

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Oral Presentations

Abstracts are sorted by session and listed in sequence according to their time slot.

Wildlife Techniques

Detecting Secretive Marsh Birds and the Impacts of Water Management

Megan Brown, Jason Riddle, Shelly Dubay and Ross McLean¹
Brad Strobel²

¹*University of Wisconsin – Stevens Point*

²*United States Fish and Wildlife Service*

Millions of acres of wetlands were lost in the United States between the early 1600s and the mid-1980s. Conservation and government agencies restore and manage wetlands for both waterfowl production as well as endangered species, such as the Whooping Crane. However, some wetland dependent birds are exceedingly difficult to monitor. These birds, often collectively called secretive marsh birds, include species such as the American Bittern, Virginia Rail, and Sora. Secretive marsh birds may be good indicators of wetland habitat quality and surveying for them can help guide management efforts. Our objectives are 1) to estimate detection probabilities for secretive marsh birds at Necedah National Wildlife Refuge, and 2) to determine the habitat relationships between secretive marsh bird abundance and wetland management at Necedah National Wildlife Refuge. Specifically, we are interested in how water management for Whooping and Sandhill Crane juvenile survival affects the distribution of American Bittern, Virginia Rail, and Sora. We conducted point counts using the national, standardized secretive marsh bird protocols as described by Conway in 2011. We will use Program MARK to estimate detection probability and abundance of these secretive marsh birds at full pools, drawdown pools, and natural wetlands. Potential opportunities and challenges of simultaneously managing for cranes and secretive marsh birds will be discussed.

Comparing camera traps and in-person survey observations for monitoring prairie chicken lek sites

Taylor Peltier, Jennifer Stenglein, Lesa Kardash and Christopher Pollentier

Wisconsin Department of Natural Resources

The Greater Prairie-chicken (GPC) is a threatened grouse species native to Wisconsin's open, grassland ecosystems. Once ubiquitous across the state, GPC populations declined and were nearly extirpated from the state by the 1950's due to habitat loss and fragmentation. The Wisconsin Department of Natural Resources conducts yearly in-person lek surveys to provide an annual index to population abundance in Wisconsin with which to make informed management decisions. In-person surveying techniques can often be limited by weather, staff availability and volunteer engagement. Camera traps are a popular non-invasive method of monitoring wildlife that may save time, reduce costs and increase the accuracy of these surveys. During the spring of 2018, the Wisconsin DNR implemented a camera trap pilot study in conjunction with in-person surveying. During the study period, 5 active GPC leks were surveyed by Wildlife Management staff and 15 trail cameras. 584 photos of GPC were collected from the cameras and yielded a comparable mean and maximum number of male prairie-chickens to in-person surveying. Our study also compares the cost and effort for the two methods. Further research is needed to address the potential overlap of individuals captured in a moment by trail cameras and avoid overestimating GPC populations.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Using camera trap time-lapse photos to understand site-specific phenology and habitat quality.

Vivek Malleshappa, Jennifer Stenglein and Amanda McGraw

Wisconsin Department of Natural Resources

Camera traps are a widely used tool in ecological research and applied wildlife conservation projects. While most research projects use motion-triggered camera trap pictures to study wildlife populations, the use of camera trap imagery to understand site-level habitat parameters has not been explored. We propose that camera traps can be useful in tracking phenology and habitat quality, like other digital repeat photography studies like the Phenocam network. Many studies have confirmed the reliability of Green chromatic index(Gcc) for phenology measurements from surface and near-surface digital cameras. We want to apply this principle to camera trap imagery from Snapshot Wisconsin, a volunteer-based camera trapping project across Wisconsin. The project uses customized camera traps, which take motion triggered photos and a daily time-lapse photo. We present preliminary results that time-lapse photos can be used to calculate green-up and brown-down dates, and the length of growing season at camera trap sites. Obtaining these metrics in situ as opposed to remotely sensed satellite imagery could provide a more accurate assessment of phenology at a finer spatial resolution. Further work will explore the utility of these metrics as variables or covariates in the assessment of wildlife population health and estimation of wildlife populations.

Deriving fawn to doe ratios from a network of volunteer-run trail cameras

Emily Buege and Jennifer Stenglein

Wisconsin Department of Natural Resources

Traditional methods of collecting wildlife observation data can be spatially and temporally biased, time-consuming, and costly. One of the major goals of Snapshot Wisconsin, a network of over 1,500 volunteer-run trail cameras, is to support wildlife management decision making by increasing the number of wildlife observations while reducing the hours required in the field. One metric that Snapshot Wisconsin has successfully supplemented is fawn-to-doe ratios (FDRs), which are an important component in estimating the recruitment and health of deer populations. Typically, these ratios are calculated using roadside surveys, but trail cameras in a diversity of habitats and out of sight from major roadways have provided new opportunities to increase the accuracy of these counts. In 2017, information from 622 camera sites across 43% of deer management units contributed to FDR estimates. The data aligned with our expectations and exhibited fewer extremes when compared to other FDR estimation methods. Here, we highlight the strengths and limitations of this methodology in the context of FDRs, report on our 2018 FDR findings, as well as discuss other current and potential applications for Snapshot Wisconsin data to contribute to wildlife management decision making.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Accounting for Spatial Autocorrelation in Snow-Track Surveys for Terrestrial Carnivores

Shawn M. Crimmins

University of Wisconsin – Stevens Point

Monitoring of elusive and cryptic species, such as carnivores, can be a challenge for managers and conservationists. Often times direct observations of such species are difficult, requiring monitoring frameworks utilizing indirect measures such as with snow-track surveys. Here, we apply an occupancy modeling framework to snow-tracking data collected for multiple carnivore species (bobcat, coyote, fisher, fox, river otter) in northern Wisconsin. Using 12 years of snow-tracking data, representing nearly 5,000-km of surveys, we developed a series of occupancy models in which sampling segments ($n = 20$ per transect) were aggregated to eliminate spatial autocorrelation in detection histories for each species. We included covariates related survey conditions and habitat conditions along the transect, generating unique estimates of relative abundance for each species in each year. We then applied a state-space population growth model to the time-series of abundance estimates to identify the optimal modeling framework based on minimizing sampling variation across years. Levels of correlation varied among species, likely to differing levels of mobility and movement behaviors. Ultimately, habitat conditions were not strongly associated with aggregated detection histories for any species. Estimates of population trends (increasing, decreasing, stable) and detection probabilities varied among species and modeling approaches.

