EFFECTS OF LIVESTOCK GRAZING MANAGEMENT ON THE ECOLOGY OF SHARP-TAILED GROUSE, GRASSLAND BIRDS, AND THEIR PREDATORS IN NORTHERN MIXED GRASS PRAIRIE HABITATS

PROJECT No. 58308

2018 2nd QUARTER REPORT

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2nd Quarter Report
Reporting Period: 1 April – 30 June

EXECUTIVE SUMMARY

Field efforts this quarter focused on capturing and banding sharp-tailed grouse and marking females with radio transmitters in both the rest-rotation grazing system implemented by Montana Fish, Wildlife, and Parks (hereafter "easement") and reference sections of the study area, tracking and locating nests of radio-marked females, conducting habitat surveys at nest and brood locations as well as random points throughout the study area, and deploying remote cameras to evaluate predator occupancy.

Sharp-tailed grouse were trapped at 8 leks using walk-in funnel traps from 18 March – 3 May 2018. Overall, 125 sharp-tailed grouse (63 males, 62 females) were captured, including 89 new captures (36 males, 53 females) and 36 recaptures from 2016 and 2017 (27 males, 9 females). A total of 57 female grouse were fitted with radio-collars during the 2018 trapping season. An additional 13 females that were radio-marked during the 2017 field season were still present in the study area and therefore monitored for a second year. A total of 70 radio-marked females were monitored ≥ 3 times per week throughout the nesting and brood-rearing period.

We collected 1,441 locations on 70 radio-marked females during 3 April. – 15 June. As of 15 June, 58 nests have been located (52 first nests, 6 renests; Table 3; Figure 2). Median nest initiation date for first nests was 4 May. Twenty-two nests have successfully hatched and 19 failed (17 depredated, 1 abandoned, 1 trampled by cattle). Apparent nest success for nests that were completed by 16 June was 0.53 ± 0.08. Habitat conditions were measured at both nest and brood locations, as well as random points within the study area. Of the 22 nests that successfully hatched, 21 broods are still alive, while one has failed.

Remote cameras were deployed for two 3-week sessions at 62 random locations within the study area. We checked cameras every week, rebaiting each station, clearing photos, and replacing batteries as needed.

OBJECTIVES

Objective 1: Investigate rest rotation grazing as a rangeland management technique to improve sharp-tailed grouse fecundity and survival.

Accomplishments Since Last Quarter:

Efforts this quarter focused on capturing and radio-marking female sharp-tailed grouse and intensive monitoring of radio-marked females to locate nests and broods. Sharp-tailed grouse were trapped using walk-in funnel traps on both the easement and reference areas of the study site. We recorded standard morphometrics including body mass, wing chord, tarsus length, and culmen length, and fitted all birds with a uniquely numbered metal leg band. Birds were sexed and aged by plumage characteristics. Males were fitted with a unique combination of color bands to allow for resighting at leks next year. We fitted captured females with 18-g necklace-style radio-transmitters with a 6-8 hour mortality switch and an expected battery life of 12 months (model A4050; Advanced Telemetry Systems, Insanti, MN). Previous work found no impact of necklace-style radio-transmitters on prairie-grouse demography (Hagen et al. 2006).

Radio-marked females were located by triangulation or homing ≥3 times/week using portable radio receivers and handheld Yagi antennas during the nesting and brood-rearing period (April—June). When females localized in an area and their estimated location did not change for 2 successive visits, we assumed that the female was sitting on a nest. For half of the females, we used portable radio receivers and handheld Yagi antennas to locate and flush the female so eggs could be counted and nest location recorded with a handheld GPS unit. We marked nest locations with natural landmarks at a distance ≥ 25 m to aid in relocation. Nest sites were not visited again until it was determined that the female had departed (i.e., was located away from the nest for ≥ 2 days during incubation and ≥ 1 day after expected hatch date) due to successful hatching of the clutch or failure due to either predation or abandonment. Nesting females were otherwise monitored by triangulation from a distance > 25 m. Thus, nest sites for half of the females were only disturbed by the presence of an observer a maximum of 1 time during the laying and incubation period. The remaining half of the females were never flushed and nest attempts were monitored from a distance of >25 m to evaluate whether the protocol of flushing females has a negative effect on nest survival. A female was assumed to be incubating if she was located in the same location for 2 consecutive visits and nest sites were only visited after the female was located away from the nest for ≥ 2 days during incubation or ≥ 1 day after expected hatch date.

Once the female departed the nest, we classified nest fate as successful (≥ 1 chick produced), failed, depredated, or abandoned. Nests were considered abandoned if eggs were cold and unattended for >5 days. Nests were considered failed if the eggs were destroyed by flooding, trampling by livestock, or construction equipment. Nests were considered depredated if the entire clutch disappeared before the expected date of hatching, or if eggshell and nest remains indicated that the eggs were destroyed by a predator. When a depredation event occurred, the egg remains were evaluated and the area was searched for predator sign. For successful nests, hatchability was calculated as the percentage of eggs that hatched and produced chicks. Eggs that failed to hatch were opened to determine stage of development and possible timing of embryo failure.

