"Whooping it up on the Minnesota prairie!"

30TH Meeting of the
Prairie Grouse Technical Council

Bede Ballroom
University of Minnesota, Crookston
Crookston, Minnesota
10-13 October 2013

Welcome to the 30th Prairie Grouse Technical Council Conference!

We prairie grouse enthusiasts have gotten this way largely through serendipity, as we were first exposed to these great birds and later came to understand and marvel at the landscapes they represent. In my case, it was as a young lad in the '50s watching Walt Disney's, "Vanishing Prairie", and later as a college student watching Don Christisen of the Missouri Department of Conservation end a slide presentation with a silhouette of a booming prairie chicken against a rising run. Wow, great memories all. In the early '70s, as a new faculty member I was manning a booth about prairie chickens at the Crookston Winter Shows and overheard a young fellow remark as he glanced at a Charlie Schwartz movie and display of prairie; "*I don't understand what the big deal is about something that doesn't have a purpose*." Now that made me ponder! Clearly those of us here at this meeting feel that these birds do indeed have a purpose, and have spent parts of our lives helping to secure their welfare so others may appreciate them as well. Welcome to northwest Minnesota as we share research findings, good stories, good food, and views of good grass!

Many individuals have made this meeting possible. First, the primary sponsor, the Northwest Research and Outreach Center of the University of Minnesota and Albert Sims, the Director of Operations. Prior to Albert, Larry Smith and Bernie Youngquist were leaders of this unit of the University and were supportive of my involvement in things prairie and all that goes with it for over 40 years. Thanks to Chancellor Fred Wood of the University of Minnesota, Crookston and many other associates of the college for their encouragement and support for prairie conservation and education. Colleagues over the years with the Minnesota Department of Natural Resources, the U.S. Fish and Wildlife Service, The Nature Conservancy, and the Minnesota Prairie Chicken Society are appreciated and acknowledged for their steadfast efforts in grassland conservation and are too numerous to mention individually.

In staging this meeting let me thank the following for their huge roles: Emily Hutchins who handled abstract and poster submissions along with assembling the conference booklet; Laura Bell and Megan Luxford assisted with many organizational details; Terry Wolfe organized the field trip and has been a long-time, prairie conservation partner; Ross Hier graciously developed signature artwork for the conference and generously shares his prairie prose with students

and citizens in a memorable way; and my wife Vicki, who has supported me in yet another conference project!

Thanks to the following who contributed financial and/or material support: the Minnesota Prairie Chicken Society, Minnesota Sharp-tailed Grouse Society, Truax Company, Crookston Convention and Visitor's Bureau, Minnesota Department of Natural Resources, U.S. Fish and Wildlife Service, The Nature Conservancy, UMC Center for Sustainability, UMC Student Chapter of The Wildlife Society, UMC Media Services, UMC Dining Services, UMC Facilities and Operations Department, and Erickson's Smokehouse Grill and Bar.

And finally, thanks to the conference presenters, moderators, and participants and all that you do. You have truly made this conference and the Prairie Grouse Technical Council possible. As we listen to and digest this conservation information let us thoughtfully consider how it applies to situations that we can influence as we strive to manage habitats and populations in the face of a multitude of changing land use and societal conditions. Let us remember too, that these reports are not the final word but are rather, in the words of Fran Hamerstrom, "merely progress reports at some point in time based on the data at hand on how we perceive things to be."

Thanks for coming and have a great conference.

Dan Svedarsky, Chair, 30th Prairie Grouse Technical Council

Agenda

Thursday, 10 October:

5:30-9:00 PM Informal grazing and browsing social and registration, Prairie Lounge, U of MN, Crookston (UMC). Food and drink in Nature Nook, weather permitting, otherwise in Prairie Lounge of Sargeant Student Center

Friday, 11 October:

7:00 AM	Shuttle pickup at motels; Registration desk opens
7:15 AM	Breakfast
8:00 AM	Opening remarks
8:15 AM	Sessions commence (Posters on display during breaks)
12:15 PM	Lunch
1:00 PM	Sessions resume
5:00 PM	Social and fun/fundraiser
6:00 PM	Program and banquet

Saturday, 12 October:

7:00 AM	Shuttle pickup at motels
7:15 AM	Breakfast
8:00 AM	Business meeting
10:00 AM	Sessions commence (Posters on display during breaks)
12:00 PM	Lunch
1:00 PM	Field trip to Glacial Ridge NWR and environs. Bus provided
5:30-9:00 PM	Evening BBQ in the prairie – Booming Flats

Sunday, 13 October:
Dispersal.

***All activities will occur in Bede Ballroom on the campus of the University of Minnesota, Crookston unless otherwise noted.**

Program

Thursday, 10 October:

5:30-9:00 Informal grazing and browsing social and registration. Prairie Lounge, U of MN, Crookston (UMC). Food and drink in Nature Nook, weather permitting, otherwise in Prairie Lounge of Sargeant Student Center.

Friday, 11 October:

(Moderator: Dan Svedarsky)

7:00 Motel shuttles; Registration desk opens

7:15 Breakfast

8:00 Opening remarks. Dan Svedarsky.

8:05 Welcome. Albert Sims, Northwest Research and Outreach Center.

8:15 The Lay of the Prairie Landscape of Minnesota. Dan Svedarsky.

8:30 Why We Love These Gorgeous Birds Who Do Funny Things in the Spring. Noppadol Paothong, Missouri Dept. of Conservation.

8:50 Prairie Grouse Technical Council: Then (1952) and Now (2013). Jerry Kobriger, Punch Podoll, and Max Alleger.

9:20 Climate Change and Predicted Effects on Prairie Grouse. Nova Silvy, Texas A & M.

9:40 Break

9:55 Development of the Minnesota Prairie Plan. Steve Chaplin, The Nature Conservancy.

10:15 The Minnesota Prairie Plan in Action: Conservation of the Greater Prairie-Chicken. Greg Hoch, Minnesota Dept. of Natural Resources.

10:35 A Preliminary Look at Greater Prairie-Chicken "Ecology" Nebraska versus Minnesota, 2012-2013. John Toepfer, Society of Tympanuchus Cupido Pinnatus, Ltd.

10:55 Brood Habitat and Invertebrate Biomass of the Greater Prairie-Chicken in Northwest Minnesota. Jen Syrowitz, University of Manitoba, Winnipeg.

11:15 Reproductive Ecology of Female Greater Prairie-Chickens in Minnesota. Nate Emery, Alaska Dept. of Natural Resources, and Dan Svedarsky.

11:35 Reproduction and Survival of Translocated Minnesota and Local Wisconsin Greater Prairie-Chicken Hens in Central Wisconsin. Lesa Kardash, Wisconsin Dept. of Natural Resources.

11:55 Attwater's Prairie-Chicken Brood Survival – The Invertebrate and Red Imported Fire Ant Connection. Michael Morrow, US Fish and Wildlife Service.

12:15 Lunch

(Moderator: Nova Silvy, Texas A & M)

1:00 Evaluation of Methods Used to Improve Grasslands as Gallinaceous Brood Habitat. Mandy Orth, South Dakota State University.

1:20 Large-scale Landscape Characteristics Associated with Occurrence of Sharp-tailed Grouse in Michigan's Upper Peninsula. Heather Porter, Michigan State University.

1:40 Developing a Landscape-level, Model-based Approach to Evaluating Sharp-tailed Grouse Habitat and Populations in North Dakota. Aaron Robinson, North Dakota Game and Fish Dept.

2:00 Distribution and Landscape Attributes of Greater Prairie-Chickens and Sharp-tailed Grouse Outside of Their Traditional Range in South Dakota. Mandy Orth, South Dakota State University.

2:20 Greater Prairie-Chicken in Illinois I: Historical Context and Evolutionary Legacy of a Conservation Icon. Mark Davis, Illinois Natural History Survey.

2:40 Greater Prairie-Chicken in Illinois II: Contemporary Genetic Monitoring of a Conservation Icon. Whitney Anthonysamy, Illinois Natural History Survey.

3:00 Break

3:20 Investigation of Thermal Habitat Selection by Greater Prairie-Chickens. Torre Hovick, Oklahoma State University.

3:40 Quantifying Greater Prairie-Chicken Spatial Ecology in Response to Wind Energy Development in North-central Kansas. Virginia Winder, Kansas State University.

4:00 Landscape Genetic Analysis of Greater Prairie-Chicken Response to Wind Energy Development in Kansas. Andrew Gregory, Bowling Green State University.

4:20 Morphological Differences Between Lesser Prairie-Chickens and Greater Prairie-Chickens in a Hybrid Zone. Jacqueline Augustine, Ohio State University at Lima.

4:40 Development of a Range-wide Conservation Plan for Lesser Prairie-Chickens. Jim Pitman, Kansas Dept. of Wildlife, Parks, and Tourism.

