PERFORMANCE REPORT

WILDLIFE RESEARCH

PROJECT NO. W-75-R-49

FEDERAL AID IN WILDLIFE RESTORATION PROGRAM

PERIOD COVERED: July 1, 2006 – June 30, 2007

WILDLIFE DIVISION

SOUTH DAKOTA DEPARTMENT OF GAME, FISH AND PARKS

Administrative Costs

Number: 7500

Narrative: These costs are associated with the administration of this statewide program and cannot accurately be assigned to individual studies. This work involves developing federal aid project documents, reviewing research proposals and monitoring study costs. Costs are primarily in the form of staff salaries.

Total Cost: $3,934.04

Publications

Number: 7501

Narrative: Costs for publishing results of individual studies are often difficult to predict because of differences in costs between publishers of scientific journals. Also, articles are often published long after a particular study has been completed.

Total Cost: $12,666.67

Study Title: Converting Exotic Cool Season Grasslands to Native Warm-Season Grasslands with Native Cool-Season Components Utilizing Herbicide Treatments

Study Number: 7502

Objectives:

1. Determine best herbicide combinations, rates, and timing for killing bromegrass and reed canary grass.
2. Determine tolerance of other native plants to various herbicide treatments (Outrider™ and Journey™).
3. Determine the appropriate herbicide and timing combination to aid in conversion of crop (soybean) stubble to NWSG communities.
4. Document the benefits or detriments of exotic cool season grasses to upland grass nesting birds

Narrative: During the fall of 2004-2006 and spring of 2005-2007, we implemented a smooth brome and reed canarygrass removal study of 12 sites (7 for smooth brome and 5 for reed canarygrass) in eastern South Dakota. Each site had herbicide treatments applied in the fall and spring and were seeded in the spring. Two soybean stubble sites were established in spring 2006. From these data, we will estimate efficacy of each herbicide treatment in removal of selected species and establishment of planted native species. Additionally, a project examining grassland bird use of conservation plantings was initiated in June 2007.

Results: Vegetation measurements for treatments established in Fall 2005 and Spring 2006 will be taken from 12-24 September 2006. Plots are being monitored and sampled using a 0.5 meter square frame with a minimum of three to five samples per plot (depending on variation). Five new treatments were applied in 2006-2007 based on data collected from original plots. Treatments have been effective at reducing cover of exotic species, but response of native plants has been limited and needs further monitoring. Data are currently being analyzed and results of several aspects of the study have resulted in 6 presentations at both regional and national meetings. Presentations are scheduled for presentation at the Natural Areas Conference (Oct. 2007), Midwest Fish and Wildlife Conference (Dec. 2007), and Society for Range Management Meeting (February 2008).

Principal Investigators: Kent C. Jensen, Assistant Professor, Department of Wildlife and Fisheries Sciences, Box 2140B, South Dakota State University, Brookings, SD 57007. Telephone (605) 688-6121, and Thomas G. Barnes, Professor, Department of Forestry, University of Kentucky, Lexington, KY 40506. Telephone: (859) 257-8633. *Prepared by:* Matt A. Bahm, Graduate Research Assistant, and Kent C. Jensen, Assistant Professor, Department of Wildlife and Fisheries Sciences, Box 2140B, South Dakota State University, Brookings, SD 57007. Telephone (605) 688-6121.

Total Study Cost: $41,648.00

Study Title: Assessing American marten use of track plate box surveys for estimating population size in the Black Hills, South Dakota.

Study No.: 7525

Objectives:

1. Identify factors affecting range expansion of American marten in the Black Hills by 30 June 2007
2. Assess population status of American marten through genetic analyses as well as age and sex structure information by 30 June 2007
3. Document population trends of American marten in the Black Hills, South Dakota by 30 June 2007.

Narrative: Limited information is available on the population status of American marten (*Martes americanus)* in the Black Hills of South Dakota. Beginning in 1980, a total of 125 American marten were reintroduced into the Black Hills after 50 years of extirpation. Since that time, several attempts have been made to monitor the population, including snow-track surveys in the 1980's and 1990's, and more recently, a trackplate box survey in 2002. Data derived from the track-plate box survey indicated that two subpopulations of marten exist in the Black Hills; one in the northern region and a second slightly smaller subpopulation in the central Black Hills. Results of this survey indicated that a total of 124 adult breeding individuals inhabited in the two combined regions. This estimate was derived without empirical information on age and sex classes of marten, which were unknown for this population. The estimate also was based on home ranges generated from a relatively small number of individuals (n=11; 9 male, 2 female).

In addition, the effectiveness of the track-plate boxes to detect marten at low densities outside of high-quality habitat patches was poorly understood. Research that assesses population characteristics via age and sex structure, genetics, and further evaluates monitoring techniques for determining relative abundance of American marten will allow for effective management of this carnivore in the Black Hills of South Dakota.