Efficacy of acoustic triangulation for Gray Wolves (*Canis lupus*)

*Jordyn R. O’Gara, Charlie A. Wieder, Elyse C. Mallinger, Alyx N. Simon, and Erik R. Olson¹
Adrian P. Wydeven²*

¹*Northland College, Ashland, WI*

²*Timber Wolf Alliance*

Acoustic triangulation is a relatively non-invasive monitoring approach that can inform our understanding of a species distribution. Acoustic triangulation relies on standard triangulation techniques to determine the location of an acoustic event. Howl surveys are frequently used to survey wolves (*Canis lupus*) and other canids. We evaluated the efficacy of acoustic triangulation for estimating the location of wolves. We examined the precision and accuracy of acoustic triangulation using an experimental mock howl survey and field data collected with wild wolves collected in northern Wisconsin (2014-2018). Accuracy of acoustic triangulation was similar to triangulation with ground-based radio telemetry for both pooled data ($p > 0.05$, $n = 264$) and for individual wolves at specific times ($p > 0.05$, $n = 50$). Distance from wolves was the most significant factor influencing precision and accuracy of acoustic triangulation ($p < 0.05$). However, precision improved with the number of bearings ($p < 0.05$). We estimated a mean bearing error of 13.2 degrees (± 2.1 , 95% confidence interval; $n = 226$) for single bearings and a maximum distance of 1.76 km (0.96-1.76 km; km $n = 7$) detection for audible anthropogenic howls. Such information can be applied to howl survey data to generate more fine-scale location information for wolf pack home sites. Acoustic triangulation of wolves can provide high-quality location information in areas where wolves are not monitored with radio collars.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Big Game Management and Predator Dynamics

Impacts of Latitude on Seasonal Activity Patterns of the American Black Bear (*Ursus americanus*)

Aletha Hefko and Erik R. Olson¹

Max Allen and Julie Van Stappen²

Timothy R. Van Deelen³

¹**Natural Resources, Northland College, Ashland, WI**

²**Forest & Wildlife Ecology, University of Wisconsin – Madison, Madison, WI**

³**Apostle Islands National Lakeshore, National Park Service**

Understanding the relationship between latitude and hibernation length can provide insights into how a species will respond to changes in latitude-associated conditions. To examine this, we utilized historical hibernation records and trail camera data. We conducted a literary review of reported American black bear hibernation lengths, with the hypotheses that black bears would hibernate for extended periods at more northerly latitudes. We also compiled and analyzed extensive camera-trap data for winter absence periods in association with latitude. Preliminary results indicate a significant relationship between latitude and hibernation records.

Environmental Cues for Migration in White-tailed deer (*Odocoileus virginianus*) in the Great Lakes Region

Megan Morrison

University of Wisconsin – Madison

Depending on the severity of winter conditions, White-tailed deer (*Odocoileus virginianus*) in the Northern parts of their range are known to migrate to winter ranges in the fall and return in the spring. Deer that only migrate when conditions are severe are known as conditional migrators while deer that follow these migration traditions every year are labeled obligate migrators. Distinguishing individuals as conditional vs. obligate migrators is difficult as most studies examining white-tailed deer migrations are short-term. Additionally, the environmental cues for these migrations are not thoroughly understood although both snow depth and changing temperatures are known to be factors. As climate change alters regular winter conditions, deer migration may be affected. This project aims to determine environmental cues for white-tailed deer migration by conducting a preliminary analysis of archival telemetry data on white-tailed deer in Northern MN and WI, and Michigan's Upper and Northern Lower Peninsula.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Variation in the nutritional landscape modulates sublethal effects of competitors and predators on herbivore fitness.

*Jennifer I. Merems and Ryan A. Long*¹

*Joel Ruprecht and Taal Levi*²

*Lisa A. Shipley*³

*Darren A. Clark*⁴

*Michael J. Wisdom*⁵

*Nathan J. Jackson and Kelley M. Stewart*⁶

¹*Department of Fish and Wildlife Sciences, University of Idaho, Moscow, ID*

²*Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR*

³*Washington State University School of the Environment, Washington State University, Pullman, WA*

⁴*Oregon Department of Fish and Wildlife*

⁵*USDA Forest Service Pacific Northwest Research Station*

⁶*Department of Natural Resources and Environmental Science, University of Nevada, Reno*

In heterogeneous landscapes large herbivores employ plastic behavioral strategies to cope with tradeoffs among environmental variables that influence fitness. Yet how individual responses to such tradeoffs scale up to influence population performance remains uncertain. Similarly, the degree to which sublethal effects of competitors and predators on herbivore fitness are modulated by variation in the nutritional landscape has not been adequately addressed. Over the past several decades, mule deer (*Odocoileus hemionus*) populations have declined throughout their range in western North America, whereas populations of elk (*Cervus canadensis*) and mountain lions (*Puma concolor*) have increased. We sought to understand whether the risk of encountering competitors (elk) or predators (mountain lions) displaced mule deer from the most favorable parts of the nutritional landscape, whether that displacement translated into effects on early winter body condition of mule deer, and whether the indirect effects of interference competition and predation risk on mule deer condition were modulated by plastic behavioral responses to those risks among individual deer. Our study is among the first to elucidate the nutritional mechanisms underpinning indirect effects of predation risk and competition on a large herbivore in western North America.

Following Leopold's Footsteps

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Understanding spatial patterns of wolf and coyote predation on white-tailed deer in Northern Wisconsin.