5:00 Social and fun/fundraiser

6:00 Program and banquet

(Moderator: Dan Svedarsky)

Welcome, Chancellor Fred Wood

Presentation of the Hamerstrom Award

"P^4G". Ross Hier, Minnesota Dept. of Natural Resources (prairie manager, artist, and story teller extraordinaire).

Saturday, 12 October:

7:00 Motel shuttle

7:15 Breakfast

7:50 Comments from "Sharptails Plus." Bill Burns and Terry MacKay

8:00 Business meeting

9:40 Break

(Moderator: Rick Baydack, University of Manitoba)

10:00 Developing Targeting Tools for Woody Plant Encroachment and Prairie Grouse Conservation. Michael Falkowski, University of Minnesota.

10:20 Lesser Prairie-Chicken Initiative: Targeted Solutions to Threat Reduction. Christian Hagen, Oregon State University.

10:40 Regional Variation in Nest Success of Lesser Prairie-Chickens in Kansas and Colorado. Joseph Lautenbach, Kansas State University.

11:00 Breeding Season Movements of Adult Female Lesser Prairie-Chickens in Kansas and Colorado. Reid Plumb, Kansas State University.

11:20 Development and Testing of a Greater Sage-Grouse Connectivity Model and its Use in Evaluation of Transmission Line Scenarios. Michael Schroeder, Washington Dept. of Fish and Wildlife.

11:40 Beef that's for the Birds: Audubon's Prairie Bird Initiative. Max Alleger, Missouri Dept. of Conservation.

12:00 Lunch

1:00 Field trip to Glacial Ridge NWR and environs.

5:30 Evening BBQ in the prairie – Booming Flats

9:00 Bus returns to Parking Lot A at U of MN, Crookston

Poster Session: Posters will be available for viewing Friday, October 11-Saturday, October 12 during breaks and social hour.

Effects of Wind Turbines on Male Greater Prairie-Chicken Lek Behavior. Cara Whalen, University of Nebraska, Lincoln.

Greater Prairie-Chicken Survival, Reproduction, and Movements in the Nebraska Sandhills. Jocelyn Olney, University of Nebraska, Lincoln.

Habitat Characteristics of Greater and Lesser Prairie-Chicken Leks in a Recently Developed Hybrid Zone. Kevin Oxenrider, Ohio State University, Columbus.

Adult Female Survival of Breeding Lesser Prairie-Chickens in Kansas and Colorado. Reid Plumb and Joseph Lautenbach, Kansas State University.

Factors Affecting Brood and Chick Survival of Lesser Prairie-Chickens in Kansas and Colorado. Joseph Lautenbach, Kansas State University.

Sage-Grouse Spatially Heterogenic Responses to Energy Disturbance in Wyoming. Andrew Gregory, Bowling Green State University, and Jeffrey Beck, University of Wyoming, Laramie.

Impacts of Anthropogenic Structures on Grouse. Torre Hovick, Oklahoma State University.

Sunday, 13 October: Dispersal

Airport shuttles as needed.

Prairie Grouse Technical Council Field Trip
Polk County, Minnesota - October 12, 2013

We will be traveling to the Glacial Lake Agassiz beach ridges in Polk County, which begins some 5 to 7 miles east of Crookston. Crookston is near the edge of the Red River Valley, a flat landscape of deep clay soils, intensively farmed, and where little is left for wildlife.

The beach ridges are a series of ridges left as Lake Agassiz subsided around 10,000 years ago. They are a mix of sandy, gravelly, rocky soils in between strips of cropland of loamy sand or sandy loam (little clay, generally dry). Most run in a north/south direction. Wetlands were pronounced throughout, as water was trapped behind ridges.

With a drop in elevation from east to west of 10 to 20 feet per mile in the ridges, wetlands were prone to drainage naturally through erosion, but man has significantly increased the drainage of wetlands. Within the relatively flat Red River valley, where water from the beach ridges flows, elevations drop at one to two feet per mile. The Red River flowing north only drops at about 1/2 foot per mile. Can anyone see a possibility of flooding here?

In the 1950s the State of Minnesota began a Save the Wetlands program, funded with a surcharge on hunting licenses. It targeted western Minnesota especially where agriculture was making drastic changes after World War Two. The U. S. Fish and Wildlife Service (F&WS) began a land acquisition program about 10 years later, in the 1960s, funded with duck stamp funds. We are near the north end of the prairie pothole country of western Minnesota. This area was targeted by both agencies to protect wetlands and grasslands. In the 1970's The Nature Conservancy stepped up its land acquisition program in western Minnesota, especially to preserve prairies.

Most recently the Glacial Ridge National Wildlife Refuge came about. In the same period the federal Wetland Reserve Program (WRP) acted to preserve or restore wetlands and grasslands on private land. All of the above programs were meant to permanently protect wildlife land.

We should note that some private land owners deserve much credit as they have maintained native grasslands for a variety of reasons - haying, grazing, wildlife, and for about the last 10 to 15 years - for native prairie seed harvest. The Conservation Reserve Program (CRP) has also been a major grassland factor in our prairie grouse range, though it is diminishing.

Today we will drive past signs of all these organizations and individuals who are maintaining our grasslands. You won't see signs designating, "Prairie Chicken Management Area" as

seen in Illinois, Wisconsin, North Dakota, etc. Minnesota chickens just fit into the management programs of all these organizations wherever there is enough grass and the trees are short. To the credit of many wildlife managers over the years, prairie chickens were of special interest and their needs were addressed in acquisition and management plans.

Watch for diversity in Minnesota grasslands!

Stop 1: Chicog Wildlife Management Area.
We are overlooking Chicog Lake, a shallow (3-5 feet deep) marsh. Speaking of diversity, we'll talk about water, grasslands - native and restored, gravel pits, food plots, deer wintering areas, brushland and aspen timber - complete with logging.

Between stops note the diversity in land ownership and land use.

Stop 2: Thorson Prairie Wildlife Management Area.
Take a Quarter Section of cropland (ordinarily not purchased, but this was part of a much larger land acquisition project of F&WS, TNC and DNR working together) divide the Quarter three ways into native grass restoration, a patch of alfalfa, and some cropland for a food plot. Give it a few years -- and a booming ground appears.

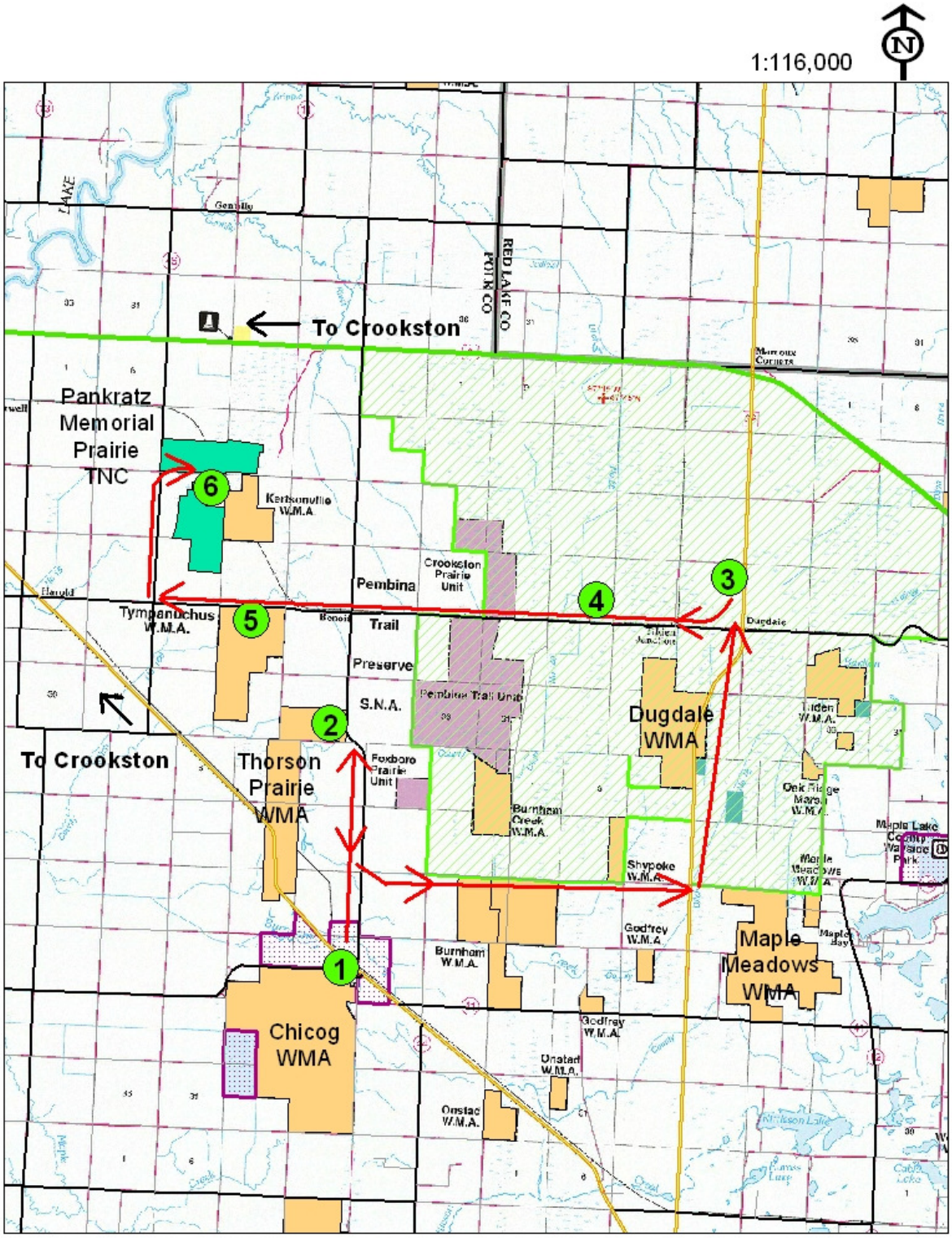
Stop 3: Former headquarters of the Glacial Ridge project, now MN DNR office. We'll take a break, and observe some equipment used in grassland management.