Results: Following a 50-year absence, American marten (*Martes americana*) were reintroduced into the Black Hills of South Dakota in 1980. Surveys conducted post-reintroduction indicated 2 regions of the Black Hills where sub-populations of marten existed; 1) a 246-km^2 region in the northern Black Hills, and 2) a 121-km^2 area in the central Black Hills. However, due to their low densities and secretive nature, monitoring efforts for carnivores routinely neglect to identify all individuals in the population, leading to biased estimates of species distribution and abundance. Thus, assessing the efficacy of techniques designed to determine presence of forest carnivores, such as American marten, is crucial for validation of survey results. Furthermore, reintroduced populations face numerous genetic problems resulting from low number of founder individuals. The fragmented nature of the Black Hills marten population could exacerbate bottleneck effects and threaten long-term viability. To improve active management of this species, we evaluated factors affecting range expansion, estimated probability of detecting (*p*) marten at high (>2 marten/10.2 km^2) and low (≤ 1 marten/10.2 km^2) densities, and assessed connectivity and genetic variation among the 2 sub-populations of marten from 2005-2006 in the Black Hills of South Dakota. We used presence-absence data obtained from a track-plate survey in conjunction with results from a saturation-trapping study to derive detection probabilities when marten occurred at high (>2 marten/10.2 km^2) and low (≤ 1 marten/10.2 km^2) densities within 8, 10.2 km^2 quadrats. Estimated probability of detecting marten in high density quadrats was $p = 0.952$ (se = 0.046), while the detection probability in low density quadrats was considerably lower ($p = 0.333$, se = 0.136). Results indicated that failure to account for imperfect detection could lead to an underestimation of marten presence in 15% − 52% of low density quadrats. Additionally, we surveyed and collected habitat data at track-plate boxes ($n = 144$) in the northeast (NE; $n = 56$) and central ($n = 88$) Black Hills to assess habitat characteristics affecting site occupancy (*Psi*) and detection probabilities at the micro-habitat (e.g., track plate) scale. Marten were detected at 30 of 144 track-plate boxes (NE = 26, Central = 4), yielding occupancy estimates of 0.462 (SE = 0.123) and 0.042 (SE = 0.023) in the northeast and central Black Hills, respectively. Marten occurrence was associated with areas of high precipitation, near prior release locations, and mature stand-aged forests. Detection probabilities were relatively constant across all sites ($p = 0.650$, SE = 0.067), but were positively associated with ground cover, canopy cover, and spruce dominated habitats. To assess connectivity and gene flow, we collected DNA from 41 marten in the northern (n = 32) and central (n = 9) regions of the Black Hills. Marten in the north showed similar levels of heterozygosity ($H_O = 0.701$, SE = 0.056) and allelic diversity (A = 5.714, SE = 0.612) as marten from the central ($H_O = 0.825$ SE = 0.068; A = 4.429, SE = 0.612) Black Hills. Furthermore, genetic structure (F_{ST}) between the 2 populations was low ($F_{ST} = 0.027$), and thus, suggestive of high levels of gene flow. Results also indicated genetic variability was relatively high in comparison to other marten populations in Canada, however, a more thorough comparison to

source populations from Idaho and Colorado would be essential for a more formal analysis of viability. We recommend that repeated site-survey data be analyzed to assess detection probabilities when documenting carnivore survey results, and, to facilitate colonization into additional areas, long-term planning include protection of mature forest stands surrounding occupied areas. Additionally, translocation of individuals from high-density areas to suitable unoccupied areas would promote a more rapid expansion of marten into all available habitats and ensure long-term viability of this species in South Dakota.

Principal Investigators: Dr. Jonathan A. Jenks, Professor, South Dakota State University, Department of Wildlife and Fisheries Sciences, Telephone: (605) 688-6121, Email: Jonathan_Jenks@sdstate.edu, and Josh Smith, Graduate Research Assistant, Department of Wildlife and Fisheries Sciences, Telephone: (605) 688-6121, Email: josh_f150@yahoo.com

Total Study Cost: $40,000.00

Study Title: ***An Evaluation of Mixed-Vegetation Plantings (MVPs) as Avian Nesting Habitat***

Study Number: 7526

Objectives:

1. Estimate nest densities of birds utilizing fields of MVP.
2. Estimate nesting success and percent of eggs hatched of bird species utilizing fields of MVP.
3. Investigate effects of field stand age by comparing nest densities in MVP stands planted in 2000 though 2004.
4. Compare vegetative species composition between nest site locations and random locations in order to assess if nest site selection preference for cool- vs. warm-season vegetation is occurring.
5. Compare near ground temperature and relative humidity to above canopy temperature and humidity at each nest site in order to ascertain the influence of vegetation on microclimate.

Narrative: This study has been completed and a M.S. thesis submitted.

Thesis Abstract: Mixtures of legumes and non-native cool-season grasses have long been planted as avian nesting cover on wildlife management units. However in the recent past, there has been a trend toward planting native warm-season grasses. In 2000, South Dakota Game, Fish and Parks (SDGFP) began planting mixtures of cool-season and warm-season native grasses with non-native alfalfa (*Medicago sativa*) or red clover (*Trifolium pratense*) on Game Production Areas (GPAs). It is thought this mixed-vegetation planting (MVP) may better approximate native prairie. Project objectives were to (1) estimate avian nesting density, nest success and percent of eggs hatched within study sites of MVP, (2) assess the effects of stand age class on nest density and nest success, (3) compare vegetative species composition between nest sites and random locations, (4) compare nest site and above-canopy temperatures and relative humidity, and (5) to address the effects spraying of noxious weeds may have on