Lucas O. Olson and Timothy R. Van Deelen¹
Daniel Storm²
Shawn Crimmins³

¹*University of Wisconsin – Madison*

²*Wisconsin Department of Natural Resources*

³*University of Wisconsin – Stevens Point*

The behavioral ecology of joint space use (i.e., encounters) between predators and prey has important implications for predation rates and ultimately population dynamics. Determining how landscape features affect outcomes of predator and prey encounters is important for conservation and management efforts. We studied where wolves (*Canis lupus*) and coyotes (*Canis latrans*) killed deer. 499 white-tailed deer were monitored for cause-specific mortality between 2011-2014 using VHF radiocollars. Kill site investigations provided 28 wolf kill sites, 35 coyote kill sites. We analyzed spatial patterns of kill sites using resource selection functions (RSF's) in a model selection framework. Model variables included indices for land cover, human activity, proximity to water, and snow depth. Our findings show that increasing snow depth results in increased white-tailed deer mortality risk from coyote and wolf predation, corroborating other research on the importance of snow depth and snow cover duration for white-tailed deer survival. Our results suggest that understanding the effect of snow depth on white-tailed deer survival may require a better understanding of snow depth variation. While the importance of climate on the functional response of prey has been well studied, variability in climate on the outcome of predator-prey spatial dynamics has not been explicitly explored but may increase understanding of fine-scale population dynamics.

Where To From Here? An Update on the Wisconsin Bear Management Plan Revision

Scott Walter

Wisconsin Department of Natural Resources

The current Wisconsin Bear Management Plan was drafted in the early 1980s. Since that time, bear populations have increased and expanded in the state, interest and participation in bear hunting has increased, new population assessment and management tools have been developed, and approaches to bear damage and nuisance management have been formalized. During 2018, the WDNR Bear Advisory Committee evaluated the current bear management program and developed objectives and strategies that embrace current knowledge and contemporary issues. This synthesis will be captured within a management plan that will guide bear management decisions from 2019 – 2029. Issues and recommendations relevant to bear management will be discussed, as will the utility of the document as an outreach tool to increase the transparency of the bear management program.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Getting more out of Wisconsin's deer data with spatial smoothing models.

Jennifer Stenglein and Dan Storm

Wisconsin Department of Natural Resources

Each year, Wisconsin Department of Natural Resources estimates the population size of white-tailed deer in each Deer Management Unit (DMU) of Wisconsin to track population trends and provide a baseline for recommending a harvest season framework and quota for harvest of antlerless deer. Population estimates are made with the sex-age-kill (SAK) formula, which relies on annual inputs at the DMU level of buck and total harvest, fawn-to-doe ratios and aging data to estimate percent of the buck and doe populations that are yearlings. These inputs are needed for each DMU, but there are insufficient observations of these parameters in ~25% of the DMUs. To make better use of all available data, we used spatial smoothing models to estimate fawn-to-doe ratio and aging data input parameters for each DMU. By doing this in a Bayesian framework, we got measures of uncertainty on these inputs, and by extension on the population estimates. The SAK formula for estimating deer population size in Wisconsin has been used for >50 years. Our implementation of spatial smoothing models on SAK inputs and producing estimates of uncertainty on pre-hunt and post-hunt population estimates are important modernizations to the continued use of SAK for deer monitoring in Wisconsin.

The Social Side of Wildlife

What Should a Baccalaureate Program in Conservation Law Enforcement Emphasize?

Michael Rader

University of Wisconsin – Stevens Point

The job duties of conservation law enforcement (CLE) officers have been expanding and getting more complex as natural resource agencies interact with an increasing number of non-traditional stakeholders and issues. It has been 30 years since research has examined what curricular components to emphasize in a CLE baccalaureate program. This study surveyed conservation wardens in the Wisconsin Department of Natural Resources to determine opinions on probationary officer strengths & weaknesses, preparedness for entry-level training, relative importance of academic subject areas, relative importance of modes of instruction, and officer demographics. Results (65% response rate; n = 108) indicated that probationary officers were weakest in CLE field techniques, written communication, and natural resource law and policy; officers were strongest in technology/computer applications, physical fitness and basic law enforcement skills; the top three skills to develop in a baccalaureate program were CLE field techniques, natural resource sciences, and basic law enforcement skills. Specific courses rated extremely/very important included oral/written communication, CLE fundamentals/field skills, criminal justice investigation, law enforcement academy, resource policy and law, English, human dimensions, internship, and natural resource field skills. Observations about how to incorporate the results into a CLE baccalaureate curriculum are made as are recommendations for future research.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Public Engagement in Deer Management Decisions: A Wisconsin Experience

Curt Rollman

Wisconsin Department of Natural Resources

In 2014 the Wisconsin Department of Natural Resources (DNR) introduced a new initiative to engage stakeholders and the public in local deer management decisions. County Deer Advisory Councils (CDAC) were established in each of Wisconsin's 72 counties to provide the DNR recommendations on harvest goals, permit levels, and deer season structure. Each council consists of up to 9 members representing stakeholder groups impacted by deer management decisions: tribes, transportation, tourism, agriculture, forestry, hunt clubs, private landowners, and Wisconsin's Conservation Congress (2 members). The DNR performs annual surveys of CDAC members to gauge their level of satisfaction with the program and opportunities for improvement. This presentation will share results from a 4-year review of the program, including satisfaction from current CDAC members and issues they identified as barriers. Of note, nearly 80% of CDAC members were satisfied with the program and nearly 90% were pleased with the support they received from the DNR in each of the four years. In those 4 years, the DNR has not accepted all CDAC recommendations they received, leading to challenging discussions with volunteers that devoted time and energy to the process. Open discussion on areas of disagreement and transparency in the decision-making process is key to the success of the CDAC program. This presentation will share challenges faced, lessons learned, and plans for the future of the CDAC program in Wisconsin.

Giving a Voice to Wildlife Area Visitors

Dreux J. Watermolen, Karen Kettner, Timothy Mayeshiba and Kent Van Horn

Wisconsin Department of Natural Resources

The Wisconsin DNR manages various property types to ensure sustainable wildlife populations and provide a full range of outdoor recreation opportunities. State statutes provide legislative direction for state wildlife areas, "areas in which any citizen may hunt, trap or fish." While hunting and trapping constitute the primary public uses of these properties, other uses, such as walking, nature study, and berry picking, are also allowed. Property master plans identify which activities are permitted at each wildlife area and the facilities required to support those uses. The master planning process allows for public input, but concerted efforts have not been made previously to 1) understand who visits state wildlife areas or how those visitors use the properties, 2) measure how satisfied visitors are with the properties and their experiences, or 3) solicit visitor opinions about changes in wildlife area management. The Wisconsin DNR's "Voice of the Customer" project is currently employing a mixed methods approach to better understand wildlife area visitor behaviors and opinions on a statewide basis. Through intercept interviews, windshield surveys, and survey kiosks, researchers have gathered input from hundreds of property visitors. Data analysis is now underway and we will share some of our preliminary findings.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Attitudes towards a large, transient carnivore, *Puma concolor*, prior to recolonization

