IMPACTS OF ALTERNATIVE GRASSLAND MANAGEMENT REGIMES ON THE POPULATION ECOLOGY OF GRASSLAND BIRDS

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Submitted by:

Division of Biology
Kansas State University

Presented to:

Kansas Department of Wildlife and Parks

Principal Investigators

Lance B. McNew
Brett K. Sandercock
Jim C. Pitman

Graduate Students

Amy Erickson

Field Technicians

Kyle Lunsford, Michael Ritchie, William White

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EXECUTIVE SUMMARY

The primary objectives of this study are: i) to investigate patch-burn grazing as a rangeland management technique to improve habitat conditions for grassland bird communities, ii) to determine how rangeland management influence the population demography and viability of a grassland indicator species, the Greater Prairie-Chicken, and iii) to develop a mechanistic understanding of the benefits of patch-burn grazing by examining densities and demographic performance of the grassland bird community.

Accomplishments — We conducted 156 surveys for grassland birds at 104 stratified random sampling transects during 24 May – 10 July. The mean number of birds detected by treatment was ranked: MSB > CCB >MPBG2 > MPBG1 > MPBG0 > IESB. Mean number of species observed was ranked MPBG0 > MPBG1 = IESB > CCB > MPBG2 > MSB. Vegetation was sampled at 130 points along the songbird transects; each point was sampled twice during the season. Songbird nests were located and monitored on one MPBG pasture and one IESB pasture. Nest survival differed by species, and for Dickcissels, also differed by treatment type.

Trapping of prairie-chickens via walk-in traps and drop nets occurred at 17 leks during 11 March – 5 May, resulting in 208 captures of 180 adult and yearling prairie-chickens. Seventy-three (46 M, 27 F) were captured at sites managed with patch-burn grazing and 107 (79 M, 28 F) prairie-chickens were captured at sites with other management practices. Radio-transmitters were fitted to 55 females. During 29 April – 27 June, 44 nests were located (31 first nests, 8 renests). Females selected unburned areas for initiating nests. During 29 April – 4 August, 152 vegetation surveys were conducted at 44 nest sites, 17 brood locations, and 91 random points in pasture patches that were burned this spring, last spring, and two springs ago. Approximately 66% of nests were located in grassland patches purposely left unburned for at least one year prior; whereas unburned grassland accounted for only 26% of our study area.

Fifteen of 44 nests successfully hatched ≥ 1 chick for an apparent nest success of 34% pooled across rangeland management treatments. However, apparent nest success was 2.7 times higher in patches burned > 1 year prior to nest initiation (41%) than in patches burned during the current year (15%). Apparent nest success was lowest in pastures stocked with cattle at high densities (IESB, IPBG) and highest in pastures stocked at moderate to low densities. Reproductive potential was high across all rangeland management treatments. Mean clutch sizes (±SD) were 11.6 ± 1.1 and 8.8 ± 1.4 eggs for first nests and renests, respectively. Mean nest initiation dates for first nests and renests were 27 April and 2 June, respectively. The proportion of eggs that hatched in successful nests was 90.1 ± 2.7% across all treatments.

We monitored 15 broods from hatch to failure or 1 October. Pre-fledge brood success (i.e., the proportion of broods hatched where ≥ 1 chick survived to fledge at 14-d of age) was 47−54% for 15 broods, depending on the unknown outcomes of 2 broods that moved into inaccessible private property. The proportion of hatched chicks that survived to fledge at 14-d of age given at least one chick survived (i.e., fledge success in successful broods) was 62.1 ± 39%. Brood movements from nests to brood-rearing areas were typically from unburned nesting sites to areas burned in the spring and having lower residual vegetation and more bare ground than nest locations, and more forbs than random points. The mean distance (±SD) between nest locations and 14-d old brood locations was 871 ± 331 m; suggesting that optimal proximity of burned brood-rearing habitat to unburned nesting habitat is < 1 km.

During 11 March – 12 December, 2011, 55 radio-marked female prairie-chickens were monitored via triangulation or homing ≥ 1 time per week until death, censor, or 21 December; resulting in 2,659 locations of radio-marked prairie-chickens during the period. We documented 19 mortalities that were unrelated to capture. All mortalities showed evidence of predation (14 avian, 5 mammalian). Three females were thought to have slipped their radio-transmitters and were right-censored.

Administration and Reporting — Seasonal contracts of field technicians expired on 6 September, 2011. As of 15 December 2011, three full-time employees and one seasonal technician are being paid with grant funds. Principal Investigator, Lance McNew, has accepted a research position at the Alaska Science Center and will be minimizing his duties on this study. He will continue to monitor and co-direct the study in a secondary role. Co-PI, Brett Sandercock, will assume the fiscal and scientific supervisory duties, and will coordinate with Jim Pitman (KDWPT) on hiring of seasonal workers and project permitting and reporting. We anticipate recruiting a doctorate student to direct field activities for the two remaining field seasons.

