling of the bear population, followed by a 50% decline. This lack of temporal pattern was reflected at the finer BMU scale as well. However, we found strong support for our second hypothesis: age of primiparity was youngest in BMUs along the periphery of bear range (4.54 ± 0.070 SE years) and increased northward, being delayed by 1.3 years along Minnesota's northern border with Canada (5.80 ± 0.129 SE years). This pattern corresponds with the gradient of bear foods — hard mast and agricultural crops are most abundant along the periphery of Minnesota's bear range, whereas crops and most mast-producing species decline northward.

GENERAL SESSION 4

More Offal Than We Thought: Extended Availability of Lead to Wildlife from Hunter-Discarded Gut Piles.

Presented by: Margaret Rheude, US Fish and Wildlife Service, Minnesota Field Office

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10:55 am – 11:20 am

Lead ammunition from hunting is a known environmental contaminant, and wildlife poisoning from lead consumption is well-documented. While lead exposure and impacts to carnivores and raptors is readily observed, the degree of exposure and ingestion of lead by songbirds and other small wildlife is uncertain. We posed two questions: Do winter resident songbirds and small wildlife feed on discarded deer gut piles, and do gut piles persist long enough on the landscape to become available for consumption. In the Minnesota Valley National Wildlife Refuge, we placed remote cameras by four deer gut piles which were wrapped in chicken wire and tethered to trees (visitation piles). Tethered gut piles were monitored for three weeks, then untethered for an additional three weeks. Additionally, we placed four fresh untethered gut piles (persistence piles). Persistence pile duration varied among sites from 1-17 days (mean = 11). We documented 21 species actively feeding on piles, including 6 species of winter resident songbirds. We documented extensive feeding by small mammals (deer mice, squirrels, shrews). While carcasses from visitation piles “disappeared” within 1-2 nights of availability, stomach and intestinal contents were left behind and had active feeding from most species for up to three weeks (including an increase in song bird and small mammal visitation). We conclude that gut pile persistence on the landscape is highly variable and a large variety of wildlife has may have exposure to lead.

Promoting Use of Nontoxic Ammunition to Minnesota Hunters: Past, Present, and Future Presented by: Brian Hiller, Bemidji State University

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11:20 am – 11:45 am

Conservationists in Minnesota have been at the fore of a growing movement to promote use of non-toxic ammunition for hunting and shooting. We will present an overview of past and present actions by different groups in Minnesota, including MNTWS members. We will also cast an eye to the future about what additional steps should be taken to continue to encourage hunters to make the switch to non-lead ammunition.

GENERAL SESSION 5

Integrating ArcGIS Collector in the Search for the Rusty-Patched Bumble Bee on a National Wildlife Refuge

Presented by: Michelle Turton, U.S. Fish and Wildlife Service

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8:00 am – 8:25 am

Once widespread and abundant, the rusty-patched bumble bee (*Bombus affinis*) has experienced a dramatic decline since the 1990s. On March 21, 2017, the US Fish and Wildlife Service listed *B. affinis* as endangered under the Endangered Species Act. Upper Mississippi River National Wildlife and Fish Refuge-Winona District (Refuge) recognized the great importance of conducting baseline inventory for what species of bumble bees occurred on the Refuge in order to better protect, and restore pollinator habitats. The technological data collection tool, ArcGIS Collector, was used with the new non-lethal bumble bee protocol to test the vitality of using the tool for other Refuge's surveys in the future. Over 550 individual bumble bee records were documented using Collector on three different sites during the summer of 2017. The result from the summer's data collection was the presence of eight different species including *B. affinis* on the Refuge. This presentation will go over some of the challenges and benefits of using Collector in gathering presence/absent data for bumble bees.