Erik R. Olson and Jamie Goethlich

Northland College

Cougars are capable of long-distance dispersal, and dispersing cougars have become increasingly more common in the Midwestern portion of the USA. Anticipatory human attitude surveys can identify potential management challenges, stakeholder groups, and conservation and educational priorities for recolonizing cougars. We described the history of cougar sightings across the western Great Lakes region (i.e., MN, WI, MI), and examined the results of an anticipatory human attitude survey towards transient cougars implemented in northern Wisconsin, USA. We compared attitudes towards transient cougars to attitudes towards other established large carnivores, mainly wolves (*Canis lupus*) and black bears (*Ursus americanus*). Finally, we explored factors affecting attitudes towards cougars, and how current attitudes towards this locally rare and transient species may highlight priority areas for increased educational outreach or the potential for future conservation conflict.

College Students and Bear Management: Future Conflicts and Challenges?

Haley Netherton

University of Wisconsin – Stevens Point

Increasing global bear populations and human-bear conflicts have made it more imperative to understand public attitudes towards bears and management interventions. Management methods vary in effectiveness and public support, further complicating the management of bears and other large carnivores. Without proper understanding of public attitudes towards bears and specific management actions, conflict can ensue between stakeholders and managers. To address this need, we conducted a survey of undergraduate and graduate students at UW-SP, as they will become the next stakeholders and policymakers. The objective of our study was to evaluate university student attitudes towards bears and their management and determine the associated factors, including personal experience with bears, gender, and college membership. UW-SP students tend to favor education and relocation as management tools, with education creating the least conflict. Destruction of the bear is more favorable as conflict escalates but remains fairly controversial. Our results suggest that college of study, gender, and personal experience may be correlated with attitudes towards different management interventions. The results of this study will contribute to the greater body of literature that can be used to inform the best management options for bears and other large carnivores in a particular socio-demographic context.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Build It (Habitat) & They Will Come – Part I

Butterfly Response to Barrens Management at Crex Meadows Wildlife Area, Grantsburg, WI

McKenna Hammons

University of Wisconsin-Stevens Point

The Northwest Wisconsin Sand Barrens are a unique habitat in decline. Active management is required to maintain this landscape. Butterflies are very responsive to habitat changes. This study aimed to assess the effect of various barrens management strategies on the diversity (i.e. richness and evenness) of the butterfly community at Crex Meadows Wildlife Area, Grantsburg, WI. Butterfly surveys and concurrent vegetation surveys occurred in July and August 2018. Using the Shannon-Weiner diversity index and a Hutchinson t-test I found prescribed fire increased butterfly diversity and richness in the initial years after burn and mowing had no significant effect. These results can be used to guide future management decisions concerning butterfly diversity.

Land cover and habitat preference for breeding *Falco sparverius*: How spatial analysis can influence management techniques

Mary R. Sellars, Allison Kholer and Erik R. Olson¹
Brian Heeringa²

¹*Northland College*

²*United States Forest Service*

Falco sparverius, American kestrel, has experienced population declines since the 1960's, however, the causes for the declines are largely unknown. Kestrels have been known to favor breeding habitat that consists of predominantly open-grasslands. To examine the effects of land use and habitat structure on *F. sparverius* nest box occupancy and recruitment, we installed 55 nest boxes on private agricultural lands and public lands within the USFS Moquah Barrens of the Chequamegon-Nicolet National Forest. Since the project began in 2015 we have recorded an average occupancy rate of (56%, n=32) on USFS lands and (38%, n=23) on private lands. To quantitatively examine kestrel breeding habitat and territories in Northern Wisconsin we examined the availability of open-habitat (shrubland, pasture, open roadsides), forest, and developed habitats within 1km of each nest box. Nest boxes that were occupied by *F. sparverius* had a higher proportion of open habitats. Nest boxes that were not occupied by *F. sparverius* had a higher proportion of forested habitat within their 1km² breeding territory. Larger-scale habitat considerations such as these are difficult to assess qualitatively when beginning to implement a nest box program, we hope to use this analysis to better inform placement of *F. sparverius* nest box sites.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Fire in Forested Peatlands of the Upper Great Lakes: Reconstructing our past for future management

Colleen M. Sutheimer and Volker Radeloff¹
Jed Meunier²

University of Wisconsin – Madison

Wisconsin Department of Natural Resources

Changes in disturbance regimes are a likely driver for the loss of forested peatlands in the U.S. since the turn of the century. Yet, there has been little research assessing the changing role of fire as a disturbance mechanism. We are addressing this by reconstructing historic fire regimes within forested peatlands throughout Michigan and Wisconsin and contributing to burgeoning fire research in the Great Lakes. We are sampling remnant pine stumps from the 1800s cutover and using dendrochronological techniques to cross date and determine fire dates. By collaborating with Michigan Technological University we are also collecting peatland soil cores. We are conducting a multi-proxy comparative analysis using tree-ring records of fire history to calibrate the longer and coarser char record. In 2018, we collected fire-scarred tree samples both around the periphery of a forested peatland in the Hiawatha National Forest (n = 42) and on pine islands within it (n = 43). Preliminary work has resulted in a 500 year long tree-ring based fire chronology and through continued research we will extend reconstructions at more localized peatland sites. Our research will provide the most detailed fire history within forested peatlands to date and contribute to active management of these systems.