nest success. Three fields of MVP were randomly selected from each of the 2000-2004 year-class plantings. The hockey stick search method was used to systematically search 10% of each field's total area. The 2005 field season yielded 178 nests while 362 were located in 2006. Mean apparent nest success for pheasants (*Phasianus colchicus*) (16.3 vs. 12.6%) and passerines (Passeriformes) (34.4 vs. 24.8%) was marginally higher in 2006 than in 2005, while lower for ducks (*Anas* spp.) (10.5 vs. 19.4%). Pheasant, passerine, and duck nest densities were also higher in 2006 than in 2005 (4.6 vs. 2.8, 1.9 vs. 1.0, and 0.6 vs. 0.2 nests/ha, respectively). Mean percentage of eggs hatched from all successful pheasant nests was similar (P = 0.92) between 2005 and 2006 (87.1 vs. 86.5%). Multiple regression analyses modeling nest density as a function of stand age class, field size and year were performed, while nest success was modeled as a function of stand age class, density, field size and year. Nest density (R2 = 0.23, P = 0.01) explained the greatest variation in pheasant nest success where success increased with density. Field size (R2 = 0.19, P = 0.02) and year (R2 = 0.17, P = 0.02) explained the greatest variation in duck nest density, while field size explained the greatest variation in nest success (R2 = 0.31, P = 0.03). Both duck nest density and nest success increased with field size. No variables entered the model to explain variation in passerine nest densities or nest success. Pheasant (P = 0.48), passerines (P = 0.13), and ducks (P = 0.31) all nested in habitat proportionate to its availability with no preference for nest sites dominated by cool-season grasses, warm-season grasses or mixtures of both. Average temperatures in 2005 for all nests were similar (P = 0.89) among nest sites of cool-season grasses (22.9℃), warm-season grasses (23.1℃), and mixtures of both (22.5 ℃). Temperature differentials between nest site and above-canopy were similar (P = 0.58) as well (1.4, 1.6, and 1.3℃, respectively). Humidity was s imilar (P = 0.84) among nest sites of cool-season grasses (55%), warm-season grasses (57%), and mixtures of both (56%), as were humidity differentials (P = 1.00) (7, 7, and 7%). Mammalian predators caused the greatest percentage of nest failure with large mammals destroying 21 and 24% of all nests located in 2005 and 2006; in addition, small mammals destroyed 21 and 22% of all nests, respectively. Abandonment rate in 2005 was twice that of 2006, being 21 and 10%, respectively. Brown-headed cowbird parasitism caused the failure of 38 and 24% of all passerine nests in 2005 and 2006, respectively. My results suggest avian nest density and nest success within MVPs are similar to those found in previous studies evaluating DNC and WSN plantings in eastern South Dakota. Seasonality in growth as well as increased structural complexity provided by MVPs is also likely to provide benefits beyond that depicted by this study. Hence, wildlife managers and habitat biologists should consider MVPs when establishing avian nesting habitat.

Technical Personnel: Dr. Daniel E. Hubbard, Professor, Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings, SD 57007, telephone (605) 688-6121; Thomas R. Kirschenmann, Biologist, S.D. Department of Game, Fish and Parks, Huron, SD 57350, telephone (605) 353-8477 and Jesse C. Hankins, Graduate Research Assistant, Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings SD 57007, telephone (605) 688-4788.

Total Study Cost: $40,409.33

Study Title: ***Introductions of Eastern Wild Turkeys into Agricultural Landscapes of Eastern South Dakota: Evaluation of New and Recently Established Transplants***

Study Number: 7527

Objectives:

1. Determine movements and habitat use of transplanted eastern wild turkeys (Meleagris gallopavo silvestris) in agricultural landscapes
2. Monitor and determine mortality/survivorship rates for transplanted and supplemented populations
3. Determine nesting success of introduced eastern wild turkey hens
4. Identify movement patterns of introduced wild turkeys as they relate to farmsteads, land use/cover pattern types, and seasonality

Narrative: During the winter of 2007, we released 46 turkeys at Dry Lake in Hamlin County and captured 15 wild turkeys, 7 of which were recaptures. We had 16 remaining radio-collared turkeys from 2006 so we collared an additional 16 in 2007, for a total of 5 collared males and 28 collared females. All other turkeys were banded. All turkeys were released between 1 February and 18 February. No additional turkeys were released at Oakwood GPA in 2007, however we still monitored 11 radio-collared turkeys from 2006. We took two to three radio-locations per week on all collared birds from release through August 31, 2007. From this data we will estimate survival, home ranges, reproductive success, and dispersal from release site. Additionally, we will analyze the relationships of nesting and brood rearing locations in relation to landscape habitat variables such as cropland, CRP, and woody cover interspersion.

Results: Of 25 marked hens at Dry Lake, 19 (76.0%) survived to 20 August and of 8 marked hens at Oakwood GPA, 3 (37.5%) survived to 20 August. At Dry Lake two died from unknown causes, one from a vehicle collision, one from a raptor, and one from a coyote. At Oakwood, one died from unknown causes while two were killed by coyotes and 2 were killed by haying operations. We found 25 nests and 10 were successful, 4 of those were renests and one was successful. Clutch sizes ranged from 3 to 17 with a mean of 10.5 eggs. Of the 15 unsuccessful nests four were predated by a striped skunk (*Mephitis mephitis*), one by a badger (*Taxidea taxus*), one by a coyote (*Canis latrans*), one by a cow (*Bos taurus*), 3 were unknown causes of predation, and 5 were abandoned. At Dry Lake GPA, 8 of 21 nests hatched (38.1%), at Oakwood GPA, 2 of 4 nests hatched (50%). Two nests were parasitized by ring-necked pheasants (*Phasianus colchicus*); both nests had one egg each. Both nests were successful, however the pheasant chicks were found dead in the nest bowl.

Principal Investigators: Kent C. Jensen, Associate Professor, Department of Wildlife and Fisheries Sciences, Box 2140B, South Dakota State University, Brookings, SD 57007. Telephone (605) 688-6121. *Prepared by:* Heidi M. Jacobsen, Graduate Research Assistant, and Kent C. Jensen, Associate Professor, Department of Wildlife and Fisheries Sciences, Box 2140B, South Dakota State University, Brookings, SD 57007. Telephone (605) 688-6121

Total Study Cost: $50,884.00

Study Title: ***Evaluating Habitat Suitability, Population Size and Prey Use of Bobcats in South Dakota***

Study Number: 7528

Objectives:

1. Determine current distribution and movement patterns of bobcats in the Black Hills, western South Dakota, and eastern South Dakota by 30 June 2010.
2. Determine habitat selection of bobcats at landscape, meso, and plot scales in the Black Hills, western South Dakota, and eastern South Dakota by 30 June 2010.
3. Determine food habits of bobcats inhabiting forest and prairie habitats of South Dakota by 30 June 2010.
4. Estimate population size of bobcats in the Black Hills, western South Dakota, and eastern South Dakota by 30 June 2010.