Remote Sensing Technologies for Wildlife Management **Presented by: Brian Huberty, U.S. Fish & Wildlife Service**

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8:25 am – 8:50 am

Habitat can be defined as the biological, chemical and physical features over space and time. Remote Sensing technologies help map these features over space and time. From drones, aircraft and satellites, our views of the planet are increasing to where one can get a five meter resolution satellite image delivered to their cellphone, every day.....anywhere on the planet.... today! The variety of new digital remote sensing sensors has also expanded to include, optical, radar, lidar, hyperspectral, thermal, acoustic, and sonar systems. The volume of this data may be in the order of petabytes. So the larger question may not be can one get remote sensing imagery anymore, but can one manage it all? This will require a complete rethinking of how our organizations seek earth observation information from these massive datasets.

GENERAL SESSION 5

From data collection to analysis: Pairing Collector for ArcGIS with custom ArcGIS adding toolbars to create a controlled process for multiple users.

Presented by: Josh Knopik, MN Department of Natural Resources

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8:50 am 9:15 am

Shallow water plant communities provide critical habitat for fish and wildlife, and help maintain water quality. However, they can be degraded by humans through development and eutrophication. Accurately mapping these communities can indicate environmental stress and provide change detection. But mapping these communities can be very time consuming and logistically challenging. MN DNR staff use the mobile application *Collector for ArcGIS* to accurately classify and delineate emergent and floating leaf aquatic plant communities, and assess shoreline habitat. *Collector for ArcGIS* standardizes data collection and centralizes data storage, improving efficiency and consistency. However, data collection is only one component of the data flow. Custom ArcGIS add-in toolbars were created to complement the collected data, and simplify the post processing steps. These custom toolbars create a seamless data workflow: from survey preparation, to field data collection, post collection quality control, even analysis and reporting. The custom tools automate numerous tasks and enables access of complex tools to basic level GIS users.

Pairing these technologies has created a controlled process that has significantly improved the efficiency and accuracy of data collection, post processing, and reporting. This presentation will highlight a few examples where using these tools (*Collector for ArcGIS* and custom add-in toolbars) have had synergistic and positive results.

Developing monitoring protocols for the Minnesota Prairie Plan: a multi-partner effort

Presented by: Jessica Petersen, MN Department of Natural Resources

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9:15 am – 9:40 am

The vision presented in the Minnesota Prairie Conservation Plan to create multifunctional landscapes that support wildlife and habitat include protecting, enhancing, and restoring prairie in Minnesota. A group of scientists from participating partners (Science Team) was created to develop and execute plans to research and monitor the ecological outcomes of the prairie plan actions. However, the scope and scale of this task has provided considerable challenges. This presentation will highlight past and current challenges and the future direction for the Science Team including discussion of a grassland bird pilot research project in 2018 and plans for a more comprehensive project to monitor the effectiveness of prairie restoration as it relates to water quality, grassland birds, pollinators, and prairie plant communities.

Landscape Habitat Management for Prairie Grouse Session

What is Landscape Habitat Management?

Presenter: Steve Chaplin, The Nature Conservancy (TNC)

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8:00 am – 8:25 am

Landscape habitat management has five components: 1) a defined conservation target - species, assemblage, or ecosystem, 2) clear goals, 3) a large scale appropriate for the conservation target, 4) goals that are applied across the entire landscape regardless of ownership or habitat type, and 5) planning that deals with all the life cycle needs of the target. Prairie grouse are among the most iconic prairie species in the state and their re-establishment in the Core Areas of the Prairie Plan where they have been lost would be a tremendous milestone bringing continued interest and funding for prairie conservation. There are two hurdles to achieving re-establishment: 1) a lack of knowledge of what are the critical components of high-quality grouse habitat in different parts of Minnesota and 2) no demonstrated successes where the critical components have been analyzed and mapped at a large scale followed by management activities to correct the deficiencies.