Using GIS to Predict the Impacts of Woody Biomass Harvesting on Forest Biodiversity: Case Studies in Northeast USA

Heather Stricker¹
Deahn Donner²
T. Bently Wigley³
Darren Miller⁴

¹**University of Wisconsin – Stevens Point**

²*United States Forest Service*

³*National Council for Air and Stream Improvements, Inc.*

⁴*Weyerhaeuser Company*

With the projected increasing demand for wood biomass to partially meet renewable energy needs, concerns have centered on whether this material can be removed while still conserving biological diversity and retaining ecosystem functioning. According to the US Department of Energy (Volume 1 Billion Ton Plan 2016; Oak Ridge National Laboratory) forest biomass removal is projected to be significantly expanded over the next few decades. Feedstock producing potential of woody biomass varied across the nation, however, contributing to a variability of potential biodiversity responses. In the northeastern U.S., source feedstocks were generated primarily by whole-tree harvests of smaller-diameter trees through clearcutting rather than logging residues, particularly in northern hardwoods and natural softwoods. Using GIS and LANDIS, we investigated the potential consequences of this regional projected woody biomass removal on several case study species by spatially simulating and quantifying changes in the landscape under the most significantly expanded near-term scenario (high energy demands, 2017 scenario). We then used multiple landscape metrics to predict how these changes in northeastern forests may be beneficial for some species (e.g., early successional species), but negative for other species (e.g., disturbance intolerant species). From a biodiversity perspective, region-wide analysis of changing landscape patterns can be used to help managers spatially plan and evaluate changes for multiple conservation species of interest that functionally depend on woody biomass.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

The Influence of Impoundment Management on Whooping and Sandhill Crane Colt Survival at Necedah NWR

Ross P. McLean

University of Wisconsin – Stevens Point

Whooping Cranes (WHCR, *Grus americana*) are federally endangered and in 2001, a reintroduction effort was initiated at Necedah National Wildlife Refuge (NNWR) in Wisconsin to establish an Eastern Migratory Population (EMP). However, despite seventeen years of management, recruitment remains low. Greater Sandhill Cranes (SACR, *Antigone canadensis tabida*) are biologically similar to WHCRs and have similar breeding ecology. We studied colt survival for both crane species at NNWR to determine if low recruitment is unique to the Eastern Migratory Population (EMP) of WHCRs. Additionally, we lowered water levels in some wetland impoundments to better mimic the natural annual water cycle. Our objectives were to determine (1) if summer drawdowns and reduced wetland water levels increase survival of WHCR and SACR colts, and (2) differences in overall colt survival rates between species. We hypothesized that (1) WHCRs would use the drawdown areas more often when available, and (2) that colt survival would be higher in lower water wetlands. We placed VHF transmitters on adults and colts of both species to collect colt survival status and locations during the 2017-2018 field season. Analyses are ongoing, but many of the fledged colts were raised in areas with lower water.

Partnerships and Professional Development

Boots on the Ground: UWSP Student Chapter of The Wildlife Society Partners with Wisconsin DNR through the Adopt a Wildlife Area Program

Lesia Kardash¹

Benjamin Tjepkes²

¹*Wisconsin Department of Natural Resources*

²*University of Wisconsin – Stevens Point*

In October 2017, the University of Wisconsin-Stevens Point Student Chapter of The Wildlife Society became a sponsor for the Buena Vista Wildlife Area in Portage County through the Wisconsin Department of Natural Resources' Adopt-A-Fish-and-Wildlife-Area (AWA) Program. During the 2017-18 academic year, 48 students participated in 6 field work days, 2 chainsaw safety workshops, 2 furbearer winter tracking classes, and developed educational materials for the property kiosk, totaling 646 volunteer hours. During the 2018-19 academic year, 20 students have already participated in 5 work days, volunteering 168.5 hours. Students gain practical, hands-on experience implementing grassland habitat management, including brush removal, herbicide treatment, and conservation grazing fence installation and maintenance, as well as technical competence with chainsaws, brush trimmers, herbicide, and grazing equipment. Future student involvement includes conducting winter carnivore track and prairie chicken surveys, assisting with prescribed burns, hosting K-12 field trips, and implementing independent research projects. Natural resource students not only gain valuable training and habitat management experience, they are able to build upon their communication skills through outreach and teamwork in the field and develop professional relationships with local wildlife professionals. This partnership provides students with opportunities to become more successful in their pursuit of natural resource careers, while providing local wildlife professionals with assistance in completing important work.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Education Meets Data Collection: Lessons Learned from Engaging Educators in Wildlife Research

Sarah Cameron and Christine Anhalt-Depies

Wisconsin Department of Natural Resources

Citizen science offers a tool for wildlife research projects to maximize effort spent collecting sufficient datasets, as well as covering larger geographic areas otherwise restricted by time or funding. Although citizens scientists can help projects collect high quality data with relatively low staff time, ability to achieve project goals is dependent on recruiting volunteers that are well matched to data collection tasks. Using data from Snapshot Wisconsin, a Wisconsin DNR led citizen science program for monitoring wildlife, we evaluate the effectiveness of educators in deploying and monitoring camera traps. Educators are in a unique position to not only collect data, but also engage young people hand-on in science and use their roles as community leaders to spread the word about research projects. We analyze project records and survey results from 507 educators compared to traditional volunteers. Preliminary findings compare retention rates, time spent volunteering, and timeliness of data collection amongst the two groups of volunteers. We also report on how educators use citizen science to connect their students and communities with local wildlife. We anticipate our work will help direct efforts for efficiently recruiting citizen science volunteers to maximize the quality and quantity of data collected.

Wild CWD positives in Lincoln and Oneida Counties: From detection to communication efforts to sampling goals.

Janet Brehm, Michele Woodford and Carissa Freeh

Wisconsin Department of Natural Resources

Extensive efforts have been conducted regarding Chronic Wasting Disease (CWD) in wild deer from northeast Lincoln County, and south-central Oneida County, which were detected from the fall of 2017 gun-deer season and spring of 2018 surveillance efforts, consecutively. Wisconsin Department of Natural Resources (WDNR) staff worked with Lincoln, Oneida, and Langlade County Deer Advisory Councils (CDAC), local tribes, local media, businesses, deer processors, taxidermists, conservation clubs, and the general public to get the message out regarding the importance of sampling deer for CWD in the area aforementioned. Surveillance areas were established as well as sampling goals. Hunters submitted numerous samples via voluntary submission as well as through Surveillance Permits requirements, which helped the WDNR reach their goals.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Working for wildlife: Partnerships for Green Bay habitat restoration