Narrative: Little information exists on the distribution and population size of bobcats (*Lynx rufus*) in South Dakota. Bobcats occupy habitats within the three regions (Black Hills, western prairies, eastern prairies) that characterize the state. However, it is unknown how bobcats utilize the landscape or their effects on other wildlife populations (i.e., prey species) within the state. There is a need to determine distribution of habitats and their use and to evaluate indices to population abundance of bobcats in South Dakota. Currently, bobcats are harvested in western South Dakota. However, effects of harvest on population size and potential for harvest in eastern South Dakota are unknown. Information obtained from this study will enhance understanding of bobcat distribution, habitat selection, prey use, and population size in South Dakota.

Results: Data from the first field season were collected in the Badlands area of the state. Ten GPS collars were obtained from the National Park Service and refurbished for bobcats. Capture was conducted from July to Dec 2006. Six male and 4 female bobcats were fitted with GPS 3300 radio collars and animals were tracked by ground and aerial telemetry. Overall mortality was 50% (2 harvest, 1 mortality due to interaction with a porcupine, and 2 unknown). The last collar is expected to drop off in the 1st week of September 2007. Bobcat locations will be used to address distribution and habitat selection. A total of 229 bobcat carcasses were collected from 14 counties and necropsied between December 2006 and March 2007. Stomachs were removed and frozen for food habit analysis. Kidneys and femurs were removed and frozen as well for analysis of body condition. Kidney fat and bone marrow fat indexes were calculated for each animal. In addition, 36 samples of bobcat scat were collected opportunistically from the study area. Bobcat physical and nutritional condition is being analyzed for 3 regions of western South Dakota (North [Harding County], Central [Custer and Pennington counties], and South [Jackson County]). These data will be used to generate a habitat suitability map for the western portion of the state.

Abundance will be investigated using 2 approaches. Once all the radiotelemetry data are retrieved, abundance information will be generated from areas occupied by bobcats. Modeling techniques will be used to assess large scale abundance.

The second method will use 3 years of life history and harvest data (age classes, fecundity, male harvest, female harvest, natural mortality, illegal mortality) to reconstruct the population.

Principal Investigators: Dr. Jonathan A. Jenks, Professor, South Dakota State University, Department of Wildlife and Fisheries Sciences, Telephone: (605) 688-6121, Email: Jonathan.Jenks@sdstate.edu, and Bernard Hien, Graduate Research Assistant, Department of Wildlife and Fisheries Sciences, Telephone: (605) 688-6121, Email: hienbernard@yahoo.fr

Total Study Cost: $55,685.72

Study Title: ***An Evaluation of Anthraquinone for Control of Pheasant Depredation on Corn***

Study Number: 7529

Objectives:

1. Evaluate the efficacy of an experimental dry planter-box formulation of Avitec (anthraquinone) to reduce pheasant depredation on planted corn.
2. Estimate the duration of susceptibility of planted corn to depredation by pheasants.
3. Evaluate the intensity of use and the behavior of pheasants using treated areas of corn food plots vs. untreated areas.

Narrative: On 19 May 2007, four wildlife food plots were planted with Round-up ready seed corn. The south third of a 2.7-acre food plot (Big House) within land in a grassland easement was planted as the control, the middle third was planted with seed corn treated with high doses of hydrolyzed casein (HC) (2.79 pounds per 980 pounds of seed), hydrolyzed collagen (HCOL) (3.72 pounds per 980 pounds of seed) and Avitec™ (GS repellent) and the north third was planted with seed corn that had been mixed with 1 gallon of Avitec™ per 980 pounds of seed. A 1.2-acre food plot (Small House) was divided into thirds with the control planted on the north side, the Avitec™ treated corn was in the middle third and the seed corn treated with low doses of HC (1.40 pounds per 980 pounds of seed), HCOL (1.86 pounds per 980 pounds of seed) and Avitec™ was planted on the south side of the field. Two food plots on a Game Production Area (GPA) were also planted on that same day. One 3.0-acre food plot (GPA South) was planted with low doses of GS on the north side, control in the middle and Avitec™ on the south side. The other 2.7-acre food plot was planted with high does of GS on the north, Avitec™ in the middle and the control on the south side. Location of treatments within each field was distributed randomly. All sites selected had been replanted as a result of corn loss to depredation in 2005/2006. A tripod was set up at the Small House food plot before the study began and used to make observations of the number, sex, time, duration and movement of pheasants during peak feeding hours after sunrise and before sunset. Each section of the field was marked off into 10-10 meter by 2 row plots which were walked every other day. In each section, 2, 5-meter x 2-row and 1, 3-meter x 2-row pheasant exclosures were randomly distributed. Exclosures were constructed with 2 x 3 inch welded wire on 5 sides allowing ground squirrels to

enter while keeping pheasants out. Depredation holes were identified as pheasant or ground squirrel and marked with golf tees labeled with the date and species within plots and exclosures. Once plants began to emerge (26 May), plant height was randomly measured twice per row per plot. Daily depredation was marked until there was no longer signs of depredation and observations of feeding ceased (11 June). A final tally of depredation was taken by recording all plants remaining in the field and previously marked depredation by plot in each field.