Successful broods were relocated ≥3 times/week until failure. Pre-fledging brood survival was estimated by conducting flush counts between 14 and 16 days post hatch. Flush counts were conducted at dawn when chicks were close to radio-marked females to determine the number of surviving chicks in the brood. After females were flushed, the area was systematically searched and the behavior of the female observed to assess whether chicks were present but undetected. For counts of 0 chicks, the brood female was flushed again the following day to be certain no chicks remained in the brood. Broods were considered successful if ≥ 1 chick survived until fledging at 14-d post-hatch (Pitman et al. 2006). Flush counts were repeated at 14, 30, 45, and 60 days post-hatch or until we were confident that no chicks remained with the female.

We evaluated habitat conditions at each nest and brood flush site within 3 days of hatching or expected hatch date in the case of failure (Figure 1). We recorded visual obstruction readings (VOR) at the nest bowl and at four points 6 m from the nest in each cardinal direction. At each point, VOR was measured in each cardinal direction from a distance of 2 m and a height of 0.5 m using a Robel pole (Robel et al. 1970). We estimated non-overlapping vegetation cover (percent new grass, residual grass, forbs, shrubs, bare ground, and litter) at 12 subsampling locations within 6 m of the nest using a 20 x 50 cm sampling frame (Daubenmire 1959). At each subsampling plot, we measured the heights of new grass, residual grass, forbs, shrubs and litter. We also estimated shrub cover using the line-intercept method, recording the species, height, and length of each shrub intersecting the transect. For nests, we conducted parallel sampling at randomly selected points within a study area defined by a minimum convex polygon placed around the leks of capture and buffered to 2 km. For broods, we conducted parallel sampling at paired points in a randomly determined direction and distance (maximum of 250 m) from each flush location to represent available habitat within the average daily distance traveled by broods (Goddard et al. 2009). Random points that fell within unsuitable habitat (i.e., water, cultivation, etc.) or were located on properties to which we did not have access were replaced.

We monitored radio-marked females ≥3 times per week to estimate survival. Transmitters were equipped with a mortality switch that activated after 6–8 hours of inactivity. Once the mortality switch activated, transmitters were located and the area searched to determine probable cause of death. Mortality events were classified as either predation, hunter, other, or unknown. Predation mortalities were further identified as either mammal, avian, or unknown predator. A mortality event was classified as mammalian predation if bite marks, chewed feathers, or mammalian tracks were present. Mortality was determined to be avian predation if the carcass had been decapitated and/or cleaned of the breast muscle with no bite marks, or if the feathers had been plucked. If none of these signs were present or if there were conflicting signs of mortality, the event was classified as unknown predation. Females were censored from the study if their collars were found with no sign of death or if they could not be located for ≥2 months.

Eight sharp-tailed grouse leks were monitored during 15 March – 3 May 2018. Sharp-tailed grouse were trapped at 3 easement and 5 reference leks during 18 March – 3 May 2018. Mean overall lek attendance was 11.7 birds (average of 9.5 males and 2.2 females) during this period (Table 1). Attendance declined at all but one lek, with overall attendance at individual leks declining 33-57% compared to previous years, with the most marked declines occurring in male attendance. Female attendance occurred significantly later than in previous years, with the first female observed on 10 April, which was about 2 and 3 weeks later than in 2017 and 2016, respectively. Female attendance also peaked later in the year, with the majority visiting between 24 and 27 April. We captured a total of 125 sharp-tailed grouse (63 males, 62 females), including 89 new captures (36 males, 53 females) and 36 recaptures from 2016 and 2017 (27 males, 9 females) and 57 females were radio-marked (Table 2). An additional 13 females that were radio-marked during the 2017 field season were still present in the study area and therefore monitored for a second year. Overall, 70 radio-marked females were monitored ≥ 3 times per week throughout the nesting and brood-rearing period.

As of 15 June, 58 nests have been located (52 first nests, 6 renests; Table 3). Median nest initiation date for first nests was 4 May. Twenty-two nests have successfully hatched and 19 failed (17 depredated, 1 abandoned, 1 trampled by cattle). Apparent nest success for nests that were completed by 16 June was 0.53 ± 0.08. Apparent nest success (± SE) was 0.40 ± 0.15 and 0.58 ± 0.09, for the easement and reference areas, respectively. Hatch rate of eggs in successful nests was 0.93 ± 0.06. Mean clutch size for completed nests was 12.6 ± 1.50 eggs.