Stop 4: Glacial Ridge National Wildlife Refuge.
This is the site of a patch burn grazing project. We're near the middle of the refuge. We'll talk about any aspects of the refuge that haven't been covered in earlier talks, and then discuss how grass, fire, cattle and chickens are getting along.

Stop 5: Tympanuchus Wildlife Management Area.
This will be the stop for botanists in the group. Tympanuchus is native prairie - one of our better examples of ridge-top dry grasslands. Some 840 acres in size, most every year some part has been burned for about 40 years. Prairie grouse response -- there have been as many as four prairie chicken booming grounds and one sharptail dancing ground either on or near the edge of the unit. Usually there is a coyote den in the middle, to keep all on their toes.

Stop 6: Booming Flats -- Dan Svedarsky's back yard.
None of we field trip organizers are admitting any responsibility as to what happens here -- though all of us have dealt with fire in various forms over the years. Dan will explain . . .

Field trip map



30 Sept 2013
E. Hutchins, MN DNR

Presentation Abstracts

PRAIRIE GROUSE TECHNICAL COUNCIL: THEN (1952) AND NOW (2013)

J.D. KOBRIGER*, ND Game & Fish Department, Dickinson, ND 58601 and
E. PODOLL*, NRCS, Retired, Aberdeen, SD 57401 and
M. ALLEGER*, Missouri Department of Conservation, Clinton, MO 64735

First part (Kobriger) of paper will be a presentation of the history of the Prairie Grouse Technical Council from its inception in 1952 to the present day, including photos of early prairie grouse biologists. Middle portion (Podoll) will be a reflection back by one of the persons who helped draft the original charter of the Council. Final portion (Alleger) will be a report on PGTC materials archived at the State Historical Society of Missouri.

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CLIMATE CHANGE AND PREDICTED EFFECTS ON PRAIRIE GROUSE

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Climate change is having significant impacts on insect phenology, with warmer environmental temperatures contributing to a progression toward earlier emergence. Spring is springing forward: spring events, like bird and butterfly migrations, flower blooming times, and frog mating have been advancing by about 3 days per decade over the past 30 years. The emergence of grasshoppers has advanced by approximately 4 days per decade since 1959, while each degree C corresponds to an advancement of roughly 10 days. This earlier grasshopper emergence does not coincide with hatching of prairie grouse chicks which leads to a shortage of food and death of chicks. Prairie grouse breeding and subsequent hatching of chicks is tied to photoperiod and is not affected as much by warming temperatures. I do not believe prairie grouse can evolve fast enough to compensate for this rapid climate change and believe this is currently leading to declining populations.

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PRAIRIE GROUSE AND THE MINNESOTA PRAIRIE CONSERVATION PLAN

STEVE CHAPLIN, The Nature Conservancy, Minneapolis, MN 55415 USA.

The Minnesota Prairie Plan calls for the establishment of functional prairie systems by identifying, protecting, and restoring 36 prairie core areas in western Minnesota. Prairie chickens and sharp-tailed grouse are important components and indicators of functioning prairie ecosystems in Minnesota but are now missing from many core areas. At one time they were much more widely spread across southern Minnesota and there is strong interest in re-establishing populations not only to bring back an important part of the system but also to be a measure of success of the Prairie Plan highly visible to the public. The Prairie Plan Working Group would like to start a conversation about how we determine the suitability of individual core areas to support viable prairie grouse populations, what management/landscape changes are needed before reintroduction, and what are challenges that need to be addressed before prairie grouse can return to southern Minnesota.

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THE MN PRAIRIE PLAN IN ACTION: CONSERVATION OF THE GREATER PRAIRIE-CHICKEN

GREG HOCH, MN Department of Natural Resources

The Prairie Plan identifies core prairie areas and corridors connecting these areas. Expanded booming ground surveys in recent years have found a number of new grounds in more agriculturally dominated areas outside of the traditional Agassiz Beach Ridges landscape which is the stronghold for the species in the state. This project looks at where grassland acquisition and management can best be applied at the landscape scale to help prairie chickens expand their range further in the state by moving along corridors to colonize new core areas.

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A PRELIMINARY LOOK AT GREATER PRAIRIE CHICKEN "ECOLOGY" NEBRASKA VERSUS MINNESOTA, 2012-2013.

John E. Toepfer, Society of Tympanuchus Cupido Pinnatus, Ltd., 319 W 3rd Ave S, Ada, MN 56510 USA

Thirty-four years ago Robel (1980) in discussing research needs for prairie grouse indicated: "Strange as it may seem, prairie grouse populations are negatively correlated with research efforts, i. e. little research is conducted in those portions of the prairie grouse range where populations are high and stable, whereas more intensive habitat related research efforts are associated with remnant flocks or areas of marginal or isolated habitat. With plenty of grouse to hunt, why worry about doing much biologically-oriented research as long as the grouse populations hold up. Such an attitude results in little meaningful research being conducted in the central portions of the grouse range, the very place where research should be conducted to understand the basic biology of the prairie grouse populations." In March 2012 STCP initiated research project in the Nebraska sandhills to address some of the questions raised by Robel. Preliminary information indicates that nest success was 10-20% higher in Minnesota yet the number of chicks fledged and percentage of hens that fledged chicks was higher in Nebraska. Prairie chickens in Nebraska were twice as mobile as radioed birds in Minnesota which seemed related to the proximity of agricultural fields to spring/summer areas and grassland cover for night roosting. A number of Nebraska adult hens made migratory movements from breeding areas to wintering areas of 5-40 miles.

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BROOD HABITAT AND INVERTEBRATE BIOMASS OF THE GREATER PRAIRIE CHICKEN IN NORTHWESTERN MINNESOTA

J. SYROWITZ*, University of Manitoba, Winnipeg, MB R3T 2N2, Canada, J. TOEPFER, Society of Tympanuchus Cupido Pinnatus, Ltd., Franklin, WI 53132 USA

This study assessed the influence of terrestrial invertebrate abundance and vegetation characteristics on northwest Minnesota greater prairie chicken brood success. Radio telemetry was used to determine movements of greater prairie chicken hens and their broods. Invertebrate abundance indices were collected using a sweep net and vegetation data were recorded with overhead and dot-board photographs. Invertebrates were dried, sorted by size and order, and weighed and counted. Vegetation was classified according to life form and height was measured. Greater prairie chicken broods appear to use those habitats most readily available with increased invertebrate resources. Invertebrate biomass was not related to the occurrence of uncultivated forbs which averaged < 17% in Minnesota habitats where greater prairie chicken broods were located. Relatively undisturbed grasslands produce sufficient invertebrate resources to fledge greater prairie chicken chicks. However, location data and invertebrate-habitat indices suggest increased brood success would be likely with improved habitat placement/availability and irregular disturbance regimes that produce beneficial mixed grass/forb vegetation attractive to both greater prairie chicken broods and their invertebrate prey.

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SEASONAL RESOURCE SELECTION AND SITE-SPECIFIC BROOD PREDICTORS OF GREATER PRAIRIE-CHICKEN BROOD HENS IN NORTHWESTERN MINNESOTA.