Results: Data were collected in each sub-plot of each field approximately 10 times. At the Small House field, 2.5% of plants were identified as depredated on the Avitec™ treated third, 10.4% of plants were identified as depredated on the GS+ Avitec™ treated third and 7.4% of plants were identified as depredated on the control third of the field (pheasants + ground squirrels). Pheasants depredated 1.2% of the Avitec™ treated third of the field, 4.9% of the GS+ Avitec™ treated third, and 6.8% of the control third. At the Big House field, 8.2% of plants were identified as depredated on the Avitec™ treated third, 7.6% of plants on the GS+ Avitec™ treated third, and 19.3% of plants on the control third of the field (pheasants + ground squirrels). For pheasants only, 11.8% of the control third, 3.7% of the GS+ Avitec™ treated third, and 6.1% of the Avitec™ treated third were depredated. At the GPA South field, total depredation (pheasants +ground squirrels) was 14.2% on the Avitec™ treated third, 19.9% on the GS+ Avitec™ treated third, and 7.2% on the control third of the field. Pheasant damage on that field was 10.4% on the Avitec ™ treated third, 9.1% on the GS+ Avitec™ third, and 5.7% on the control. At the GPA North field, total depredation (pheasants +ground squirrels) was 9.1% on the Avitec™ treated third, 4.3% on the GS+ Avitec™ treated third, and 11.0% on the control. For pheasants only on the GPA North field, 5.2% of the Avitec™ treated third, 1.9% of the GS+ Avitec™ treated third, and 7.7% of the control was depredated.

Principal Investigators: Dr. Daniel E. Hubbard, Professor, Department of Wildlife and Fisheries Sciences, Box 2140B South Dakota State University, Brookings, SD 57007. Telephone: (605) 688-6121, Thomas Kirschenmann, Sr. Wildlife Biologist, South Dakota Department of Game, Fish and Parks, PO Box 915, Huron, SD 57350. Telephone: (605) 353-8477. Emily A. Hodne, Graduate Research Assistant, Department of Wildlife and Fisheries Sciences, Box 2140B, South Dakota State University, Brookings, SD 57007. Telephone: (605) 688-6121. *Prepared by:* Emily A. Hodne and Daniel E. Hubbard.

Total Study Cost: $32,904.81

Study Title: ***Crop Depredation during summer by Canada Geese in Eastern South Dakota***

Study Number: 7584

Objectives:

1. To determine the effectiveness of the South Dakota Game, Fish, and Parks Department's goose damage program.

2. To evaluate characteristics of fields where goose damage occurs.
3. To quantify the amount of crop damage caused by geese in selected areas in eastern South Dakota.

Narrative: In eastern South Dakota, Canada geese cause localized damage to agricultural crops. South Dakota Game, Fish, and Parks Department's (SDGFP) crop damage program attempts to reduce crop damage by geese with various abatement techniques. The study was conducted in Eastern South Dakota. Day County was used in the northern region, and McCook, Minnehaha, Miner, Lake, Moody, Brookings and Kingsbury Counties were used in the southern region. Date of landowner complaint was recorded in all years and regions to determine its effect on amount of damage. In the southern region, I compared amount of damage on soybean fields where deterrents were applied by SDGFP, to fields where no deterrents were applied to determine the effectiveness of the SDGFP goose damage program. For each complaint, wetland size was also determined using GIS in 2007 in the southern region to evaluate its relationship to amount of damage. In addition, surveys were flown in most of the southern region to locate damaged areas that were not reported. Data on shoreline characteristics were also collected where damage occurred for comparison with undamaged sites on the same wetland to determine factors that influence selection by geese. Data on slope, distance from crop to water, and height-density of vegetation were collected.

Results: Using paired t-tests I found distance from water to crops ($t = 12.15$; $p < 0.001$) and visual obscurity ($t = -14.36$; $p = 0.007$) to be important factors in determining selection by geese, with geese choosing to damage crops that were closer to water and had shorelines with less visual obstruction. Slope of shoreline had no affect ($t = 0.79$; $p = 0.75$) on where geese chose to access soybeans.

In the northern region, there were a total of 38 soybean complaints in 2006, of which 28 were measured for an average of 0.39 (SE = 0.10) hectares (0.95 acres) of damage. In 2007, there were 36 complaints, of which 30 were measured for an average of .90 (SE = 0.17) hectares (2.22 acres). There was a significant positive relationship between amount of damage and date of complaint in 2006 (Spearman rank correlation $r_s = 0.4727$, $p = 0.011$), but not in 2007 (Spearman rank correlation $r_s = 0.3061$, $p = 0.10$). The amount of damage also differed between years (Wilcoxon rank-sums $Z = -2.11$, $p = 0.035$).

In the southern region, 43 abatement fields were measured in 2006 with an average of 0.10 (SE = 0.03) hectares of damage (0.26 acres). The 13 controls averaged 1.00 (SE = 0.25) hectares of damage (2.48 acres). Using aerial flights, we located 101 damaged areas in the southern region, of which 86 were unreported.

In 2007, the abatement fields averaged 0.30 (SE = 0.10; n = 47) hectares of damage (0.75 acres), while the control fields averaged 1.55 (SE = 0.46; n = 16) hectares damage (3.83 acres). We located 93 damaged areas from the air in 2007, of which 76 were unreported. Fourteen of the abatement fields in 2007 received additional damage after deterrents were installed. However, this damage was never severe.

Using pooled data from the southern region in 2006 and 2007, the application of deterrents significantly reduced damaged ($p < 0.001$). Date of application was positively correlated ($r = 0.60$; $p < 0.001$) with amount of damage, with earlier application resulting in less damage. When landowners filed complaints early in the growing season, SDGFP was able to keep damage to a minimum. Additional data analysis is in progress.