OBJECTIVES

Objective I) Evaluate the impacts of rangeland management practices on grassland bird diversity and densities.

Accomplishments

We created 104 300-meter line transects to estimate abundance and diversity of grassland songbirds within patch-burned and annually burned grazed pastures. Bird surveys were conducted at three patch-burn grazed (MPBG) pastures on the Homestead (2) and Browning (1) ranches, two double-stocked and annually-burned pastures (IESB) on the Highland and Nation ranches, one season-long single stocked and annually burned pasture (MSB) on the Huber Ranch, and one cow-calf pasture (CCB) on the Browning Ranch in Chase and Greenwood Counties. It is important to note that only ½ of the CCB pasture in this study was burned in 2011, thus the differences in bird abundances, species diversity, and vegetation measurements between the CCB pasture and other burned pastures cannot be solely attributed to differences in stocking regime. In each pasture (and for MPBG pastures, in each patch), we placed 8 transects for a total of 104 transects across the entire study site. Two of these transects were “primary transects” and were sampled three times during the field season. The remaining six transects were sampled one time during the field season. A total of 156 line transect surveys were conducted during 2011. For MPBG pastures, the time-since-burn for each patch is indicated by a number; MPG0 = 0 years since burn (burned this year), MPBG1 = one year since burn (burned last year) and MPBG2 = two years since burn (burned two years ago).

A total of 6,394 birds of 58 species were either seen or heard during the 156 surveys (Table 1). Average number of birds per treatment was ranked MSB > CCB >MPBG2 > MPBG1 > MPBG0 > IESB. Grassland bird diversity (total species observed) by treatment was ranked MPBG0 > MPBG1/IESB > CCB > MPBG2 > MSB. Relative abundance of some core grassland species (Dickcissel, Eastern Meadowlark, Grasshopper Sparrow, Henslow's Sparrow, Upland Sandpiper, and Brown-headed Cowbird) differed by treatment (Table 2). The most notable difference in abundance was seen in the Henslow's Sparrow, which was almost completely absent from areas that were burned <2 years prior.

Vegetation was sampled along the primary songbird transects. Five sampling points were evenly spaced along each primary transect for a total of 130 sampling points across the entire study area. At each sampling point, a 20x50 cm frame was used to estimate percent cover for each plant functional group (grass, forb, or shrub), bare ground, detritus, and litter. Litter depth in millimeters was also recorded at each sampling point. Aboveground biomass was estimated by using a visual obstruction reading (VOR). The VOR at each sampling point was estimated using a one meter pole marked at 1 decimeter intervals. Visual obstruction readings were taken from a height of 1 meter and a distance of 5 meters. Each point was sampled two times during the field season: once in mid-June (mid-season vegetation) and again in late July (late-season vegetation). See Table 3 for the average values for all measurements across all treatments ± SE for the mid-season vegetation measurements. Table 4 shows the same measurements for late-season vegetation. Percent cover of grass decreased significantly as the season progressed for all treatments except MPBG2. Bare ground increased significantly for all treatments except MPBG1 and MPBG2 as the season progressed. VOR remained consistent throughout the season for burned areas, but increased on unburned areas. Average litter depth increased as time since burn increased.

We searched for songbird nests in one IESB pasture at the Highland ranch and on one MPBG pasture at the Browning ranch. Pastures were the same size and search effort was equal on both pastures. The first nest was located on 20 May, and the last nest was completed on 1 August for a 74-day nesting season. Program MARK was used to generate estimates of daily survival for songbird nests. A total of 85 nests were used for nest survival analysis. Number of nests used in the analysis differed by species (Dickcissel = 55, Grasshopper Sparrow = 18, Eastern Meadowlark = 12). Due to small sample sizes, we were unable to obtain separate estimates of daily nest survival between treatment types for Grasshopper Sparrows and Eastern Meadowlarks; survival estimates for these species is pooled across the entire study area. For Dickcissels, 18 nests were found in PBG pastures, and 37 were found on annually burned pastures. Nest survival was obtained by raising the estimated daily survival rate to the minimum number of days necessary for that species to successfully complete a nesting attempt (GRSP = 20 days, EAME = 23 days, DICK = 20 days). Nest survival was highest for Eastern Meadowlarks followed by Dickcissels nesting in MPBG pastures, Dickcissels nesting in IESB pastures, and Grasshopper Sparrows (Table 5).

Goals for Next Quarter

We will prepare for the 2012 field season by purchasing any additional equipment and training one new field technician for summer field work. Data collected in 2011 will be further analyzed and results will be presented at the 2012 KNRC meeting in Wichita, KS.

Objective II) Assess the impacts of rangeland management practices on breeding habitats of Greater Prairie-Chickens.