N. G. EMERY[1], W. D. SVEDARSKY[2,3]*, and B. J. GOODWIN[2] , [1]State of Alaska, Department of Natural Resources, Anchorage, AK 99501 USA, [2]University of North Dakota, Grand Forks, ND 58202 USA, [3]Northwest Research and Outreach Center, University of Minnesota, Crookston, MN 56716

Minnesota harbors a sustained population of greater prairie-chickens. We compare habitats of hens that lost their brood to hens that were successful using multiple scales. A Resource Selection Function indicates differential use of habitats dominated by trees and soybeans. Trees were used more often than random by successful hens and ignored by unsuccessful hens. Successful hens used soybeans at random while unsuccessful hens preferred soybeans. For a site-specific view, we sampled invertebrate biomass, vegetation cover and density, and litter depth during the brood-rearing period. Logistic regression reveals five predictors of brood presence: greater percent coverage of introduced grasses, greater percent coverage of native forbs, more invertebrates less than 10 mm in length, fewer Orthopterans less than 10 mm in length, and fewer individuals from "Other" invertebrate orders. Apparent nest success decreased from 47.73% to 35% to 28.26% from 2007-2009. Mean Visual Obstruction Readings were greater at hatched nests in all types of vegetation. Clutch sizes of nests dominated by smooth brome were significantly larger than the other vegetation types. Results suggest that landscapes with grasslands comprised of introduced grasses and native forbs that produce an abundance of invertebrates less than 10 mm are most likely to improve prairie chicken nesting and brood-rearing success.

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REPRODUCTION AND SURVIVAL OF TRANSLOCATED MINNESOTA AND LOCAL WISCONSIN GREATER PRAIRIE-CHICKEN HENS IN CENTRAL WISCONSIN

SCOTT HULL, DAVID DRAKE, LESA KARDASH*, CHRIS POLLENTIER, DAVID SAMPLE, BRIAN SADLER, PETER DUNN, AND SCOTT WALTER, Wisconsin Dept. of Natural Resources, Madison, WI.

The Greater Prairie-Chicken (*Tympanuchis cupido*) is a state-threatened species in Wisconsin and exists as a relatively small statewide population (<1000 birds) separated into 4 nearly isolated populations. This population experienced a bottleneck in the 1950's, ultimately resulting in decreased genetic variation in contemporary populations. In 2005 the Wisconsin Department of Natural Resources assembled a panel of independent conservation genetics experts who advised a genetic rescue project to ensure the long-term survival of Greater Prairie-Chickens in Wisconsin. From 2006-2010, a total of 110 hens from Minnesota were translocated to the Buena Vista Wildlife Area in Central Wisconsin in an attempt to enhance the genetic diversity of the Wisconsin population. The objectives of this study were to compare demographic rates of the radio-marked translocated Minnesota hens to local Wisconsin hens in Central Wisconsin. A total of 121 nests were discovered and monitored from 2007-2009. Proportion of eggs hatching within a clutch did not differ (t= -0.92, P = 0.93) among Minnesota hens (90.87% ± 2.47) and Wisconsin hens (91.24% ± 2.84). Daily nest survival for was (0.968 ± 0.006, 95% CI = 0.954 to 0.977) for Wisconsin hens and (0.962 ± 0.005, 95% CI = 0.951 to 0.972) for Minnesota hens. Adult hen survival for the 6 month breeding season (April 1-September 30) was significantly higher ($\chi 2$ = 4.108, P=0.043) for Wisconsin hens (66.4% ± 0.06, n=65) than Minnesota hens (48.9% ± 0.06, n=79). While hatching rates were similar between hen types and overall much higher than other genetically compromised prairie grouse species, low breeding season survival of Minnesota hens suggest a likely translocation effect. This likely impacted the overall success of the genetic rescue project and should be accounted for in future translocation projects.

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ATTWATER'S PRAIRIE-CHICKEN BROOD SURVIVAL – THE INVERTEBRATE AND RED IMPORTED FIRE ANT CONNECTION

MICHAEL E. MORROW* and REBECCA E. CHESTER, Attwater Prairie Chicken National Wildlife Refuge, Eagle Lake, TX 77434 USA, BASTIAAN M. DREES, Texas A&M University AgriLife Extension Service, College Station, TX 77843 USA , JOHN E. TOEPFER, Society of Tympanuchus Cupido Pinnatus, Ltd., Ada, MN 56510 USA.

The Attwater's prairie-chicken (APC; *Tympanuchus cupido attwateri*) remains one of the most critically endangered birds in North America, and extant populations have been heavily supplemented with captive-reared birds. Research has indicated that poor brood survival associated with reduced invertebrate abundance, especially during the first two weeks posthatch, has limited population growth. In this study, we (1) continued to investigate the relationship between invertebrate abundance at brood sites and brood survival; (2) collected information on hen source (captivity or wild-reared) and age to evaluate impacts of the captive-rearing environment on the ability of hens to successfully rear young; and (3) evaluated the impacts of the invasive red imported fire ant (RIFA; *Solenopsis invicta*) on invertebrate abundance during the APC's early brooding season (May – mid-June). Brood sites were located by triangulating radioed brood hens, and broods were checked at dawn 2 weeks posthatch to determine survival. A brood was considered successful if at least one chick was observed. RIFA impacts were evaluated using an impact-reference design with 5 sets of replicates in space and 3 replicates in time during each of 2 years. The 440–725-acre treated areas received applications of Extinguish® Plus brand fire ant bait to reduce RIFA abundance during November 2011 and September 2012. Invertebrate samples were collected from control and treated areas beginning the last week in April following treatment and continued for 3 consecutive bi-weekly periods through early-June each year. All invertebrate samples were collected by sweep-netting. Survival data were collected from 44 broods from 2009–2012. Of these, 21 (48%) were successful (i.e., still had chicks at 2 weeks post-hatch). Median invertebrate numbers/sample were 2.1 times higher ($P < 0.001$) at successful brood sites compared to unsuccessful sites (128 versus 60, respectively). No other attributes of hens (age, released from captivity or wild-hatched, years since release for captive-reared hens, previous nesting experience or success with fledging chicks) hypothesized to affect brood success were significant ($P > 0.52$). Median invertebrates/sample was 1.4 times higher ($P < 0.05$) for treated sites compared to untreated controls. Median dry weight of invertebrates/sample was 1.6 times higher ($P < 0.05$) for treated sites compared to untreated controls. Data collected in this study clearly demonstrate that availability of invertebrates during the first 2 weeks post-hatch is a major factor limiting survival of young APCs. This study also clearly demonstrated that the invasive RIFA has significantly reduced invertebrate abundance within historic and extant APC habitats. APC populations consistently declined during the 25-year period following invasion of APC habitat by RIFA circa 1970. Therefore, it is likely that the introduction of RIFA played a significant role in the APC's plunge toward the precipice of extinction, and has frustrated recovery efforts in recent years.

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EVALUATION OF METHODS USED TO IMPROVE GRASSLANDS AS GALLINACEOUS BROOD HABITAT

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Due to the importance of nest survival and hen winter survival, many studies have investigated how local and landscape-level habitat conditions affect these vital rates. Many management practices for increasing upland bird populations have focused around these factors. While chick survival is an important component of gallinaceous bird population dynamics, it is poorly understood and often tends to be overlooked. Ideal brood habitat not only provides open understory for easy movement and canopy cover for protection, but also provides an abundance of arthropod foods for chicks. This research investigates the efficacy of various methods of CRP mid-contract management to improve brood rearing habitat for upland game birds. The objectives of this study are to (1) determine and compare relative arthropod abundance among CRP grasslands subject to several management techniques for three consecutive years post-management by using sweep nets, vacuum sampling and pitfall traps, (2) determine and compare relative arthropod availability among grasslands subject to several management techniques for three consecutive years post-management using human-imprinted pheasant (*Phasianus colchicus*) chicks as models, and (3) determine and compare vegetation composition and structural characteristics among grasslands subject to several management techniques for three consecutive years post-management. In addition to investigating the effect of treatment methods on arthropods, this study will also research the longevity of the benefits provided by those methods.

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LARGE-SCALE LANDSCAPE CHARACTERISTICS ASSOCIATED WITH OCCURRENCE OF SHARP-TAILED GROUSE IN MICHIGAN'S UPPER PENINSULA.

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Michigan's Upper Peninsula currently represents the eastern most population of sharp-tailed grouse (*Tympanuchus phasianellus*) in the United States, but the amount of habitat required to sustain this population is unknown. In Michigan, sharp-tailed grouse are a non-migratory species requiring large tracts of early successional habitat, which makes them sensitive to land cover change. Our objectives were to better understand the landscape characteristics associated with 1 mi^2 sections occupied by sharp-tailed grouse to improve landscape-scale habitat management. Occupancy data was derived from sharp-tailed grouse surveys conducted from 1999-2012 through lek and road transect surveys. We reclassified 3 land cover classification layers spanning the observation time period to categories representing how grouse may perceive habitat. We calculated the proportion of all land cover types and the area of the maximum intersecting openland patch for each section in the Upper Peninsula. Results indicate that sections occupied by sharp-tailed grouse were associated with larger proportions and patches of openland habitat than sections without confirmed occupancy. Our research will help wildlife managers better understand openland thresholds needed to sustain viable populations and assist with landscape-scale habitat management of sharp-tailed grouse.