At present, 17 nests (12 first nests, 5 renests) are still active, so information on final fate for these nests and nest success for the season is not yet available. Of the 22 nests that successfully hatched, 21 broods are still alive, while one has failed.

As of 8 June, 13 females have been predated: 7 and 4 by avian and mammalian predators, respectively, with an additional 2 by unknown predators. An additional four females were censored after they could not be relocated for more than two months and two females have moved onto land to which we do not have access and so were monitored solely for survival.

Goals For Next Quarter:

We will continue to monitor radio-marked females ≥ 3 times/week and all existing nests and any further renesting attempts. Nests will be monitored to determine fate and habitat will be evaluated at each nest site within three days of hatching or at expected hatch date for failed nests.

We will continue to monitor successful broods to estimate brood survival. Initial brood size will be identified by the number of chicks that were known to hatch. Systematic flush counts will be conducted within an hour of dawn to estimate pre-fledge (0–14 days) and post-fledge (14-60 days) survival. Broods will be considered successful if at least 1 chick survives until fledging. Fledging success will be calculated as the percentage of chicks that survive until fledging (14-d post-hatch) among successful broods. Habitat will be evaluated at each brood flush site. We will not capture broods during the 2018 field season as high rates of censoring were observed in previous years, with transmitters not reliably remaining on chicks past 45 days post-fledge (see 2017 annual report).

Results will also be presented at the International Grouse Symposium in September 2018.

Objective 2: Investigate impacts of rest-rotation grazing on sharp-tailed grouse home ranges, movements and habitat selection.

Accomplishments Since Last Quarter:

Efforts this quarter focused on capturing, radio-marking and monitoring female sharp-tailed grouse. Sharp-tailed grouse were trapped at a total of 8 leks on both the easement and reference areas of the study site during 18 March – 3 May 2018. Captured females were fitted with necklace-style radio-transmitters. Radio-marked females were located via triangulation or homing ≥ 3 times/week using portable radio receivers and handheld Yagi antennas.

As of 15 June, we have collected 1,441 locations from 70 radio-marked females, including 904 unique locations that exclude duplicate nest locations.

Goals For Next Quarter:

We will continue to track radio-marked females ≥ 3 times/week through the remainder of the brood-rearing season. During the non-breeding season (September – March) radio-marked fledglings and females will be monitored ≥ 1 time/month from the ground or by plane until death or transmitter failure or loss. Coordinates for triangulated locations will be calculated using Location of a Signal software (LOAS; Ecological Software Solutions LLC). All locations will be examined for spatial error and locations with excessive error (i.e., > 200 m error ellipse) will be discarded with the level of acceptable error being examined on a case-by-case basis. Analyses of space use will be restricted to birds with > 25 unique locations per season after excluding multiple nest locations.

We will use the fixed kernel method (Worton 1989) with the default smoothing parameter to calculate 95% home ranges for the breeding season (April – August) using the adehabitatHR package in Program R (R Core Team 2014, Vienna, Austria). We will also calculate centroids for each home range using the ‘rgeos’ package in Program R and calculate the distance each female traveled from lek of capture to the home range centroid in ArcGIS 10.4 (Environmental Systems Research Institute, Redlands, CA). We will use resource utilization functions (RUFs) to examine habitat selection within the breeding season home range.

Objective 3. Develop a mechanistic understanding of the ecological effects of various grazing treatments with a focus on rest rotation grazing by examining abundance and space use of the mesopredator communities

Accomplishments since the last quarter:

Efforts this quarter were focused on conducting mesopredator surveys. Passive infrared remote field cameras (Browning BTC 5HD) were used to survey the mesopredator community within the study area. Remote cameras have been cited as the best survey method for detecting medium and large sized carnivores in most habitats (Silveira et al. 2003). Automated cameras also recorded the time and date for every photographic event captured, making them useful for temporal associations, such as daily and seasonal activity patterns. Ninety-three predator survey points were randomly selected within the study site. Cameras were set in the most optimal location within 200 m of the point, where detection of predators was maximized. Cameras were often set at heavy use areas along a habitat edge, where land cover changes on the landscape at the intersection of water, grassland, agriculture, and/or trees and shrubs (Burr 2014). Habitat edges and game trails were used with a goal of increasing detection probabilities, as mammalian predators are thought to prefer such edges while traveling and foraging (Andrén 1995).

Cameras were programmed to be active 24 hours a day with a 1-minute delay between photographic events and a two photo burst for each event. For each photographic event, the date and time of the event were recorded, along with the temperature (°C), barometric pressure, moon phase, and camera ID. Cameras were secured to tree trunks or, if not available, mounted on metal stakes, and positioned approximately 0.5m above the ground and 2m in front of a scent lure. When present, cameras were faced toward game trails to maximize detections.