Accomplishments

Prairie-chickens were captured with walk-in traps at lek sites during March − May. Birds were sexed by plumage characteristics and aged by feather patterns on the outer two primary feathers of the wing. Females were equipped with VHF radio transmitters with an elastic necklace harness, a 6-8 hour mortality switch and an expected battery life of 12 months (Model RI-2B, Holohil Systems Ltd., Ontario, Canada). Radio-marked prairie-chickens were located ≥3 times/week from project trucks, an ATV, or on foot using portable radio receivers and handheld 3-element yagi antennas. Bird locations were estimated from ≥2 triangulation bearings using a maximum-likelihood estimator in program LOCATE III or flush locations were recorded with a GPS. To locate nests, females relocated on foot when females have settled and their locations have not changed for 2-3 days. Nest locations were marked discretely with natural landmarks placed ≥25 m from the nest bowl and geographic coordinates recorded with a GPS unit. Vegetation structure was quantified at each nest site within three days of hatching or failure. We recorded a suite of vegetation measurements including visual obstruction readings (VOR in dm) and non-overlapping vegetation cover (% grass, forbs, and shrub, detritus, and bare ground) at nests. Parallel sampling was conducted random points within the study area boundary. For each point, we recorded whether the local area had been burned this spring (April 2011; years since burn = 0), the previous spring (years since burn = 1), or two springs prior (years since burn = 2). Burn histories and cattle stocking practices (i.e., densities, stocking dates) were determined by interviewing land managers.

Trapping occurred at 17 leks during 11 March – 5 May, resulting in 208 captures of 180 prairie-chickens (125 males, 55 females; Table 8). Seventy-three (46 M, 27 F) prairie-chickens were captured at sites managed with patch-burn grazing and 107 (79 M, 28 F) prairie-chickens were captured at sites with other management practices, including intensive early stocking and annual spring burning. Radio-transmitters were fitted to 55 females. We located 44 nests of 33 individual females; 21 of which were found in grazed pastures of PBG properties. The remaining 23 nests were located in grasslands managed with various other strategies (see Objective IV).

The study area included privately-owned grasslands managed for cattle production (50,296 ha) and the Tallgrass Prairie National Preserve (4,450 ha). Land manager surveys revealed that rangeland management practices varied greatly across the study area. Approximately 82% of grassland habitats were burned this spring during 17 March – 18 April, 2011, 48% of the unburned grassland was burned during the previous spring (March – April, 2010), and the remaining 46% was burned during the spring of 2009. Rarely did stocking regimes fit pre-defined categories such as IESB or SLSB (Smith and Owensby 1978). Stocking densities varied from 0.5 ha per steer to 9.1 ha per cow-calf pair. Grazing season length ranged from 30 d to 365 d. However, stocking regimes did tend to fall into eight categories based on similarities in stocking densities, cattle type, and grazing period length (Table 8). Approximately 36% of the study area was burned this spring and stocked with steers or heifers at densities of 0.9 ± 0.2 ha per head for 100 ± 22 days beginning in April. These strategies were similar to the intensive early stocking and annual spring burning (IESB) regime described by Smith and Owensby (1978) and we assigned them to the category IESB. 22% of the study area was burned this spring and stocked with steers or heifers at a lower mean density (±SD) of 1.6 ± 0.2 ha per head for a longer grazing period (139 ± 29 days). Densities and grazing seasons were intermediate between IESB and season-long stock grazing (Smith and Owensby 1978), and we assigned these properties to the management category of moderate stocking and annual spring burning (MSB). Stocking densities of IPBG (intensive stocking and patch-burn grazing) and MPBG (moderate stocking and patch-burn grazing) were comparable to those of IESB and MSB, but pastures were divided into thirds and each third is burned annually on a rotational basis (Table 8). Approximately 19% of the study area was managed with cow-calf grazing. Most (ca. 68%) cow-calf pastures were burned this spring and stocked at 4.3 ± 0.6 ha per pair. 26% of cow-calf pastures were not burned this spring and grazed at densities of 3.7 ± 1.4 ha per pair, and 5% of cow-calf pastures were managed with patch-burn grazing where at least a third of the pasture was left unburned this year (Table 8). One pasture at TPNP was grazed year-long by bison at a density of 71.6 ha per head and patch-burned. Pasture sizes ranged from 30 to 1,520 ha and was generally larger for steer and heifer pastures than for cow-calf pastures (Table 8).

During 29 April – 4 August, 152 vegetation surveys were conducted at 44 nest sites, 17 brood locations, and 91 random points in pasture patches that were burned this spring, last spring, and two springs ago. Nest sites had significantly greater visual obstruction, forb coverage, and detritus coverage, and significantly less bare ground than did random points (Table 8). Vegetation composition and structure varied greatly among burn treatments. Surveys conducted in patches two years since burn were characterized by greater visual obstruction, greater forb and detritus coverage and lower amount of bare ground than were sites located in areas burned this spring (April 2011). Approximately 75, 12, and 14% of the random points were located in pasture patches that were burned this spring, last spring, and two springs ago, respectively (Table 8). Approximately 34, 30, and 36% of nests were located in patches or pastures that were burned this spring, last year, and two years ago, respectively. Of nests located in pastures burned this year, most (73%) were located in small areas that remained unburned (e.g., wet draws). Nearly all (92%) of the brood locations occurred in grassland patches burned this spring. Broods were never located in patches last burned 2 years ago (Table 8).