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DEVELOPING A LANDSCAPE-LEVEL, MODEL-BASED APPROACH TO EVALUATING SHARP-TAILED GROUSE HABITAT AND POPULATIONS IN NORTH DAKOTA

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Loss, fragmentation, and isolation of grassland habitat have greatly reduced the range and numbers of sharp-tailed grouse (*Tympanuchus phasianellus*) across North Dakota. Because sharp-tailed grouse are resident, area-sensitive species, fragmentation and disturbances that alter landscape habitat characteristics and configuration can impact the presence, abundance, and persistence of prairie grouse populations. Therefore, North Dakota Game and Fish Department is developing a landscape approach that uses spatially explicit models to guide sharp-tailed grouse conservation. To ensure effectiveness for conservation, these landscape models will incorporate grouse biology, be developed at appropriate scales, and use accurate data with spatial and thematic resolution that are sufficiently fine to target sites for specific conservation actions. Uncertainties regarding the ecology of sharp-tailed grouse need to be addressed, including the form of relationships between the amount of habitat and the presence, density, and persistence of grouse. We have designed a study to model the distribution and density of sharp-tailed grouse in North Dakota. To maximize the ability of models to extrapolate rather than interpolated we collected, lek data at randomly selected sample plots that span a broad range of habitat characteristics. The objective is the implementation of a landscape approach to grouse conservation which will require that management perspectives be broadened to explicitly include landscapes and that development of landscape models shifts, at least in part, from the realm of research to management.

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DISTRIBUTION AND LANDSCAPE ATTRIBUTES OF GREATER PRAIRIE-CHICKENS AND SHARP-TAILED GROUSE OUTSIDE OF THEIR TRADITIONAL RANGE IN SOUTH DAKOTA

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Grasslands play a critical role in providing habitat for greater prairie-chickens (*Tympanuchus cupido*) and sharp-tailed grouse (*Tympanuchus phasianellus*). Due to increased conversion of grassland to cropland, South Dakota is losing this critical habitat. The objectives of this study were to (1) identify areas of eastern SD where populations of prairie-chickens and sharp-tailed grouse were suspected to reside, (2) characterize landscape attributes within 3,000 m of leks, and (3) analyze landscape characteristics using GIS modeling to develop a predictive model. Survey routes were developed in areas of potential suitable habitat and leks were located and recorded. All land and land-uses within 3,000 m of identified leks and randomly selected non-use points were digitized into a GIS. Land-use around these points was analyzed at 7 scales. Seventy grouse leks were found in eastern South Dakota outside of the traditional range. Significantly more grassland and undisturbed grass were found around grouse leks than non-use points. The combination of the proportion of total grass (grassland, undisturbed grass, and hay) and patches on the landscape was a strong predictor of lek presence at all spatial scales. Multi-scale modeling revealed the number of patches at 3000-m and the total amount of grass on the landscape at 2000-m to be the strongest predictors of lek presence.

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GREATER PRAIRIE CHICKEN IN ILLINOIS I: HISTORICAL CONTEXT AND EVOLUTIONARY LEGACY OF A CONSERVATION ICON

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The Prairie Chicken is an icon of the North American prairies, and three of its forms [Greater (*Tympanuchus cupido pinnatus*; GRPC); Attwater's (*T.c. attwateri*; ATPC); and Lesser (*T. pallidicinctus*; LEPC)] are listed by the IUCN in relevant conservation categories. GRPC was once widespread in Illinois but is now reduced to two small and isolated south-central populations. Here we examine the genetic trace of this historic range reduction by assaying mitochondrial (mt) DNA sequence variation across 180 GRPC (IL=81; WI=21; NE=19; MN=19; KS= 13; MO=12; ND=11; OK=3; CO=1) and comparing them to data derived from 8 ATPC (TX=8) and 4 LEPC (KS=4) to test predictions that (1) mtDNA variability in GRPC is comparable among states; (2) GRPC in Illinois reflect genetic traces of both indigenous and translocated (1992-1998) birds; and (3) GRPC have undergone a genetic bottleneck. Our analyses will yield insights into the historic processes that have shaped GRPC populations and will be informative for adaptive management of GRPC in Illinois.

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GREATER PRAIRIE CHICKEN IN ILLINOIS II: CONTEMPORARY GENETIC MONITORING OF A CONSERVATION ICON

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Once abundant in Illinois, Greater Prairie Chicken (GRPC) declined to < 50 individuals by the early 1990s. Annual translocations of out-of-state birds (1992-1998) increased population size and partially restored genetic diversity lost through historic population bottlenecks. Yet, long-term population persistence and maintenance of genetic diversity remain uncertain, particularly in light of fluctuating and/or declining population sizes. We generated DNA profiles from shed feathers collected during the breeding season on leks at Prairie Ridge State Natural Area (Illinois) by genotyping 24 microsatellite loci. We conducted population-level analyses to: (1) identify individuals based on unique genotypes, (2) perform genetic mark/recapture analyses over 3 lekking seasons, and (3) assess gene flow and genetic structure within and among leks. Population structure was identified at two levels: county and family group. Remarkable lek fidelity was also identified, with a surprising number of individuals returning to breed across years. Our study underscores the utility of molecular genetic data in elucidating survivorship, dispersal, and demography, and is an essential component for adaptive management and recovery of this iconic species.

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INVESTIGATION OF THERMAL HABITAT SELECTION BY GREATER PRAIRIE-CHICKENS

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Greater Prairie-Chicken (GRPC) populations have declined throughout the Flint Hills region over the past three decades. These declines correspond with large scale shifts in management that have resulted in a homogenization of the landscape. It is likely that this shift in management has influenced GRPC nest and adult survival directly through reduced cover, but the impacts resulting from indirect factors such as alterations to the thermal environment are unknown. We investigated thermal habitat selection by GRPC in the southern Flint Hills at The Nature Conservancy's ~16,000 ha Tallgrass Prairie Preserve. We compared thermal models created from operative temperature gathered at GRPC locations, sites within 2 m of GRPC locations, and the broader landscape. We found that GRPC are selecting for nest sites that are as much as 8° C cooler than the surrounding landscape when air temperatures are ≥ 38° C. Furthermore, GRPC are selecting for fine-scale differences in thermal environments as nest sites are nearly 4° C cooler than area within 2 m of nests and successful nests had cooler environments than nests that failed. Variation in grassland structure resulting from the fire-grazing interaction may be important in moderating thermal environments. This work also suggests that heterogeneity could be important for conserving imperiled GRPC populations as climate change forecasts are predicting greater thermal extremes.

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QUANTIFYING GREATER PRAIRIE-CHICKEN SPATIAL ECOLOGY IN RESPONSE TO WIND ENERGY DEVELOPMENT IN NORTHCENTRAL KANSAS

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In Kansas, optimal sites for wind energy development often overlap with habitat of Greater Prairie-Chickens (*Tympanuchus cupido*). We used data from radio-marked female prairie-chickens to explore drivers of seasonal space use pre- and post-construction of a wind energy facility in northcentral Kansas. We developed resource utilization functions (RUFs) for four groups of females: breeding season pre-construction (2007–2008; $n = 28$), nonbreeding season pre-construction ($n = 14$), breeding season post-construction (2009–2011; $n = 102$), and nonbreeding season post-construction ($n = 37$). We chose 10 predictor variables that described land cover, habitat patchiness, anthropogenic disturbance, and prairie-chicken behavior. We documented two significant responses of female prairie-chickens to wind energy development during the breeding season: (*i*) distance to turbine was positively correlated with space use, demonstrating population level avoidance of wind turbines, and (*ii*) 50% volume contour home range size increased ~2-fold. Our study is the first application of RUF techniques to a prairie grouse population and provides quantitative insight into responses to energy development and seasonal spatial ecology of a species of conservation and recreational concern.

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LANDSCAPE GENETIC ANALYSIS OF GREATER PRAIRIE-CHICKEN RESPONSE TO WIND ENERGY DEVELOPMENT IN KANSAS.

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In 2008 the US Department of Energy set a benchmark that 20% of the US energy demand would be met by wind by 2030. Resultantly, concern over what impact this level of wind energy development might have on wildlife has become a key conservation concern. In plains states such as Kansas, much of this concern has centered on impacts of wind energy development on prairie-chickens. For the past seven years our group has been using a Before/After/Control/Impact study design to assess what impacts a 200 MW wind energy facility in Kansas has had on Greater Prairie-Chickens. Here we assess to what degree wind energy development has impacted local genetic connectivity of prairie-chickens compared to the impact on prairie-chicken gene flow of Interstate Highway 81. Using a Bayesian Areal Fuzzy Wombling Analysis of 547 prairie-chickens, genotyped at 21 microsatellite loci, we found that wind energy infrastructure development increased the posterior probability of wombled barriers on the landscape from ~0.04 to ~0.32. This suggests that wind energy infrastructure is a barrier to prairie-chicken gene flow. However, the posterior probability of wombled barriers posed by Highway 81 during the post construction period was ~0.45-0.61. Therefore, Highway 81 is a much stronger barrier to prairie-chicken gene flow than is wind energy infrastructure. In the next phase of this analysis we will use an Agents-Based Bioinformatics approach to study the probability long-term population viability of prairie-chickens on this landscape.