Amy Carrozzino-Lyon¹

Brian Glenzinski²

Patrick Robinson³

¹*University of Wisconsin – Green Bay*

²*Ducks Unlimited*

³*University of Wisconsin Extension*

The bay of Green Bay is a historically impaired and naturally dynamic ecosystem providing critical wetland habitat for fish and wildlife, as well as important socioeconomic and quality of life benefits to the community. Past land use and urbanization has impacted Lower Green Bay contributing to complex management challenges related to water quality and turbidity, nutrient loading and sedimentation, and the effects of invasive species, among others. A partnership between UW-Green Bay, Ducks Unlimited, Wisconsin Department of Natural Resources, US Fish and Wildlife Service, and UW-Extension seeks to enhance fish and wildlife habitat in Lower Green Bay and better understand factors influencing restoration success through research and monitoring. The team has several ongoing restoration projects including wild rice re-establishment in Green Bay, a marsh restoration at a public nature park, and a pilot project using woody structures as habitat and wave breaks. In addition to actionable restoration projects, the partnership is engaging local conservation professionals in a management planning process to prepare restoration priorities and resources moving forward. Restoration of coastal wetlands in Lower Green Bay provides a unique case study in working together to achieve progress in a degraded system with great potential for success.

Professional Development Initiatives within the Wildlife Management Program, WI-DNR

Michael Zeckmeister

Wisconsin Department of Natural Resources

The Wildlife Management Program within the WI-DNR is facing significant staff turnover not unlike other Fish and Wildlife Agencies nationwide. New staff joining these agencies are some of the mostly highly educated people to join the natural resource profession. However, they are often ill-equipped to connect with people with purpose and power. Likewise, some veteran staff have also struggled in this area and often face false barriers to develop professionally. Furthermore, there seems to be a growing trend within our society to focus more on technical competence and performance results. In recognition of this, the WI-DNR Wildlife Program implemented two initiatives to facilitate professional development both within the current workforce and with new staff joining the Program. The Wildlife Program developed and implemented a structured Mentoring Program and a mandatory new hire Development Program for both Wildlife Biologists and Technicians joining the agency. The purpose of the mentorship program is to develop leaders and to raise to participants to a “higher level” by connecting early and later career staff. The new hire development program focuses less on technical competence and more on becoming “Emotionally Intelligent”. There is strong interest to expand these initiatives to other parts of the WI-DNR.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Build It (Habitat) & They Will Come – Part I

Quantifying canvasback habitat quality on the Upper Mississippi River National Wildlife & Fish Refuge: assessing the effectiveness of long-term aquatic vegetation monitoring.

Kirsten Schmidt and Jacob Straub¹
Stephen Winter²

¹*University of Wisconsin – Stevens Point*

²*United States Fish and Wildlife Service*

The Upper Mississippi River National Wildlife & Fish Refuge (refuge) provides important waterfowl habitat including over 97,000 ha of land and water along 420 km of the Upper Mississippi River. The most abundant waterfowl species during fall migration is the canvasback (*Aythya valisineria*). Canvasbacks consume large amounts of winter buds from wild celery (*Vallisneria americana*), a submersed aquatic plant that is often abundant on the refuge. The abundance of wild celery, combined with other critical habitat features, makes the refuge a regionally-important and unique staging area for canvasbacks. Since 1998, the Long Term Resource Monitoring Element (LTRM) of the Upper Mississippi River Restoration Program has conducted annual summer monitoring of aquatic vegetation in Pools 4, 8, and 13 of the refuge providing course-scale insight on forage quantity (indices of abundance). It is unclear if this data can also predict food bioenergetics information (kcal/hectare). Our project seeks to determine the strength of the relationship between LTRM aquatic vegetation data monitoring with estimates of wild celery winter bud data. If a sufficiently robust relationship is found, the LTRM sampling methodology and annual monitoring efforts could be used to predict annual canvasback habitat quality, providing important information for waterfowl conservation planning efforts.

Effects of Wolves on Elk Population Dynamics and Habitat Use in Wisconsin

Jennifer Merems and Tim R. VanDeelen¹
Shawn Crimmins²
Daniel Storm³

¹*University of Wisconsin – Madison*

²*University of Wisconsin – Stevens Point*

³*Wisconsin Department of Natural Resources*

In systems where they co-occur, predation by wolves can be an important driver of elk population dynamics and habitat use. Most studies of impacts of wolves on elk come from western North America, where elk populations have been long established and predator-prey communities are more diverse. In the Great Lakes region, effects of wolves on elk are poorly understood due to a relatively small number of established elk herds existing with wolves. Because wolf densities tend to be much higher than those in western regions, wolves may have an increased capacity to limit elk populations, but the extent to which this occurs is unknown. In this study, we propose to quantify how wolves influence elk populations. Our research will not only estimate the relationship between increasing wolf densities and elk population growth, but also identify the mechanisms by which wolves affect elk population trend (e.g. increased adult mortality, use of suboptimal habitat, limited recruitment, etc.) and identify the habitat factors associated with direct predation risk. In doing so, this project will benefit elk restoration efforts in the region by providing guidance for habitat and population management that could benefit mitigate the negative effects of wolf populations.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Evaluating the Effects of Prescribed Fire on Oak Brush in central Wisconsin Prairies

Brad N. Strobel, Ph.D.

United States Fish and Wildlife Service

Prescribed fire is arguably the single most valuable tool for managing native prairie and barrens communities. Fire has been used to meet a variety of objectives including: increasing forb diversity, discouraging invasive plant seed production, and decreasing the abundance of woody species like black oak (*Quercus veluntina*). However, how factors such as the timing, intensity and frequency of fire influence the effects a fire has on the biological community is poorly understood. Like any habitat management tool, the ability to predict the biological outcomes of a prescribed fire as well as understand the potential trade-offs is important when making habitat management decisions. We experimentally evaluated the effects of seasonality, fire temperature, and fire residence time on black oak stem damage and resprouting rates on the Necedah National Wildlife Refuge in central Wisconsin. Preliminary results indicate that timing of prescribed fires may influence both the proportion of stems killed and the resprouting rates and may therefore be an important consideration for land managers.