Goals for Next Quarter

The breeding season for prairie-chickens occurs during March – May with nesting and brood-rearing occurring during May – August. We will prepare for the 2012 breeding season by recruiting and hiring three seasonal field technicians and one graduate student to direct field activities.

Objective III) Assess the impacts of rangeland management practices on fecundity of Greater Prairie-Chickens.

Accomplishments

Efforts were focused on 1) monitoring radio-marked prairie-chickens to locate nests, 2) monitoring nests and broods, and 3) capturing and equipping juveniles with radio-transmitters. Capture and handling of prairie-chickens occurred as described in our research proposal beginning 11 March. Captured females were fitted with necklace-style radio-transmitters. To locate nests, radio-marked females were approached on foot when female locations did not change for 2-3 days. We searched the area for a nest after flushing radio-marked females. Nest locations were marked discretely with natural landmarks placed ≥25 m from the nest bowl, and geographic coordinates were recorded with a GPS unit. Nest attendance by females was monitored by triangulation every 3−4 days throughout the incubation period. We revisited nest sites when females were determined to be off of the nest for >2 consecutive checks. Nests were considered *failed* if the eggs were destroyed by predation, trampling by livestock or by farming equipment. Nests were considered *successful* if >1 egg produced a chick that leaves the nest. Hatch rate was calculated as the percentage of eggs that were laid that hatched and produced chicks, among successful nests. Broods from successful nests were relocated every 4-5 days in the fall, and flush counts were used to estimate survival of chicks to fledging (14d post hatch). Broods were considered *successful* if >1 chick survived until fledging. We used a modified drop net and spotlights to capture ≥25 day old chicks by relocating radio-marked females at night. We collected 10ul of blood, record morphometrics and equipped them with radio transmitters attached with sutures and bonding cement. Radio-marked juveniles were monitored ≥2 days per week for survival and movements until death or transmitter failure or loss.

During 29 April – 27 June, 44 nests were located (31 first nests, 8 renests). Estimated lay dates ranged from 16 April to 18 June and hatched dates of successful nests ranged from 25 May to 16 July. Fifteen of 44 nests were successful (produced ≥1 chick) and apparent nest success for the pooled sample was 34%. Most of the failed nests were predated (86%), 1 (3%) nest was abandoned, 1 (3%) was trampled by cattle, and 2 (7%) losses were from unknown causes. Hatch rate of eggs in successful nests was high at 90.1 ± 2.7% chicks per egg. Mean (±SD) clutch sizes for first and renests that were known to be complete were 11.6 ± 1.5 and 8.8 ± 1.4 eggs, respectively.

Apparent nest success was 2.7 times greater in areas that were unburned this spring than in burned areas (15% in burned areas, 41% in unburned areas; Table 8). Generally, apparent nest success was lowest in pastures stocked with cattle at high densities (IESB, IPBG) and highest in pastures stocked at moderate to low densities where at least a third of the pasture was left unburned (CCPBG, CCU, MPBG; Table 8). Mismatches did not appear to occur between habitat selection and productivity as apparent nest success was more than 3.7 times greater in habitat types where selection ratios indicated preference (Table 8; see Objective IV). Apparent nest success was 41% in habitat types with selection ratios > 1 and 11% in habitat types with selection ratios < 1.

We monitored 15 broods from hatch to failure or 1 October. Seven broods were determined to fledge ≥ 1 chick, 6 failed, and the fates of 2 broods were unknown due to brood movement into inaccessible areas. Therefore, brood success to fledge (14-d post hatch) was 47–54% when pooled across habitat types. The proportion of hatched chicks that survived to fledge at 14-d of age given at least one chick survived (i.e., fledge success in successful broods) was 62.1 ± 39%. Only 2 broods survived until 60-d of age. Females tended to move broods soon after hatch from successful nests in unburned and moderately grazed areas into burned areas with intense to moderate grazing (see Objective IV). Five of 7 (71%) of broods surviving to 14-d post hatch were reared in grasslands burned in the spring. Radio-marked female movements suggested that 83% of broods failing before fledge were also moved to grasslands burned this spring.

Goals for Next Quarter

We will use the nest survival model in Program MARK to generate maximum likelihood estimates of daily nest survival. Multiple model selection and inference will be used to evaluate the importance of multiple sources of variation on daily nest survival. Variables will include: nest age, nest attempt (first or renest), hen age, VOR (dm), overhead cover, burn treatment, stocking density, and size of the burn patch treatment in which the nest occurs. We will then calculate the overall nest survival probability by raising the daily nest survival estimate to an exponent equal to the mean incubation interval for prairie-chickens on the study site. The duration of laying and incubation periods will be determined from observations of successful nests discovered during laying, or from published values in the literature if necessary.