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MORPHOLOGICAL DIFFERENCES BETWEEN LESSER PRAIRIE-CHICKENS AND GREATER PRAIRIE-CHICKENS IN A HYBRID ZONE

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Morphologically, Greater and Lesser Prairie-Chickens (*Tympanuchus cupido* and *T. pallidicinctus*, respectively) differ in size and the color of their esophageal air sac which they inflate during display. However, birds of intermediate size, hybrids and females are often difficult to identify in hand. The goal of this study was to evaluate whether species identity could be determined using a combination of measurements. Additionally, reflectance data was analyzed to determine how color of air sacs, combs and body plumage vary with other morphological characteristics. In the spring of 2013, we studied Greater and Lesser Prairie-Chickens in western Kansas, the only known hybrid zone. We captured prairie-chickens on single and mixed-species leks during the breeding season using drop nets and walk-in funnel traps. We measured mass, and the lengths of the wing, tail, tarsus, pinnae, total head, and culmen. UV-visible reflectance of air sacs, combs and plucked central breast feathers were measured using a portable spectrophotometer. Wing, tail and total head lengths and mass differed between Greater Prairie-Chickens and Lesser Prairie-Chickens of both sexes, but culmen length did not. Tarsus and pinnae length was useful for identifying males to species, but not females. Air sac color reflectance included a UV component and also differed between the two prairie-chicken species. Plumage and comb reflectance analyses are ongoing. We will present suggestions for determining species identity of females and birds of intermediate size. Being able to accurately determine species identity in the hybrid zone is critical for evaluating nesting success and habitat use data that will be used to guide management decisions.

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DEVELOPMENT OF A RANGE-WIDE CONSERVATION PLAN FOR LESSER PRAIRIE-CHICKENS

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The Range-Wide Conservation Plan (RWP) for Lesser Prairie-Chickens (LEPC): 1) Identifies range-wide and sub-population goals for LEPC; 2) Identifies desired habitat amounts/conditions to achieve population goals; 3) Develops maps of focal areas/connectivity zones where conservation actions will be emphasized to produce the habitat conditions required to expand and sustain LEPC; 4) Enhances programs/cooperative efforts to encourage and expand voluntary landowner incentives and practices to produce the desired habitat conditions; 5) Promotes agreements to avoid impacts to LEPC from various development activities, and where avoidance is not possible, to minimize and mitigate impacts; 6) Establishes a mitigation framework to be used by any entity and administered by the WAFWA that will establish development agreements and when unavoidable impacts occur, will compensate for these impacts through off-site mitigation actions; 7) Identifies and implements monitoring/ research needs; 8) Develops an adaptive management plan that will incorporate monitoring and new information into future adjustments to the plan; 9) Addresses input and suggestions from agencies, organizations, landowners, industries, other stakeholders, and the general public on the conservation plan for LEPC.

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DEVELOPING TARGETING TOOLS FOR WOODY PLANT ENCROACHMENT AND PRAIRIE GROUSE CONSERVATION

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Woody plant encroachment into native grasslands is one of the key factors driving habitat loss for prairie grouse species such as the lesser prairie-chicken (*Tympanuchus pallidicinctus*) and the greater sage-grouse (*Centrocercus urophasianus*). Conservation efforts such as the LesserPrairie-Chicken Initiative and the Sage Grouse Initiative implement habitat improvement programs that include the removal of encroaching woody plants. However, given the vast spatial expanse of threatened habitats, prioritizing and targeting treatment areas remains a challenge. In an effort to support habitat improvement efforts, we employed high-resolution aerial imagery and object-oriented image processing to map the location, size, and canopy cover of woody plants encroaching into native grasslands across approximately 26 million acres and 6 million acres of lesser-prairie chicken and sage grouse habitats, respectively. The final products are highly accurate; individual plant detection rates and copy cover estimates are greater than 90%. Accuracy is directly related to canopy cover with higher accuracies occurring in areas with canopy cover below 50%. The canopy cover products derived from this work can be employed to increase ecological understanding of the impacts of woody plant encroachment on prairie grouse, and ultimately reduce threats through proactive habitat management.

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LESSER PRAIRIE-CHICKEN INITIATIVE: TARGETED SOLUTIONS TO THREAT REDUCTION

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The lesser prairie-chicken (*Tympanuchus pallidicinctus*) is a species of conservation priority because of long-term population declines and changes in available habitat; primarily type conversion of native prairie to other uses. With large acreages of Conservation Reserve Program (CRP) expiring and new limitations on total acres to be enrolled, in 2010, The Natural Resource Conservation Service (NRCS) initiated its Lesser Prairie-Chicken Initiative (LPCI) to retain these CRP fields as grassland and transform them into working lands. The LPCI was expanded to capitalize on 27 NRCS practices that can assist in addressing other threats to the species for example: woody encroachment, improper livestock grazing, and fence collision risk. We have implemented a 3-tiered approach to assessing the effects of LPCI on LEPC populations. Through these assessments, we are simultaneously using science based targeting tools to quantify the extent of a given threat and determine objectives to adequately reduce the threats. Tools currently under development include: tillage risk (including loss of CRP), fence collision risk, eastern red cedar (*Juniperus virginianus*) encroachment, and honey mesquite (*Prosopis glandulosa*) encroachment. We will illustrate the implementation of these targeting tools in the context of invasive woody species and a framework for meaningful threat reduction.

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REGIONAL VARIATION IN NEST SUCCESS OF LESSER PRAIRIE-CHICKENS IN KANSAS AND COLORADO

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Lesser prairie-chickens (*Tympanuchus pallidicinctus*) are found within three distinct landscapes within Kansas and eastern Colorado. Concurrent evaluation of nest success trends across the northern portion of the species' range of lesser prairie-chickens will provide insight into trends within each landscape. We captured and fitted 70 adult females with satellite and VHF transmitters in 2013. A total of 50 nests were found. In Colorado, 4 nests were found in CRP (2) and sand sagebrush prairie (2); 50% hatched. We found 18 nests in grazed pastures of native grasslands of south-central Kansas, of which 8 were successful, 7 were depredated, 2 were abandoned, and 1 was trampled; an apparent nest success of 44.4%. There were 29 nests located in CRP (12) and grazed pastures of native grassland (17) of northwest Kansas; 7 nests were successful, 16 were depredated, 2 nests were abandoned, and 2 nests were trampled, with an apparent nest success of 25.0%. Apparent nest success across all study areas was 39.8%. Differences in habitat, management, and regional environmental conditions have an impact on nest success across the northern portion of the lesser prairie-chicken's range.

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BREEDING SEASON MOVEMENTS OF ADULT FEMALE LESSER PRAIRIE-CHICKENS IN KANAS AND COLORADO

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After peaking in the mid-1970s, populations of Lesser Prairie-Chickens (*Tympanuchus pallidinctus*) have declined during the past two decades, increasing conservation concern for the species. Information on seasonal movements is lacking in its northern range and yet is a necessary prerequisite to conservation planning and management. The goal of this study was to measure movement patterns during the breeding season for each of the three populations in the northern range of the species. Females were trapped during 2013 and fitted with either a 12-15-g VHF bib-style transmitter or a 22-g model 100 GPS Platform Transmitting Terminal (PTT) using a rump-style harness. Positions of marked individuals were taken either by triangulation of VHF transmitters or by GPS positions from PTT's. Female movements varied throughout the breeding period with larger movements occurring during the pre-nesting and post-nesting periods than the nesting period. Large movements occurred after the loss of a nest or brood and before re-nesting. Mean distances moved from lek-of-capture to nest sites in Kansas were within estimates reported in other portions of its range. Determining patterns and quantifying movements to indicate their spatial needs during the breeding period is paramount in directing conservation actions for lesser prairie-chickens.

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DEVELOPMENT AND TESTING OF A GREATER SAGE-GROUSE CONNECTIVITY MODEL AND ITS USE IN EVALUATION OF TRANSMISSION LINE SCENARIOS

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The Washington Wildlife Habitat Connectivity Working Group (WHCWG) recently completed a connectivity analysis for Greater Sage-Grouse in the Columbia Plateau Ecoregion of Washington. This analysis consisted of expert opinion-based spatial models incorporating landscape resistance to evaluate movement. Additional analysis has also been completed to validate these models for sage-grouse using telemetry, genetic, and lek persistence data. The model validation analysis included 78 alternate models with alternate resistance values for key features, such as transmission lines. Preliminary results for this effort indicate that transmission lines influence sage-grouse movement, gene flow, and lek persistence to a greater degree than originally anticipated in the expert models, and appear to be important determinants of habitat suitability and connectivity. Results from the modeling effort were used in a pilot analysis to assess alternate transmission line pathways for a proposed 230 kV connection between two existing substations near Yakima, Washington. The models provided a way to compare the pathways in terms of: (1) increases in cost-weighted distance for connectivity corridors; (2) decreases in quantity of potential nest habitat; (3) alteration in areas of potential impact; and (4) comparison of mitigation scenarios. We believe these tools offer a useful way to evaluate development scenarios.