SHARP-TAILED GROUSE SAY “I NEED OPEN LANDSCAPES”

Presenter: Bill Berg, MNDNR Wildlife Research (retired)

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8:00 am – 8:25 am

Sharp-tailed grouse reached their peak in Minnesota in the late settlement era of the 1930s, following extensive earlier logging, fires, and ag land abandonment. As recently as the late 1950s, hunters took 150,000 birds, but since then, populations and harvests have declined steadily. Forecasts in the early 1950s of the sharptail's imminent demise resulted in brushlands acquisition, management and research, which all commenced in the early 1960s, and continue to this day. Although these endeavors have received funding from varied sources for decades, sharptail numbers continue to decline to the point that in their East-Central range, closing the hunting season is one management alternative. Management via burning, mechanical means, and herbicides has preserved some open areas, but everyone is threatened by smaller and fragmented grass-brush open landscapes. Compared to the familiar concept of “forest fragmentation,” the converse concept of “open lands fragmentation” has received scant discussion. Among the countless fauna that need open landscapes, sharptails and prairie chickens need the largest landscapes, and thus are “umbrella species,” Every other open lands species falls under these prairie grouse umbrellas. Two management options not yet explored are 1) prescribe forest logging operations in areas adjacent to open landscapes to require all remaining trees to be flattened, and 2) designate management of all WMAs in sharptail country as open landscapes; ie., all forest and over-mature brush to be removed.

Landscape Habitat Management for Prairie Grouse Session

Minnesota's explorers of the 1700s and 1800s: Can we learn from the past to help guide future management?

Presenter: Greg Hoch, MNDNR, greg.hoch@state.mn.us

8:25 am – 8:50 am

A number of individuals explored and recorded their observations of Minnesota before Euro-American settlement in the 1700s and early 1800s. Many of the names are familiar to us today; Beltrami, Carver, Featherstonhaugh, Hennepin, Nicollet, Thompson, Henry, and others. This presentation will highlight some of the descriptions of habitat, wildlife populations, and land management at the time especially fire. While we will never get back to the Minnesota these explorers describe, there may be lessons we can use today for modern wildlife management in their narratives. There are also differences in historical disturbance regimes (fire size, seasonality, and frequency, grazing) compared to modern management that can be examined.

Getting the acres to add up: fire strategies for landscape scale fire

Presenter: Jonathan Eerkes, TNC, jeerkes@tnc.org

8:50 am – 9:15 am

Prescribed fire is a key land management tool in the entire prairie province of Minnesota. However limited time and resources often means that there are not enough acres completed each year to meet ecological objectives. Jonathan Eerkes will explain multiple fire strategies that have been cooperatively developed between The Nature Conservancy and The Minnesota Department of Natural Resources that have begun to allow these agencies to meet prescribed fire goals in a landscape with over 100,000 acres of conservation land.

Making Lemonade Out of Blowdown Lemons – St. Croix State Park's Road to Habitat Management Post-2011 Storm Event

Presented by: Karl Sieve, MNDNR, karl.sieve@state.mn.us

9:15 am – 9:40 am

In 2011 a major wind event changed the landscape in Eastern Pine County and Western Wisconsin. An area once home to pine barrens and oak savanna habitat had been mismanaged for decades and allowed to grow up into a dense aspen forest with only traces of jack pine, red pine, white pine and oak savanna. The seed bed for native warm season grasses and forbes remained dormant for years while the over mature aspen stands were allowed to flourish and take over the landscape. July 1, 2011 that all changed with straight-line winds toppling thousands of acres between MN and WI. Appx 13,000 acres of state owned land in SCSP were affected with nearly 100% loss in about 6000 acres of the total affected area. Once the timber was cleaned up, this essentially gave the park a blank canvas (for a landscape) to work with. Since then staff at SCSP have been actively working to restore the landscape more similar to pre-settlement habitat of pine barrens/oak savanna with northern tallgrass prairie understory. We've utilized things like timber sales, mechanized forest treatment and prescribed fire to stimulate our native grasses and forbes, while keeping aspen and hazel species suppressed. The work has proven successful with many wildlife and plant species that hadn't been observed in previous years showing back up in good numbers such as sharptail grouse, American kestrels, fox and hognose snakes, blanding's turtles, lupine, etc

Landscape Habitat Management for Prairie Grouse Session

Audubon's conservation ranching program: harnessing the power of the marketplace for prairie conservation