Principal Investigators: Dr. Charles Dieter, Professor, Department of Biology and Microbiology, Box 2207B, South Dakota State University, Brookings, SD 57007. Telephone (605) 688-4555. *Prepared by:* Troy M. Radtke, Graduate Research Assistant, Department of Biology and Microbiology, Box 2207B, South Dakota State University, Brookings, SD 57007. Telephone (715) 574-1652

Total Study Cost: $45,142.67

Study Title: ***Survival, Reproduction, Home Range and Habitat Use of Translocated Eastern Wild Turkeys in the Wessington Hills, South Dakota***

Study Number: 7585

Objectives:

1. Monitor survival (annual and seasonal) of translocated eastern wild turkeys.
2. Estimate reproduction (nest and brood success) for translocated eastern wild turkeys.
3. Determine home ranges of translocated eastern wild turkeys.
4. Estimate land-use composition and habitat types of translocated eastern wild turkeys.
5. Compare population dynamics to other eastern turkey translocation efforts in South Dakota.
6. Monitor farmstead use and seasonal depredation of translocated eastern wild turkeys.

Narrative: State wildlife agencies continue to explore opportunities and avenues to utilize the ever changing landscape and its habitat components for maximum wildlife benefits, including the expansion of recreational opportunities. In particular, wild turkey (Meleagris gallopavo) hunting has seen tremendous growth and popularity, as holds true in South Dakota. In many states turkey populations are experiencing tremendous growth and the highest population levels ever, resulting in a demand for more opportunities by sportsmen and the more challenging balance between landowner tolerance and optimum population levels. To achieve that balance, state wildlife agencies must look at alternative areas and unoccupied habitats.

A common theme with many studies evaluating marginally forested areas and turkey reintroduction efforts is the association or proximity of a river or stream system. In east-central South Dakota, minimally forested areas have been identified as potential turkey habitat and translocation sites, although some are

not connected, adjacent to, or part of a river system. However, woody draws, shelterbelts, and seasonal streams exist. Hence, a need also exists to further evaluate isolated, marginal forested areas in an agricultural landscape devoid of a river system.

Results: Twenty-six (20 hens, 6 jakes) eastern wild turkeys were translocated to the Wessington Hills of Hand County on March 4, 2006. All hens were fitted with back-pack style radio transmitters. On February 23, 2007, 4 hens, 2 jakes, and 1 tom from Pennsylvania were released; and another release on 5 March consisted of 8 additional hens. Transmitters retrieved from 2006 mortalities were re-deployed on hens released in 2007. Radio marked birds are located 3X per week throughout the year. Hens on nests were marked and then investigated after hatch to determine nest success. Transmitters emitting mortality signals were located and attempts made to determine mortality.

Since study inception, overall hen survival is 0.34 (SE = 0.8, n = 34). In 2006 hen survival was 0.53 (SE = 0.11, n = 20), and as of August 1, the 2007 survival rate is 0.63 (SE = 0.11, n = 22). No difference (P = 0.71) was found between the breeding season (April-July) survival rate of 2006 (S - 0.74, SE = 0.10, n = 20) and 2007 (S - 0.68, SE = 0.11, n = 19). Post breeding (August-November) survival in 2006 was 1.00 (SE = 0.00) and winter survival (December-March) was 0.70 (SE = 0.09, n = 27).

During the 2006 nesting season, thirteen hens were known to have at least attempted to nest; of those, two attempted a second nest. Eleven (73%) nest attempts were unsuccessful. Six were predated (coyote, badger, and raccoon), 3 abandoned due to hen mortality, 1 destroyed by cattle, and 1 destroyed by researchers (hen incubating nest for 34 days). Of the 4 nests that successfully hatched, three broods remained as of August 15, while one hen lost her brood less than 3 weeks post-hatch.

In 2007, thirteen hens attempted to nest with 3 re-nest attempts. Only one nest successfully hatched, however the hen and poults were predated 2 days post-hatch. Of the 15 unsuccessful nests, 11 were predated (coyote, raccoon, badger), 1 destroyed by mowing activity, 1 flooded, 1 abandoned, and 1 lost to livestock.

A variety of habitats and locations were used for nest sites during the 2006 and 2007 nesting seasons. Nests were found in alfalfa (Medicago sativa) (n = 5), snowberry (Symphoricarpos albus) patches within pastures (n = 11), under a lone eastern cedar tree (Juniperous virginiana) in a pasture (n = 1), riparian area (n = 2), wooded draw (n = 2), hayland (n = 2), Conservation Reserve Program (CRP) (n = 4), and smooth brome grass (Bromus inermis) in a roadside ditch (n = 2), and fenceline consisting of brome (n = 2).

Mean dispersal distance (distance from release site to first nest attempt) in 2006 was 3,683 m (SE = 1,250, n = 13) and in 2007 1,528 m (SE = 881, n = 4). Second nest attempts were an average of 1,256 m (SE = 736, n = 2) from the first attempt in 2006, whereas only 566 m (SE = 125, n = 3) in 2007. Average nest site fidelity distance between 2006 and 2007 was 2,241 (SE = 953, n = 6), with a minimum distance of 187 m and a maximum distance of 6,430 m.

Principal Investigator: Thomas Kirschenmann, Senior Wildlife Biologist, SD Department of Game, Fish and Parks, 895 3rd St. SW, Huron, SD 57350. Email: Tom.Kirschenmann@state.sd.us Telephone: (605) 353-8477.

Total Study Cost: $20,854.39

Study Title: Seasonal Movements of Elk Relative to Management Unit Boundaries in the Black Hills, South Dakota

Study Number: 7586

Objectives:

1. To determine seasonal movements of elk relative to management unit boundaries.
2. To document cause specific mortality.
3. To identify movement corridors.
4. To evaluate present elk survey

Narrative: This was the first year of a 4-year study. Elk are tracked 3-5 times per week and UTM's are taken as often as possible.