Brood Survival.—Initial brood size will be considered the number of chicks that were known to hatch based on nest observations. Systematic flush counts will be used to estimate pre-fledge (0-14 days) and post-fledge (14-60 days) survival. Because broods will not be observed daily, we will use the nest survival model type in Program MARK to evaluate daily brood survival probabilities. Covariates will include hen age, a forb:grass cover index, VOR, and average home range distance to closest anthropogenic feature. Daily brood survival probabilities will be calculated using maximum likelihood estimates. The daily brood survival rate will be raised to the power of 14 to estimate the pre-fledge juvenile survival rate.

Broods will be considered *successful* if >1 chick survives until fledging. Fledging success will be calculated as the percentage of chicks that survive until fledging, among successful broods. Dipnets and spotlights will be used to capture >25 day old chicks by relocating radio-marked females at night. We will mark juveniles with numbered metal leg bands, record morphometrics and equip them with radio transmitters attached with glue or sutures. Survival rates of juvenile prairie-chickens from 25-days old to first breeding (post-brood survival; PBS) will be estimated using known-fate modeling in program MARK 5.0. Models will be developed with design matrices and the logit link function, and selection will be based on minimization of Akaike's Information Criterion (AIC). AIC weights will be used to select the model best supported by the data. Post-brood survival will be estimated for individual cohorts if sample sizes are sufficient, but pooled across cohorts for small sample sizes.

Objective IV) Assess the effects of rangeland management practices on the seasonal home ranges, movements, and habitat selection of Greater Prairie-Chickens.

Accomplishments

Radio-marked females were monitored ≥3 times per week from vehicles during the nesting and brood-rearing period (Apr–Aug) and ≥1 time per week during the non-breeding season. Bird locations were determined from triangulation bearings from ≥2 positions or by homing in and flushing radio-marked birds. Program Locate III was used to estimate locations of radio-marked prairie-chickens from each set of triangulation bearings. Landowners were surveyed in regards to management practices during August – September to determine burning dates and boundaries, cattle type (e.g., heifers, steers, cow-calf pairs), stocking dates and cattle densities (ha/head or cow-calf pair). Spatial information on bird locations, leks, nests, broods, and management strategies was gathered and imported into ArcGIS 10 (Environmental Systems Research Institute, Redlands, CA) in UTM coordinates.

During 11 March – 12 December, 2011, we collected 2,659 locations of 55 radio-marked prairie-chickens, resulting in 48 locations per female on average. Evaluation of home range size and space use has not been conducted, but we are on track to collect the 30−50 locations per individual per season that are required for estimation of home range size using kernel methods.

The majority of pastures at study sites were burned this spring (71% of pastures were burned in their entirety). Prevalence for management strategies on grassland pastures available to nesting prairie-chickens was ranked IESB (36%) > MSB (22%) > CCB (13%) > MPBG (7%) > CCU (5%) > IPBG (2%) > CCPBG (1%) > Hay (1%) > BPBG (<1%; Table 8). With the exception of hayfields, none of the grassland habitats were ungrazed. More than 65% of nests were located in grazed grassland patches or pastures that were intentionally left unburned (Table 8), and 8 of the remaining 11 nests (73%) were located in burned pastures but in relatively small areas that went unburned unintentionally due to topography or hydrology. Selection ratios (% nests / % available) suggested that nesting prairie-chickens selected cow-calf pastures that were unburned (CCB), all patch-burn grazing treatments (CCPBG, IPBG, MPBG, and BPBG), as well as unburned hayfields (Table 8). Selection ratios indicated that pastures burned in the spring (IESB, MSB, and CCB) were avoided by nesting prairie-chickens.

We monitored the movements of 15 broods from 14 females during the quarter. Females tended moved broods soon after hatch from successful nests in unburned and moderately grazed areas into burned areas with intense to moderate grazing. Although 87% of successful nests were located in unburned grassland patches, 77% of the locations of the broods produced from these nests were in patches that burned this spring. The mean distance (±SD) between nest locations and 14-d old brood locations was 871 ± 331 m; suggesting that optimal proximity of burned brood-rearing habitat to unburned nesting habitat is < 1 km.

Goals for Next Quarter

Radio-marked females will be monitored ≥3 times per week from vehicles during the nesting and brood-rearing period (Apr–Aug) and ≥1 time per week during the rest of the year (Sep–Mar). Bird locations will be determined from triangulation as described above. We will begin digitizing fire and grazing treatments in ArcMap 10 to provide habitat maps and covariate data for space use and demographic analyses.

Objective V) Evaluate the effects of rangeland management practices on the survival of Greater Prairie-Chickens.