Presented by: Lucy Love, Audubon Dakota, llove@audubon.org

10:05 am – 10:30 am

Grassland birds have experienced some of the steepest, most consistent declines than any other guild of bird in North America. Since the 1960s, grassland birds have declined by nearly 40%. The loss of native, intact grasslands throughout the northern Great Plains has played a major role in their decline. To address this threat, Audubon is piloting the market-based Conservation Ranching Program (ACR). With much of the remaining grassland in private ownership (85%) it has never been more important for conservation organizations to partner with the stewards of this imperiled landscape— ranchers. Audubon's approach is to create market incentives for cattle ranchers to manage their grasslands for the benefit of grassland birds throughout the Central Flyway, from Canada to northern Mexico. The ACR program will create the first scalable, self-sustaining conservation model for a linked network of livestock producers and eco-conscious consumers. In summer 2017, Audubon certified the first ACR ranches in the Dakotas, Colorado, and Missouri, and now looks to scale the ACR program throughout the entire Central and Mississippi River Flyways. To become certified, the enrolled ranch must meet ACR program protocols related to habitat management, forage and feeding, animal health and welfare, and environmental sustainability. For each ranch, an individualized habitat management plan (HMP) is developed in accordance with program protocols and for the benefit of target grassland bird species. In the Dakotas alone six ranches, spanning 60,000 acres, have been officially certified. Within the next three years, the ACR program is expected to impact half a million acres of privately-owned grasslands in the eight Central Flyway states.

What Outdoor Heritage Funds Have Done and Can Do for Prairie Chicken

Presented by: John Voz, MN Prairie Chicken Society

john.voz@state.mn.us

10:30 am – 10:55 am

Since 2014, the Minnesota Prairie Chicken Society along with Pheasants Forever Inc. have partnered to utilize Outdoor Heritage Funds to acquire key properties within Minnesota Prairie Plan core areas that directly benefit greater prairie chickens. To date nearly 2,000 acres have been purchased and will become either Wildlife Management Areas or Waterfowl Production Areas, and will be open to the public. Due to the greater prairie chicken's linear range and availability of grass cover along the Agassiz beach ridge, efforts have been made to lengthen and/or expand core areas to increase socialization and further encourage genetic diversity. This approach has been confirmed by recent genetic research findings from Charlotte Roy MN-DNR Grouse Biologist. Since the general mission of the Society is to promote prairie and prairie chickens, outreach efforts with landowners have been extremely successful.

Landscape Habitat Management for Prairie Grouse Session

What Outdoor Heritage Funds Have Done and Can Do for Sharp-tailed Grouse **Presented by: Jodie Provost, MN Sharp-tailed Grouse Society**

jodie.provost@yahoo.com

10:30 am – 10:55 am

Since 2011, the Minnesota Sharp-tailed Grouse Society (MSGs), in collaboration with Pheasants Forever Inc.(PF), has utilized five appropriations totaling \$8.2 million in Outdoor Heritage Funds to protect, restore, and/or enhance over 7,000 acres in northeast and east-central Minnesota. In addition, MSGS has also secured \$300,400 in Conservation Partners Legacy (CPL) grants to enhance nearly 3,000 acres in northwest, northeast and east-central Minnesota. Prior to the Legacy Amendment, MSGS could only dream of facilitating brushland habitat protection. Funds for enhancement and restoration have become critical to MN DNR for management of public brushlands due to their tight budget. Partnerships are key – none of this conservation could have occurred without partners such as PF that served as fiscal agent, and RGS, NWTF, Woodcock Minnesota, as well as members that provided match for CPL grants. MSGS thanks the people of MN for supporting the Legacy Amendment and looks forward to continued conservation with partners through the funds it has provided.

NW MN Public Lands Case Studies – Capitalizing on Forest Management.

Presented by: Gretchen Mehmel, MNDNR, Gretchen.Mehmel@state.mn.us

10:55 am – 11:20 am

Forest management tools such as both individual timber stand and landscape-scale planning can aid in habitat management for prairie grouse. Specific examples of this will be presented including how: 1) open landscape plans are included in the DNR's Subsection Forest Resource Management Plans; 2) a large-scale shearing and burning project was coordinated between DNR Divisions; and 3) Private Forest Management planning can benefit prairie grouse.