Results: Forty-nine elk (10 bulls and 39 cows) were successfully captured and collared in January and February of 2007. As of August 30th, there have been two mortalities due to mountain lions and one collar has malfunctioned.

Principal Investigator: Dr. Lowell E. Schmitz, Wildlife Biologist, South Dakota Department of Game, Fish, and Parks, 3305 W. South Street, Rapid City, SD 57702

Total Study Cost: $112,022.09

Study Title: *Evaluating effects of harvest on mountain lions in the Black Hills of South Dakota*

Study Number: 7587

Objectives:

1. To determine if harvest mortality is compensated for or additive to other forms of mortality in mountain lions in the Black Hills, South Dakota, by 2011.
2. To determine if there is a change in annual production of mountain lions as a result of sport-harvest of mountain lions in the Black Hills, South Dakota, by 2011.
3. To determine the characteristics of mountain lions that are removed by Department of Game, Fish, and Parks personnel in the Black Hills, South Dakota, by 2011.
4. To examine the seroprevalence of infectious diseases of mountain lions in the Black Hills, South Dakota, by 2011.

Narrative: Mountain lions (*Puma concolor*) historically occurred throughout South Dakota but were extirpated around 1900 due to a bounty placed on the animal in 1889. Information collected on mountain lions occurring in the Black Hills of South Dakota has indicated population increase from the late 1990s to 2006. Indices that support this increase include verified sightings, subtle changes in male territories, and estimates of population size based on home range size and mark recapture. Current indices (population and nutrition) suggest the population has become saturated. This information was used by South Dakota Department of Game, Fish and Parks to establish a mountain lion harvest in 2005. An evaluation of this harvest is in need to assess compensation relative to natural (including other human-caused mortality) mortality, effects of sex-specific harvest on population size and potential recruitment, and harvest rate that will provide sustained opportunity for hunters in the Black Hills region. In addition, information on disease prevalence in mountain lions will aid in assessing population quality.

Results: We captured and collared 41 mountain lions in the last year. Sex and age classes of captured mountain lions were 21 female (7 subadult, 14 adult) and 20 male (14 subadult, 6 adult). We also captured 8 mountain lions (6 female, 2 male) that were already fitted with radiocollars to replace transmitters or obtain samples for disease testing. Additionally, we hand-captured 14 mountain lion kittens (8 female, 6 male) <2 months old and fitted them with radiocollars to assess production via agent-specific mortality.

We documented 19 mortalities of radiocollared mountain lions between 1 July 2006 and 30 June 2007. Mortalities were caused by conspecifics (n = 6), GFP removals (n = 4), sport-harvest (n = 4), old-age (n = 1), vehicle collision (n = 1), research accidents (n = 1), and unknown causes (n = 2). Deceased mountain lions were necropsied at South Dakota State University, except when disease was suspected. In such case (n = 1), the carcass was shipped to the University or Wyoming Diagnostic Laboratory to determine cause of death. No mountain lion kittens that were captured last year were known to have died. We obtained disease exposure samples from 44 individual mountain lions, from which the test results are still pending. We documented 5 subadult mountain lions (4 male, 1 female) dispersing from the Black Hills, South Dakota. Of the remaining subadult mountain lions, 2 were harvested legally in South Dakota, 1 was killed illegally in Wyoming, and 13 continue to inhabit the Black Hills.

We continue to conduct weekly telemetry flights to assess survival, obtain locations of all collared mountain lions, and to determine denning status of females. When female mountain lions are suspected of utilizing a den, we approach on foot to capture the kittens (<2 months old) for radiocollar fitting. We also continue to conduct mountain lion captures to obtain new individuals as well as collect additional samples for disease testing.

Principal Investigator: Jonathan A. Jenks, Associate Professor, Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings. Telephone (605) 688-4783; Brian Jansen, Graduate Research Assistant, Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings.

Total Study Cost: $80,000.00

Study Title: White-tailed deer preference for corn hybrids and husbandry practices during the growing season.

Study No: 7588

Objectives:

1. Document deer preference among corn hybrids and husbandry practices during the growing season.
2. Examine physical and nutritional characteristics that make specific hybrids more or less desirable to deer.
3. Compare preference of captive animals to wild deer through the use of manipulated food plots in rural areas.

Narrative: Despite the extensive use of corn by white-tailed deer (*Odocoileus virginianus*) throughout the year as a source of food and cover, virtually no information exists regarding deer selection for corn hybrids. Recently managers within the Northern Great Plains have observed deer evading food plots and proceeding to feed on producer corn. Determining if deer prefer specific hybrids or husbandry practice (i.e., fertilizer or herbicide applications) is necessary to evaluate current management strategies. If deer exhibit preference for specific corn hybrids, managers could strategically place food plots of preferred hybrids in areas prone to crop depredation to deter deer from depredating on private croplands. Likewise, producers could aid in minimizing depredation by planting hybrids less preferred by deer. Thus, information on deer preference for corn hybrids would enhance management of deer in agricultural areas.