Accomplishments

We monitored Greater Prairie-Chickens remotely at least once per week via radio-telemetry to assess survival. During 11 March – 15 December, 2011, 55 female Greater Prairie-Chickens were monitored. We documented 21 mortalities; three of which occurred within seven days of capture and were considered capture-related deaths. All mortalities showed signs of predation; 14 avian, 5 mammalian. Three transmitters were dropped with no apparent death of the female and were right censored from the study. Seven radio-marked females were lost for more than two weeks at the time of this report. The remaining females were known to be alive as of 21 December.

Goals for Next Quarter

Radio-marked females will be monitored ≥3 times per week from vehicles during the nesting and brood-rearing period (Apr–Aug) and ≥1 time per week during the rest of the year (Sep–Mar). Females will be relocated immediately whenever changes in pulse rate are detected. The event will be considered a *dropped radio* if the transmitter is found with the harness intact and no evidence of a mortality event. The event will be considered a *collision mortality* if the remains show slice marks or evidence of striking a structure. The event will be considered a *predator mortality* if the remains show evidence of bite or chew marks from a mammalian predator, or if the remains are associated with a plucking post and whitewash from a raptor. Despite rapid relocation of dead grouse, it may not be possible to eliminate scavenging as a confounding factor when trying to determine cause of death.

Objective VI) Evaluate the cumulative effects of rangeland management practices on the population growth and viability of Greater Prairie-Chickens.

Accomplishments

Projected annual population growth rates can be calculated using age-specific fecundity and survival estimates and a matrix population model. Efforts in the first year of study were focused on collected field data required to estimate 11 vital rates used in population calculations: nest initiation rate, clutch sizes and survival rates of first and renesting attempts, hatch rates within successful nests, renesting rate, brood survival, fledglings produced per chick hatched, and age specific survival of juveniles from fledge to recruitment, yearlings and adults. To address this objective, we captured, marked, and monitored 55 female prairie-chickens, located and monitored 44 nests and 15 broods. We captured and fitted transmitters to 6 juvenile prairie-chickens and monitored them until death, transmitter failure, or end of the reporting period. Demographic data from multiple years are required to accurately assess population viability. However, preliminary data from the first year of study suggest that a key population parameter, reproductive success, is significantly greater in grasslands managed with a rotational burning regime, such as patch-burn grazing, as compared to grasslands managed with intensive early stocking and annual spring burning. Unburned areas were selected by nesting prairie-chickens and nests placed in unburned areas had a higher probability of successfully hatching. However, burned areas were selected for brood-rearing and brood survival did not appear to differ among burning treatments. Our preliminary data suggest that rangeland management practices that result in structurally diverse grassland habitat types where both recently burned and unburned patches are available may provide adequate habitat conditions for variable life-history requirements of prairie-chickens. Two additional years of data are needed before conclusions are drawn.

Goals for Next Quarter

We will continue to monitor the radio-marked females captured in 2011. We will recruit and hire three seasonal field technicians to assist with summer field work and a graduate student to supervise field research on the prairie-chicken study. We will begin field work for breeding season 2 in March. Our objective is to capture and radio-mark ≥ 50 female prairie-chickens and uniquely band ≥ 80% of males attending leks. Radio-marked females will be monitored via telemetry to assess nesting status and survival.

Table 1. Birds detected along surveys conducted in six pastures in Chase County KS, 24 May – 10 July 2011.

Species	IESB	MSB	CCB	MPBG0	MPBG1	MPBG2
American Crow	9	11	9	35	15	24
American Robin	-	-	-	1	1	-
American Goldfinch	4	-	2	-	2	1
Bank Swallow	-	-	-	7	-	-
Baltimore Oriole	-	-	1	5	3	-
Barn Swallow	5	1	11	20	15	8
Black-capped Chickadee	-	1	-	2	-	-
Bell’s Vireo	-	-	8	-	1	1
Brown-headed Cowbird	109	142	107	191	317	361
Blue Grosbeak	-	-	2	7	2	-
Blue Jay	1	-	-	6	5	3
Brown Thrasher	1	4	4	9	8	1
Canada Goose	-	-	-	7	25	18
Carolina Wren	-	-	-	-	1	1
Common Grackle	-	-	-	16	8	10
Common Nighthawk	18	8	10	28	23	22
Common Yellowthroat	-	-	-	1	-	-
Dickcissel	142	193	167	173	305	467
Eastern Bluebird	1	-	-	3	3	-
Eastern Kingbird	6	-	2	17	8	3
Eastern Meadowlark	103	88	99	131	283	323
Eastern Phoebe	-	-	-	3	-	-
European Starling	-	-	-	3	1	1
Field Sparrow	-	-	-	9	-	-
Great Blue Heron	2	1	-	12	3	4
Greater Prairie-chicken	5	10	-	10	37	14
Great Egret	1	-	-	-	-	-
Grey Catbird	-	-	3	-	-	-
Grasshopper Sparrow	112	73	85	114	306	173
Henslow’s Sparrow	-	-	10	4	8	139
Horned Lark	-	-	1	13	2	-
House Wren	-	-	-	1	-	-
Killdeer	17	1	4	20	12	6
Lark Sparrow	7	15	8	32	6	7
Loggerhead Shrike	-	-	-	4	-	-
Mourning Dove	5	4	14	25	8	11
Northern Bobwhite	6	9	7	33	19	19
Northern Cardinal	1	1	-	4	5	4
Northern Flicker	4	1	-	6	-	3
Northern Mockingbird	9	3	-	24	1	2