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BEEF THAT'S FOR THE BIRDS: AUDUBON'S PRAIRIE BIRD INITIATIVE

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The National Audubon Society's Prairie Bird Initiative (PBI) is a partnership among the Society, the Missouri Department of Conservation and a growing number of funding and collaborative partners. The PBI redefines Audubon's work in grassland habitats across the Flyways of the Americas to create tangible bird conservation results from Canada to Argentina.

The PBI aims to create market-based incentives to support the sustainable management of privately owned grasslands. Ranchers are being recruited to participate in a bird-friendly beef marketing program designed to return market premiums in exchange for well-maintained grassland bird habitat. Thus far, pilot sites for initial implementation totaling nearly 20,000 acres have been identified in Kansas, Missouri and Nebraska. A detailed market feasibility study and survey of potential consumers has been completed, and monitoring protocols have been implemented to document responses by priority grassland birds, including greater prairie-chicken, to a number of grazing approaches.

Based on positive results of initial feasibility studies, the bird-friendly beef component of the PBI is moving into the trial phase. Production protocols which include patch-burn grazing, short-duration high-intensity grazing and the grazing of cover crops to produce grass-fed, grass-finished beef for premium markets are being developed. Specific business and marketing plans focused on pilot landscapes, and a verifiable certification process will soon be developed based on input from producers and biologists. Short-term objectives also include implementation on at least 15,000 acres within one or more pilot geographies and the formation of a producers' council.

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Poster Abstracts

EFFECTS OF WIND TURBINES ON MALE GREATER PRAIRIE-CHICKEN LEK BEHAVIOR

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Wind farms are being constructed at an increasing rate in Nebraska without full knowledge of their potential effects on birds. The Greater Prairie-Chicken (*Tympanuchus cupido*), a Tier I at-risk species in Nebraska, is just one of numerous bird species that is present where wind farms are being built. Wind turbines have the potential to affect Greater Prairie-Chickens in a variety of ways, including behaviorally, during the breeding season. It is important to determine whether wind turbines affect prairie chicken lek behavior since behavioral aspects during the breeding season can influence demographic processes and population dynamics. In the spring of 2013, the behaviors of male Greater Prairie-Chickens were studied at 15 leks distributed along a 25-km gradient that moved away from the Nebraska Public Power District (NPPD) wind farm in Ainsworth, NE. Prairie chicken behaviors at the leks were measured using an instantaneous sampling technique. The data will be used to determine whether any differences exist in prairie chicken lek behavior along the 25-km wind turbine gradient. Preliminary results include an overall time budget of male prairie chicken lek behavior and a comparison of four common behaviors at the 15 leks along the wind turbine gradient.

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GREATER PRAIRIE-CHICKEN SURVIVAL, REPRODUCTION, AND MOVEMENTS IN THE NEBRASKA SANDHILLS

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The Greater Prairie-Chicken is considered a Tier 1 At-risk species in Nebraska due to habitat loss across its range. The objective of this study was to investigate the survival, reproduction, and habitat use of Greater Prairie-Chickens in the Nebraska Sandhills. From April through July of 2013 we used radio and satellite telemetry to track female Greater Prairie-Chickens in the Sandhills near Ainsworth, NE. Throughout the field season we monitored nests and broods, and conducted vegetation surveys at each nest and brood location. Preliminary results show similar findings to those of previous studies in the Sandhills. However, results suggest higher use of subirrigated sites for nesting. These results will be compared to research on Greater Prairie-Chickens done in both the Sandhills and Southeast Nebraska. In addition, results will be used in a larger project investigating the effects of the Nebraska Public Power District (NPPD) wind farm in Ainsworth, NE on Greater Prairie-Chicken survival, reproduction, and habitat use.

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HABITAT CHARACTERISTICS OF GREATER AND LESSER PRAIRIE-CHICKEN LEKS IN A RECENTLY DEVELOPED HYBRID ZONE

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A recent range expansion has led to historically isolated populations of Greater and Lesser Prairie-Chickens (*Tympanuchus cupido* and *T. pallidicinctus*, respectively) to overlap in western Kansas. As a result, mixed-species leks have formed. The goal of this study was to determine if ecological isolation mechanisms exist between Greater and Lesser Prairie-Chickens by determining if both species have differing habitat preferences when selecting lek sites and display territories on the lek. In April 2013, vegetation surveys were conducted on active prairie-chicken leks in Gove and Lane Counties, Kansas, to determine lek habitat preferences by Greater and Lesser Prairie-Chickens in the hybrid zone. Lek habitat was examined by comparing grass height, litter depth, biomass density, and percent ground cover measurements between leks with differing species attendance ratios using modified methods from Hunt and Best (2010, Southwestern Naturalist 55: 477-487). To determine whether Greater and Lesser Prairie-Chickens prefer different lek microhabitats, male territories were mapped on pure and mixed-species leks and territorial habitat preference was examined by comparing grass height, litter depth, biomass density, and percent ground cover measurements at the center of the individual's territory and at 1m in the four cardinal directions. These data suggested that Greater Prairie-Chickens displayed in taller grass than Lesser Prairie-Chickens. Also, our discriminant model had 100% accuracy at predicting prairie-chicken species composition on the lek using grass height, litter depth, and percent vegetation cover. Data from this study furthers our knowledge on ecological isolation mechanisms between Greater and Lesser Prairie-Chickens and can aid in management decisions for both species in the hybrid zone.

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ADULT FEMALE SURVIVAL OF BREEDING LESSER PRAIRIE-CHICKENS IN KANSAS AND COLORADO

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Lesser prairie-chicken (*Tympanuchus pallidinctus*) populations have consistently declined range-wide during the past two decades, increasing conservation concern for the species. In an effort to offset current declines and aid in management planning, robust estimates of demographic parameters are essential. The goal of this study was to estimate seasonal survival rates of females for each of the three populations in the northern range of the species. Females were trapped during 2013 and fitted with either a 12-15-g VHF bib-style transmitter or a 22-g model 100 GPS Platform Transmitting Terminal (PTT) using a rump-style harness. Survival of tagged individuals was determined weekly. Preliminary estimates of apparent survival suggest that breeding season survival varies among populations (apparent breeding season survival ranged from 0.465-0.500), with most of our estimates low relative to other studies. We speculate our low estimates were representative of harsh spring conditions and the ongoing drought in the Central Great Plains. Understanding variation of demographic parameters within and among populations is critical for guiding effective management decisions.

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FACTORS AFFECTING BROOD AND CHICK SURVIVAL OF LESSER PRAIRIE-CHICKENS IN KANSAS AND COLORADO

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There is limited information on brood and chick survival of lesser prairie-chickens (*Tympanuchus pallidicinctus*) in the northern portion of their range. We captured and fit 70 adult females with GPS satellite and VHF transmitters in 2013; 50 nests were found and monitored across all study sites, of which 17 hatched. Within 5 days of hatch, 0.6 g VHF transmitters were attached to 12 chicks. In Colorado, both broods were lost before 30 days; an apparent survival of 0.0%. In south-central Kansas, 8 broods were monitored, of which 3 were lost before 30 days; an apparent brood survival of 63.5%. In northwest Kansas, 1 brood out of 7 made it to 30 days; an apparent brood survival of 14.3%. No transmitters were attached to chicks in Colorado, as all broods were lost within days after hatch. In northwest Kansas, all 6 chicks with transmitters were lost. In south-central Kansas, 2 of 6 chicks were lost. The entire region experienced a late spring, which in turn delayed nesting. Colorado experienced its third consecutive year of drought, while northwest Kansas was subjected to extreme temperatures during peak nest hatch. These factors contributed to reduced brood survival and delayed nesting.