Understanding relationships between habitat and deer demographics and health through partnerships with DMAP participants

Amanda McGraw, Dan Storm, Dustin Bronson

Wisconsin Department of Natural Resources

Deer health reflects habitat quality, climate, and interspecific competition. Deer health, in turn, is reflected in body condition. To relate deer health to habitat quality, climate, and deer density levels, the Wisconsin Department of Natural Resources began a collaborative project with landowners enrolled in the state's Deer Management Assistance Program (DMAP) to collect data on deer and habitat on private properties. DMAP cooperators were recruited as to participate as citizen scientists through outreach including public presentations and email announcements during 2017 and 2018. Several training tools were developed to facilitate quality data collection by cooperators. In 2017 we received data from 57 DMAP cooperators for 280 deer. Cooperators measured morphological characteristics indicative of body condition and overall health, such as antler dimensions and carcass weight. Cooperators extracted a tooth for aging via cementum annuli and photographed hearts for organ fat estimation. This study highlights methods developed to ensure quality data collection by citizen scientists, and feasibility of operating a citizen-science based research project at a state-wide scale. We also provide insights about how habitat quality on private lands impacts deer health and productivity.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Eastern Wild Turkey Distribution and Patch Occupancy Across Northern Wisconsin

Chris Pollentier

Wisconsin Department of Natural Resources

Eastern wild turkeys (*Meleagris gallopavo silvestris*) were successfully reintroduced in Wisconsin beginning in the mid-1970s and populations have since expanded beyond their ancestral range. While much research has occurred in southern Wisconsin, study of wild turkeys across northern reaches of their range has been limited at best. To better understand wild turkey distribution and habitat relationships across northern Wisconsin, we conducted gobbling call-count surveys from 2014–2017 and instituted a multiseason occupancy modeling approach to link landscape characteristics to patch occupancy. Probability of occupancy was best related to percentage of open cover ($\beta = -4.10$, SE = 1.07), with occupancy peaking in routes with 30–40% open cover. Probability of colonization was positively associated with the percentage of available agriculture planted in corn ($\beta = 1.14$, SE = 0.42), and also showed a weak association with the amount of snow cover ($\beta = -1.13$, SE = 0.62). Our results suggest that even in landscapes where forest cover is pervasive, wild turkeys benefit from availability of open-herbaceous cover, and access to food resources greatly influences movement into previously unoccupied areas. A better understanding of wild turkey distribution across their northern range will provide much needed information to help guide contemporary management actions in a post-restoration era.



2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Poster Presentations

Abstracts are sorted alphabetically by primary author last name.

Wisconsin Turtle Conservation Program

Andrew Badje

Wisconsin Department of Natural Resources

The Wisconsin Turtle Conservation Program was initiated to catalogue existing turtle crossing (i.e., roads and railroads) locations throughout the state, so that road agencies, maintenance crews, wildlife biologists, and citizen conservationists can work together to make passages safer for turtles and other wildlife. We will describe the achievements to date and show where the Wisconsin Department of Natural Resources plans to take this program in future years. See how easy it is to volunteer for the Wisconsin Turtle Conservation Program, and learn how your contributions can revolutionize the way we conserve turtles in Wisconsin.

Impacts of Development on Presence and Abundance of Terrestrial Species in *Piedras Blancas* and *Corcovado* national parks, Costa Rica

Max Beal, Brooke Niermann, Parker Matzinger, Guido S. Rodriguez, and Dr. Erik R. Olson

Northland College

Providing connectivity between protected areas is a critical component of successful conservation efforts. The biological corridor between Corcovado and Piedras Blancas National Parks in Costa Rica is key to the survival of threatened species. We implemented a camera-trap study to provide baseline data on presence and abundance of wildlife within Corcovado national park in 2015, 2016, 2017, and 2018. The same camera-trap study was conducted within Piedras Blancas National Park in 2016, 2017, and 2018. We installed 21-24 camera trap stations in Corcovado and 10 throughout Piedras Blancas, in a 4x4km grid as part of a long-term camera trap monitoring network on the Osa peninsula. Comparison of preliminary data reveals differences between the two parks. We observed a higher abundance of collared peccaries in Piedras Blancas, however, Corcovado had a much higher abundance of white-lipped peccaries, puma, and jaguar. Unlike Corcovado, Piedras Blancas is surrounded by developed lands. We believe the ability of white lipped peccary, collared peccary, puma, and jaguar to cope with human influence is linked to the dissimilarities in species composition between the two parks. This baseline data will be important in assessing the efficacy of the biological corridor linking Corcovado and Piedras Blancas National Parks and will contribute to regional wildlife monitoring efforts.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Effects of Prescribed Fire on Small Mammal Community of Schmeckle Reserve, Wisconsin

McKenna Hammons, Benjamin Tjepkes, Paul Schwabenbauer, Andrew Johnson, Cori Semlar, and Miguel Cardenas

University of Wisconsin – Stevens Point

Prescribed fire is a management tool commonly used by wildlife biologists to manipulate the habitat on their properties. Research exploring the short- and long-term effects of fire on vegetation and wildlife have increased our understanding of its importance. Our study aimed to assess the effect of prescribed fire on the diversity (i.e., richness and evenness) of the small mammal community in Schmeckle Reserve on the University of Wisconsin – Stevens Point campus. A prescribed fire was applied to the Berard Oaks subunit in April 2018 and trapping followed in August 2018. Diversity of this site was compared to that of an unburned control site by using the Shannon-Weiner Diversity Index and follow-up Hutcheson t-test. We found the burned area had a significantly higher small mammal diversity than the unburned area. Property managers may use this information to improve their burn prescriptions and their master management plan, especially if maintaining small mammal diversity is a main concern.