Orchard Oriole	7	-	1	14	10	2
Prairie Falcon	-	-	-	-	1	1
Purple Martin	-	-	-	-	-	17
Red-bellied Woodpecker	4	1	-	4	2	2
Red-headed Woodpecker	-	-	-	-	1	2
Red-tailed Hawk	2	-	-	6	1	-
Red-winged Blackbird	4	12	1	32	43	40
Rock Dove	-	-	-	2	-	-
Swainson’s Hawk	-	-	-	-	1	-
Scissor-tailed Flycatcher	6	-	-	3	2	-
Tree Swallow	1	-	-	-	4	5
Tufted Titmouse	2	-	-	8	-	3
Turkey Vulture	4	-	1	7	1	3
Upland Sandpiper	69	44	41	107	71	58
Vesper Sparrow	-	-	-	1	-	-
Western Kingbird	-	-	-	1	-	-
Wild Turkey	1	1	1	-	-	-
Yellow-billed Cuckoo	3	-	2	2	1	1

Table 2. Relative abundance (average number detected) of six grassland species by rangeland management treatment.

Treatment	DICK	EAME	GRSP	HESP	UPSA	BHCO
MPBG0	58	44	57	1	36	64
MPBG1	124	94	79	3	24	106
MPBG2	156	108	58	46	19	120
IESB	71	52	56	0	34	27
MSB	193	88	73	0	44	142
CCB	167	99	85	10	41	107

Table 3. Mean ±SE mid-season vegetation measurements along grassland songbird survey transects,10 June – 19 June 2011.

Treatment	%Grass	%Forb	%Shrub	%Bare	%Litter	%Detritus	Litter Depth (mm)	VOR
IESB	43.6 ± 2.7	13.2 ± 2.4	0.5 ± 0.3	35.3 ± 2.2	0	3.6 ± 0.6	0	1.5 ± 0.1
MSB	57.3 ± 2.5	18.3 ± 1.8	0.9 ± 0.8	25.2 ± 2.7	0	1.6 ± 0.2	0.01 ± 0.01	2.6 ± 0.2
CCB	56.8 ± 4.1	30.3 ± 3.6	0	10.9 ± 4.4	2.9 ± 0.9	0.8 ± 0.4	6.3 ± 2.2	1.4 ± 0.2
MPBG0	47.6 ± 3.5	11.4 ± 1.6	1.3 ± 0.5	20.6 ± 2.6	7.0 ± 1.2	2.7 ± 2.1	2.9 ± 0.5	0.8 ± 0.1
MPBG1	53.6 ± 2.5	19.5 ± 2.0	1.8 ± 0.6	3.8 ± 0.8	14.1 ± 1.7	1.6 ± 0.3	7.9 ± 0.8	1.7 ± 0.1
MPBG2	60.2 ± 1.9	17.4 ± 1.7	2.5 ± 0.8	0.1 ± 0.1	10.7 ± 1.2	5.1 ± 1.0	15.9 ± 2.0	2.7 ± 0.1

Table 4. Mean ±SE late-season vegetation measurements along grassland songbird survey transects, 25 July − 29 July 2011.

Treatment	%Grass	%Forb	%Shrub	%Bare	%Litter	%Detritus	Litter Depth (mm)	VOR
IESB	27.3 ± 3.7	11.0 ± 1.4	0.06 ± 0.03	42.5 ± 2.5	1.9 ± 1.2	21.0 ± 3.0	0.2 ± 0.1	1.3 ± 0.2
MSB	37.0 ± 2.7	14.8 ± 1.5	0.90 ± 0.41	41.4 ± 2.0	0	13.1 ± 2.5	0	2.3 ± 0.2
CCB	41.6 ± 6.6	11.1 ± 1.3	1.3 ± 0.6	17.2 ± 7.8	5.4 ± 2.4	32.0 ± 2.6	5.2 ± 1.3	2.9 ± 0.2
MPBG0	21.7 ± 2.3	6.2 ± 0.7	0.7 ± 0.3	35.7 ± 3.9	7.3 ± 1.2	28.4 ± 3.2	1.3 ± 0.5	0.8 ± 0.1
MPBG1	36.1 ± 3.2	9.8 ± 1.0	1.7 ± 0.4	5.8 ± 1.3	15.4 ± 2.8	34.1 ± 1.6	5.2 ± 0.5	2.7 ± 0.2
MPBG2	61.4 ± 3.4	9.5 ± 1.2	1.6 ± 0.8	0.5 ± 0.2	4.8 ± 1.1	28.2 ± 3.0	10.7 ± 0.9	3.1 ± 0.1

Table 5. Estimated daily survival rates and extrapolated nest survival probabilities (± SE) for Grasshopper Sparrows (GRSP), Eastern Meadowlarks (EAME), and Dickcissels (DICK) in pastures managed with intensive early stocking (IESB) and patch-burn grazing (MPBG).