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SAGE-GROUSE SPATIALLY HETEROGENIC RESPONSES TO ENERGY DISTURBANCE IN WYOMING

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Landscape modification due to rapidly expanding energy development in the Intermountain West, USA has prompted concern over how such developments impact wildlife. Sage-grouse (*Centrocercus urophasianus*) have been petitioned for listing under provisions of the Endangered Species Act seven times and the state of Wyoming alone represents 64% of the extant sage-grouse population. Consequently, the relationship between sage-grouse populations and oil and gas development in Wyoming is an important component to managing the long-term viability of this species. We used 814 leks from the Wyoming Game and Fish Department's lek survey database and well pad data from the Wyoming Oil and Gas Conservation Commission to evaluate changes in population trend of sage-grouse as a function of oil and gas development since 1991. We found that from 1991–2011 oil and gas well-pad density increased 3.6-fold across the state and was associated with a nearly 24% decline in lek attendance. Using a spatial and temporally structured analysis via Geographically Weighted Regression, we found a 1-to-4 year time lag between development density and lek attendance. Sage-grouse also responded to development densities at multiple spatial neighborhoods surrounding leks, including broad scales of 10 km from lek sites. Finally, our analysis suggests a maximum development density of 1 well-pad within 2 km of leks to avoid measurable impacts within 1 year, and <6 well-pads within 10 km of leks to avoid delayed impacts.

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IMPACTS OF ANTHROPOGENIC STRUCTURES ON GROUSE

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Anthropogenic structures such as those associated with energy development, are a major threat to wildlife. Grouse species (*Tetraonidae* spp.) are of particular conservation concern because their complex life history strategies require large, unfragmented landscapes. We searched the peer-reviewed literature to assess impacts of anthropogenic structures on grouse survival and displacement across the northern hemisphere. We used a meta-analytic technique to calculate overall effect size and structure-specific impact on different life history stages of grouse. Structures consistently resulted in displacement behavior and population decline regardless of grouse species or structure type. Roads had the greatest negative impact on displacement, while lek attendance declined the most of all life history stages examined. Available data varied in the number of studies, types of structures, and grouse species investigated. Furthermore, the effects of wind energy development on grouse in North America have not been studied. European research has examined a broad suite of structures, but few studies have focused on the impacts in terms of survival. We conclude that all anthropogenic structures examined resulted in an overall decline in grouse survival and caused displacement behavior, and it is thus imperative that future anthropogenic structures are targeted at landscapes that are already fragmented.

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State Reports

2013 MINNESOTA PRAIRIE-CHICKEN SURVEY

Charlotte Roy, MN Dept. of Natural Resources

Greater prairie-chickens (*Tympanuchus cupido pinnatus*) were surveyed in 15 of 17 survey blocks during the spring of 2013. Observers located 188 booming grounds and counted 1,415 male prairie-chickens and 528 birds of unknown sex. Estimated densities of 0.10 (0.06-0.14) booming grounds/km^2 and 11.4 (9.9-13.0) males/booming ground within the survey blocks were similar to densities during recent years and during the 10 years preceding modern hunting seasons (i.e., 1993-2002).

Table 2. Prairie-chicken counts within survey blocks in Minnesota.

			2013		Change from 2012[a]	
Range[b]	Survey Block	Area (km^2)	Booming grounds	Males[c]	Booming grounds	Males[c]
Core	Polk 1	41.2	7	62	1	21
	Polk 2	42.0	14	148	6	38
	Norman 1	42.0	2	16	-1	-6
	Norman 2	42.2	7	70	1	14
	Norman 3	41.0	5	58	-4	-20
	Clay 1	46.0	6	97	0	24
	Clay 2	41.0	2	49	0	10
	Clay 3	42.0	6	86	-2	9
	Clay 4	39.0	2	27	-1	-5
	Wilkin 1	40.0	5	67	-1	-8
	Core subtotal	415.0	56	680	-1	77
Periphery	Mahnomen	41.7	2	16	NA[d]	NA[d]
	Becker 1	41.4	NA	NA	NA	NA
	Becker 2	41.7	2	34	-3	3
	Wilkin 2	41.7	2	15	0	-17
	Wilkin 3	42.0	4	29	1	-6
	Otter Tail 1	41.0	3	20	2	8
	Otter Tail 2	40.7	NA	NA	NA	NA
	Periphery subtotal	290.6	13[e]	114[e]	0[e]	-16
Grand total		705.5	69[e]	794[e]	-1[e]	61[e]

[a] The 2012 count was subtracted from the 2013 count, so positive values indicate increases.
[b] Survey blocks were categorized as within the core or periphery of the Minnesota prairie-chicken range based upon bird densities and geographic location.
[c] Includes birds recorded as being of unknown sex but excludes lone males.
[d] Surveys were not conducted in this block during 2012.
[e] These totals only reflect blocks for which count data were available.

For the full report, visit
http://files.dnr.state.mn.us/recreation/hunting/prairiechicken/2013_springsurvey.pdf

2013 MINNESOTA SHARP-TAILED GROUSE SURVEY

Charlotte Roy, MN Dept. of Natural Resources

Sharp-tailed grouse surveys were conducted between 23 March and 15 May 2013, with 1,284 birds observed at 139 leks. The mean numbers of sharp-tailed grouse/lek were 4.8 (3.8-5.9) in the East Central (EC) survey region, 10.5 (9.3–11.7) in the Northwest (NW) region, and 9.2 (8.2–10.2) statewide. Comparisons between leks observed in consecutive years (2012 and 2013) were similar in the NW region and statewide, but in the EC region sharp-tailed grouse counts declined substantially.

Table 2. Difference in the number of sharp-tailed grouse / lek observed during spring surveys of the same lek in consecutive years in Minnesota.

	Statewide			Northwest[a]			East Central[a]		
Comparison[b]	Mean	95% CI[c]	*n*[d]	Mean	95% CI[c]	*n*[d]	Mean	95%CI[c]	*n*[d]
2004 - 2005	-1.3	-2.2– -0.3	186	-2.1	-3.5– -0.8	112	0.0	-1.0– 1.1	74
2005 - 2006	-2.5	-3.7– -1.3	126	-3.6	-5.3– -1.9	70	-1.1	-2.6– 0.6	56
2006 - 2007	2.6	1.5– 3.8	152	3.3	1.7– 5.1	99	1.2	0.1– 2.3	53
2007 - 2008	0.4	-0.8– 1.5	166	0.0	-1.6– 1.6	115	1.2	0.1– 2.5	51
2008 - 2009	0.9	-0.4– 2.3	181	1.8	-0.1– 3.8	120	-0.8	-2.1– 0.6	61
2009 - 2010	-0.6	-1.8– 0.6	179	-0.8	-2.6– 1.0	118	-0.1	-1.2– 1.0	61
2010 - 2011	-1.7	-2.7– -0.8	183	-1.8	-3.1– -0.5	124	-1.5	-2.8– -0.3	59
2011 - 2012	-2.0	-2.9– -1.1	170	-1.7	-2.9– -0.4	112	-2.4	-3.3– -1.6	58
2012 - 2013	-0.8	-2.0– 0.4	140	0.4	-1.3– 2.3	88	-2.9	-4.2– -1.8	52

[a] Survey regions; see Figure 1.
[b] Consecutive years for which comparable leks were compared.
[c] 95% CI = 95% confidence interval
[d] *n* = number of leks in the sample.

For the full report, visit
http://files.dnr.state.mn.us/recreation/hunting/grouse/grouse_survey_report13.pdf

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1991 Fran Hamerstrom
1993 Ron Westemeier
1995 Dan Svedarsky and Jerry Kobriger
1998 Bob Robel
1999 Bill Berg
2001 Len McDaniel
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2005 Nova Silvy and The Society of Tympanuchus Cupido Pinnatus, Ltd.
2007 Rick Baydack and Kerry Reese
2009 Randy Rodgers and Bill Vodehnal
2011 Mike Morrow, Jack Connelly, and The Minnesota Prairie Chicken Society

Past PGTC Conferences

1st	Grand Island, Nebraska	September 1957
2nd	Emporia, Kansas	March 1959
3rd	Stevens Point, Wisconsin	September 1960
4th	Pierre, South Dakota	September 1961
5th	Nevada, Missouri	September 1963
6th	Warroad, Minnesota	September 1965
7th	Effingham, Illinois	September 1967
8th	Woodward, Oklahoma	September 1969
9th	Dickinson, North Dakota	September 1971
10th	Lamar, Colorado	September 1973
11th	Victoria, Texas	September 1975
12th	Pierre, South Dakota	September 1977
13th	Wisconsin Rapids, Wisconsin	September 1979
14th	Halsey, Nebraska	September 1981
15th	Emporia, Kansas	September 1983
16th	Sedalia, Missouri	September 1985
17th	Crookston, Minnesota	September 1987
18th	Escanaba, Michigan	September 1989
19th	Billings, Montana	September 1991
20th	Ft. Collins, Colorado	July 1993
21st	Medora, North Dakota	August 1995
22nd	College Station, Texas	February 1998
23rd	Gimli, Manitoba	September 1999
24th	Woodward, Oklahoma	September 2001
25th	Siren, Wisconsin	September 2003
26th	Valentine, Nebraska	September 2005
27th	Chamberlain, South Dakota	October 2007
28th	Portales, New Mexico	October 2009
29th	Hays, Kansas	October 2011

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