Arboreal Camera Traps and Call Site Observations Extend Arboreal Habitat Use of *Hyla versicolor*

Hannah Hoff, Jonathan G. Martin, Madison M. Laughlin, and Erik R. Olson

Northland College, Ashland, WI

Hyla versicolor (Eastern Gray Tree Frog) is known to be arboreal, however, little is understood about its arboreal activity. In the summers of 2015 and 2016, we observed *H. versicolor* in the upper canopies of *Pinus strobus*. We hypothesized that arboreal habitat use of *H. versicolor* was significant and modified our methodology better evaluate *H. versicolor* arboreal activity patterns. Using time-lapsed photos and artificial refugia we observed *H. versicolor* at heights up to 24-28m high, indicating that these frogs use the full extent of *P. strobus* canopies. We also evaluated the diel and seasonal activity patterns of this species, which suggest strong seasonal and diel activity patterns for arboreal activity. Our research provides a basic understanding of the arboreal activity patterns of this species, further describes successful methods for studying arboreal wildlife, and adds to our basic understanding of the natural history of this species.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Adopt-a-Kiosk and Adopt-a-Dumpster Programs in Chronic Wasting Disease Surveillance: Year 1 Review

Mandy Kamps and Wildlife Health Staff

Wisconsin Department of Natural Resources

In 2018, the Department of Natural Resources initiated the Adopt-a-Kiosk (AAK) and Adopt-a-Dumpster (AAD) programs as additional tools to assist in chronic wasting disease (CWD) surveillance and reduce the risk of disease transmission. The main goal of the AAK program was to enhance CWD sample numbers, ease, and options for hunters in the world of electronic registration. Kiosks were already utilized by the DNR, but with AAK, it was the first-time individuals or organizations could sign-up to monitor a kiosk at an entry, intermediate, or advanced level and assist with surveillance efforts. Another component of the AAK program was to Construct-a-Kiosk, where participants purchased materials, built a kiosk using standard guidelines, and donated it to the DNR. The AAD program was a new initiative in 2018, and the main goal was to provide hunters an option for appropriate deer carcass waste disposal, especially in areas where carcass disposal options were very limited or not already available. Overall feedback from hunters show they appreciate the option of having a kiosk and/or dumpster available for CWD sample submission and a means for deer carcass waste disposal. This poster provides a review of the first-year efforts of the AAK and AAD programs.

Evaluating Gray Fox Climbing Behavior Through the Lens of Risk-averse Foraging Theory

Abby Keller, Michaela Fisher, Seth Hiers, Jordyn O'Gara, Ella Shively, Melissa Walsh, and Erik R. Olson

Northland College

Gray fox (*Urocyon cinereoargenteus*) are one of two canid species that are capable of climbing trees. Researchers have hypothesized that gray fox climb for food acquisition, predator avoidance, or denning. In the fall of 2014, we initiated a study to quantify the limitations of gray fox climbing ability. Using baited trail cameras from thirty-two study sites in Northern Wisconsin, we observed gray fox climbing on over 33 separate occasions. Fox were 4 times more likely to climb branched trees than clean-bowled trees; with seemingly no limitations to climbing a branched tree. We then examined whether bait height and weight were significant predictors of fox climbing, finding that as the height increases the probability of climbing decreases for larger bait. Fox climbing behavior was also more prevalent during time periods that correspond with spikes in seasonal nutritional limitations. Finally, we altered our methodology to give the fox a choice of different baits within two trees at the same site. Through preliminary analysis we try to get a better understanding of how fox make this decision. We believe gray fox climbing is a risk-averse foraging behavior. Climbing clean-bowled trees appears to be a risky behavior relative to branched trees. Gray fox appear to maximize benefits while minimizing risks.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Distribution of Small Mammals across the Apostle Islands

Elyse Mallinger and Erik R. Olson¹

Tim Van Deelen, Morgan Morales and Megan Morrison²

Julie Van Stappen³

¹**Northland College**

²University of Wisconsin – Madison

³National Parks Service

Small mammal species are an important component of ecosystems. We analyzed the history of small mammal community dynamics within the Apostle Islands archipelago. We also examined the influence of island biogeography on small mammal community dynamics. We compared historical reports and publications to more recent small mammal trapping efforts, spanning a time period from 1961 through 2018. We also examined changes in abundance of small mammals from the early 2000's to present for a subset of islands. Since the 1960's, *Microtus pennsylvanicus* and *Sorex cinereus* exhibited significant changes in presence across the archipelago, with *M. pennsylvanicus* extirpated from most of the islands and *S. cinereus* increasing in presence across the archipelago. These changes were likely due to changes associated with human use of the archipelago and successional changes associated with those changes. However, recent trends (early 2000's to present) in abundance indicated that *S. cinereus* is declining in abundance locally on the islands. We observed a positive correlation between species richness and island size, especially when pooling data over time. Our work suggests that island biogeography influences the species richness of island small mammal communities and may play a role in mitigating the dynamics of small mammal communities over time.

Length-mass allometric relationships for salamander species in Wisconsin, USA

Taylor Pichler and Dr. Erik R. Olson

Northland College

The study of allometry is particularly useful in understanding amphibian physiology where standard measurements such as snout-vent-length (SVL) predict difficult to measure traits like body mass that can describe multiple aspects of a species' life history. Although accurate length-mass allometric models for amphibians already exist, they have a limited sample size for salamanders. In order to further validate these models, we investigated the allometric relationship between snout-vent length and body mass for four species of terrestrial salamanders in Northern Wisconsin, USA. Salamanders were captured, measured, and released by student observers using time-effort surveys along the shorelines of multiple vernal ponds in Chequamegon-Nicolet National Forest, USA. SVL and body mass were compared using simple linear regression analysis. The preliminary results of this research provide more insight into life history variance among different salamander species that can supplement monitoring of amphibian community biomass in the Great Lakes region.

2019 Annual Conference Abstracts

Wisconsin Chapter of The Wildlife Society

Non-fatal black bear attacks in the conterminous United States: 2000-2017

Janel Scharhag

University of Wisconsin – Stevens Point

Attacks on humans by bears have increased in recent decades, as both human and bear populations grow. To help prevent future attacks, we must understand past attacks. There is information and statistics regarding fatal attacks of both black and grizzly bear, and non-fatal attacks by grizzly bear. There is no comprehensive research on non-fatal black bear attacks. Our study addressed this information gap by analyzing agency-confirmed, non-fatal black bear attacks in the 48 conterminous United States from the years 2000-2017. We identified 210 attacks. Half of all occurred in California and Colorado. Most attacks were defensive reactions by female bears with young. A high proportion involved dogs and anthropogenic attractants. A CART model suggests the predictors of severity are a female victim, with a dog, who fights back during an attack. When compared with previous studies of fatal black bear attacks, our results illustrate clear differences between fatal and non-fatal black bear attacks. They also lend evidence to the hypothesis that dogs can trigger defensive attacks by female black bears. These results may have implications for risk assessment, attack mitigation, and how we advise the public to respond to an attacking bear.