Species	Daily survival rate	Nest survival probability
GRSP	0.927 ± 0.021	0.220 ± 0.095
EAME	0.961 ± 0.016	0.400 ± 0.192
DICK (IESB)	0.926 ± 0.015	0.215 ± 0.070
DICK (MPBG)	0.934 ± 0.020	0.255 ± 0.109

Table 6. Number of male, female and total prairie-chickens captured during 11 March – 5 May, 2011

Treatment	No. Leks	Males	Females	Total
PBG	7	46	27	73
Other	10	79	28	107
Total	17	125	55	180

Table 7. Rangeland management of study area for grassland bird research in Chase, Greenwood and Morris Counties, KS, 2011.

Management*	Spring Burn (Y/N)	No. of Properties	No. of Pastures	Mean Pasture Size (ha ± SD)	Mean Patch Size (ha ± SD)	% of Study Area	Stocking Density (ha/head)	Mean grazing period (d ±SD)
IESB	Y	11	73	273 ± 293	--	36	0.9 ± 0.2	100 ± 22
MSB	Y	10	41	307 ± 185	--	22	1.6 ± 0.2	139 ± 29
CCB	Y	4	23	307 ± 90	--	13	4.3 ± 0.6	324 ± 151
CCU	N	11	18	153 ± 96	--	5	3.7 ± 1.4	261 ± 92
CCPBG	*	2	4	126 ± 126	56 ± 61	1	3.3 ± 0.2	183 ± 0
IPBG	*	2	2	407 ± 54	136 ± 20	1	1.1 ± 0.1	99 ± 2.2
MPBG	*	3	8	501 ± 553	197 ± 180	7	1.9 ± 0.2	151 ± 35
BPBG	*	1	1	435	217 ± 4	< 1	30	365
Hay	N	4	12	49 ± 45	--	1	--	--
Unknown	--	> 5	--	--	--	13	--	--

* Management acronyms described in text.

Table 8. Mean vegetation measurements (± SE) at nest, brood, and random locations of Greater Prairie-Chickens in Chase, Greenwood and Morris Counties, KS in 2011.

Habitat Measurement	Point Type			Statistics
	Brood	Nest	Random	
VOR (dm)	1.9 (0.3)	2.6 (0.1)	1.2 (0.1)	$F_{2,149} = 33.8$, $P < 0.001$
Grass cover (%)	65.9 (5.7)	47.0 (3.6)	53.9 (2.5)	$F_{2,149} = 4.0$, $P = 0.02$
Forb cover (%)	18.2 (4.2)	20.5 (2.0)	14.6 (1.3)	$F_{2,149} = 33.8$, $P = 0.05$
Shrub cover (%)	2.7 (0.9)	1.9 (0.7)	1.7 (0.4)	$F_{2,149} = 0.36$, $P = 0.69$
Bare ground (%)	10.3 (3.3)	3.1 (0.8)	25.2 (2.5)	$F_{2,149} = 20.9$, $P < 0.001$
Detritus cover (%)	2.5 (1.0)	24.5 (3.6)	4.8 (1.2)	$F_{2,149} = 24.9$, $P < 0.001$
Distance to nearest shrub (m)	29.8 (8.8)	27.7 (7.2)	43.4 (7.3)	$F_{2,149} = 1.1$, $P = 0.32$
Height of near shrub (cm)	59.4 (12.0)	55.5 (5.9)	70.7 (6.7)	$F_{2,149} = 1.2$, $P = 0.31$
Number in patches burned this year	11	15	71	
Number in patches burned last year	1	13	11	$\chi^2 = 30.9$, $P < 0.001$
Number in patches burned 2 years ago	0	16	13	

Table 8. Nesting statistics and habitat selection ratios of Greater Prairie-Chickens relative to 9 types of rangeland management practices in Chase, Greenwood and Morris Counties, KS in 2011.

Management	% of Study Area	No. failed nests	No. successful nests	Apparent nest success (%)	% of Nests	Selection Ratio*
IESB	35.9	4	0	0.0	9.1	0.25
MSB	22.4	4	1	20.0	11.4	0.51
CCB	13.0	3	1	25.0	9.1	0.70
CCU	4.7	4	4	50.0	18.2	3.84
CCPBG	0.9	1	2	66.7	6.8	7.42
IPBG	1.5	2	0	0.0	4.5	3.05
MPBG	7.0	6	6	50.0	27.3	3.90
BPBG	0.1	4	0	0.0	9.1	90.91
Hay	0.8	1	1	50	4.5	6.00

* Selection ratios > 1 indicate management types were selected by nesting prairie-chickens, ratios < 1 suggest management types that were avoided.