For each three-week sampling period, camera sites were revisited weekly to re-bait stations, download and clear memory cards of digitally recorded images, change camera batteries, and remove any obstructive vegetation. Each camera trap was baited with a long-distance trapping lure (Gusto; Minnesota Trapline Products, Inc.) to increase detection frequencies of predators. Following each 3-week survey period, cameras were moved to new random points for another 3 weeks. Two of three sampling periods were surveyed this quarter, with one sampling period to be conducted early next quarter.

Goals for Next Quarter:

All photos from the remote camera traps will be analyzed and predators will be identified based on body shape and coloration.

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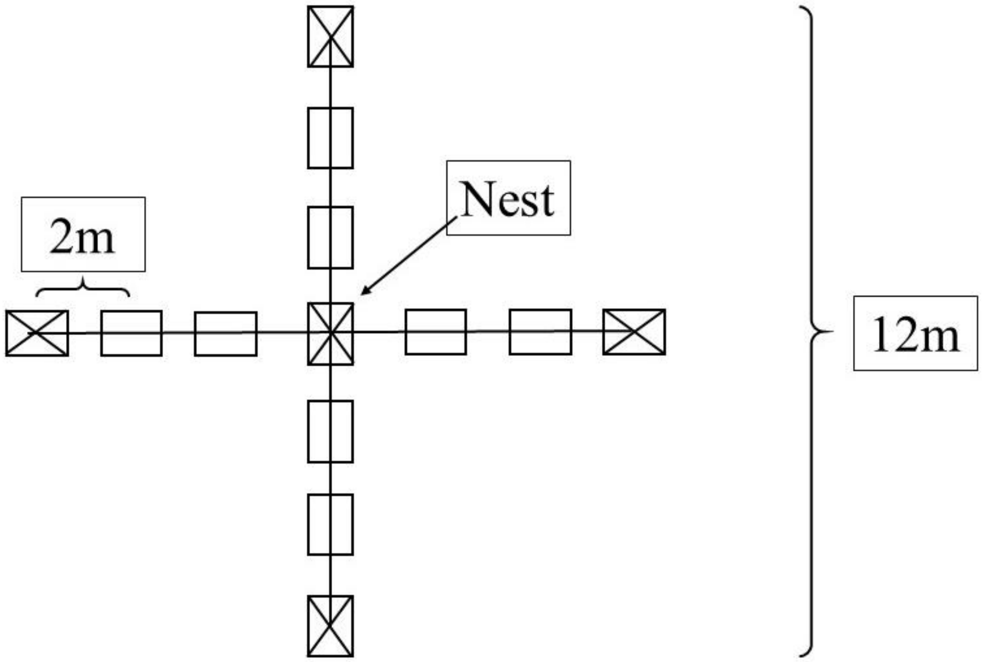

Figure 1. Setup of a vegetation plot. Vegetation cover and height were measured using a Daubenmire frame at each rectangle and visual obstruction with a Robel pole at each X. The lines represent the 12 m transects that were used to estimate shrub cover with the line-intercept method.

Table 1. Average attendance at 8 leks during 15 March – 3 May 2018. The three leks located within the easement are listed first.

Lek	Average Total Attendance	Minimum Total Attendance	Maximum Total Attendance	Average Male Attendance	Average Female Attendance
EasState1	9.7	5	21	7.9	1.8
Prewitt1	9.2	6	14	7.5	1.7
Laumeyer2	14.4	10	21	12.3	2.1
Grassland01	11	6	16	5.8	5.2
Iversen1	17.0	7	28	14.3	2.3
Pennington01	7.2	4	16	5	2.4
Ullman01	9.2	7	12	7.7	1.5
Whited01	8.6	6	13	6.1	2.4
Total	11.7	4	28	9.5	2.2

Table 2. Total number of grouse captured and radio-marked on and off the easement in 2018. The total radio-marked females includes females radio-marked in 2017 but monitored again in 2018.

	Males	Females	New Radio-marked Females	Total Radio-marked Females
Easement	25	28	26	32
Reference	38	34	31	38
Total	63	62	57	70

Table 3. Overview of nests in the easement and reference sections of the study area. Egg hatch rate is the percentage of eggs that hatched from the initial clutch size. Seventeen nests are still active, so information on final fate and nest success are not yet available.

	Median Initiation Date	Clutch Size	First Nests	Renests	Nests Hatched	Median Hatch Date	Egg Hatch Rate	Apparent Nest Success
Easement	4 May	11.2 ± 4.0	13	3	4	10 June	0.94 ± 0.05	0.40 ± 0.15
Reference	4 May	12.9 ± 1.29	39	3	18	11 June	0.93 ± 0.13	0.58 ± 0.09
Total	4 May	12.6 ± 1.50	52	6	22	11 June	0.93 ± 0.06	0.53 ± 0.08