Results: Data were collected on the observed proportional intake of corn hybrids by study animals at the Wildlife Research facility at South Dakota State University to determine preference. Three enclosures, each approximately 11m x 39m in size, contained corn plots surrounded by grass buffers. Eight rows of corn were planted in each plot in a block pattern with a specific corn hybrid (n = 3) systematically placed representing one-third of each plot. Study animals were allowed equal access to each corn plot (2 deer in each plot) on a weekly basis for 30-minute periods or until feeding was completed; observations were recorded at 30-second intervals. Data were collected weekly from 05 July – 15 September 2006. Preference differed ($P<0.05$) among hybrids throughout the study period. Mean weekly number of feeding observations for hybrid A (Dekalb DKC44-92 (RR2)), hybrid B (Dekalb DKC46-28 (RR2)), and hybrid C (Dekalb DKC48-52 (RR2)) were 48.2, 33.4, and 34.5, respectively. Currently, similar trials are being conducted that began 25 June 2007 and will end roughly 12 September 2007. Procedures were the same, but different corn hybrids have been used to acquire a greater range in days to maturity. In addition, experimental plots also were established at several sites on property owned by private producers in the local area for 2006 and 2007. Corn hybrids have been manipulated in each plot on each property to document the feeding patterns and preference of deer. Feeding activity in each plot has been measured regularly throughout the growing season by inspecting each plant for damage and then quantifying damage within the respective plots. This data have yet to be analyzed. Subsamples of each hybrid

at all plots studied were collected throughout the growing season both years and will be analyzed at the Analytical Services Laboratory at South Dakota State University to determine moisture content, crude protein, crude fat (ether extract), acid detergent fiber, neutral detergent fiber, digestible dry matter, and sugar content. Complimentary data provided by Monsanto characterizing our study hybrids indicates that preference is likely based on nutritional characteristics and/or days to maturity.

Principal Investigators: Jonathan A. Jenks, Professor, Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings. Telephone (605) 688-4783; Joshua A. Delger, Graduate Research Assistant, Department of Wildlife and Fisheries Sciences, South Dakota State University Brookings.

Total Study Cost: $44,000.00

Study Title: ***Development of a site-occupancy model for monitoring ruffed grouse in the Black Hills National Forest***

Study Number: 7589

Objectives:

1. Develop occupancy models for ruffed grouse monitoring in the Black Hills National Forest.
2. Compare site sampling requirements for occupancy models developed from fall and spring drum counts of ruffed grouse in the Black Hills National Forest.
3. Determine the characteristics of habitat patches that affect the metapopulation dynamics of ruffed grouse in the Black Hills National Forest.
4. Determine the habitat characteristics that affect ruffed grouse selection of drumming structures in the Black Hills National Forest.

Narrative: The ruffed grouse (*Bonasa umbellus*) is a management indicator species for quaking aspen (*Populus tremuloides*) habitat in the Black Hills National Forest (BHNF). Ruffed grouse surveys have been conducted in the past with varying degrees of success due to inconsistent efforts and insufficient sample sizes. Due to limited time and manpower, a monitoring protocol should be established that minimizes survey effort while offering statistical validity. Using occupancy modeling, we will develop an effective and efficient approach to monitoring ruffed grouse in the Black Hills. Occupancy modeling will provide both the proportion of the BHNF occupied by ruffed grouse and the change in occupancy from year to year and how this compares to aspen increase/decline. Occupancy and habitat data will aid managers in making management decisions for ruffed grouse and quaking aspen in the BHNF.

Results: Between 2 April and 31 May 2007, we conducted ruffed grouse surveys in the Black Hills National Forest (BHNF). Our surveys consisted of driving to pre-determined random sites throughout the BHNF (North of Highway 16) and listening for five minutes for ruffed grouse drumming. We surveyed each site at least three times. Along with the presence/absence of ruffed grouse at a site, we

recorded the date, time, observer, temperature, wind speed, and weather conditions. Overall, we surveyed 414 sites and found 30 to be occupied by ruffed grouse. Using this information we will determine both the occupancy and appropriate survey procedures for monitoring ruffed grouse in the BHNF.

In addition to the survey work, we searched for drumming logs when a ruffed grouse was heard. During the spring season, we found 38 drumming logs. When the drumming log was located, we took habitat measurements including basic dimensions of the log, adjacent canopy cover, visibility (using a cover board), stem density, and tree measurements (all within a 12.5 meter radius of the log). We selected three random locations between 50 and 300 meters of each drumming log and obtained the same measurements. Eventually, these data will help us understand what habitat characteristics ruffed grouse select for when choosing a drumming log in its territory.

Principle Investigators: Dr. Joshua J. Millspaugh, Associate Professor, Department of Fisheries and Wildlife, University of Missouri, Telephone: 573-882-9423; Email: MillspaughJ@missouri.edu; Dr. Mark A. Rumble, Research Wildlife Biologist, Forest Service, Rocky Mountain Research Station, Telephone: 605-716-2174, Email: mrumble@fs.fed.us; Christopher P. Hansen, Graduate Research Assistant, Department of Fisheries and Wildlife, University of Missouri, Telephone: 573-884-8533; Email: cphb66@mizzou.edu.

Total Study Cost: $0.00 Costs for this reporting period were paid for using USFS (Black Hills National Forest) funding source

Study Title: Evaluation of duck and pheasant nest success in large block predator management areas in northeast South Dakota

Study Number: 7590

Objectives:

1. To determine duck and pheasant nesting success in Block Predator Management areas in northeast South Dakota.
2. To compare duck and pheasant nesting success in Block Predator Management areas to areas without predator management in northeast South Dakota.
3. To evaluate the effectiveness of Block Predator Management and determine if it is a viable management option in South Dakota.

Narrative: Duck nest success is the greatest limiting factor to waterfowl production in the Prairie Pothole Region. Mammalian predation accounts for the majority of nest losses. Block predator management has been effective at increasing duck nest success in North Dakota and Canada, but no work has been done in South Dakota. In addition, there has been no research on block predator management on pheasant nest success. Two trappers were hired by Delta Waterfowl Association to remove mammalian predators in two 36-square mile blocks during the time period of March 15-July 15, 2007. Two sites were located in northern Roberts County with the eastern site being trapped and the western site serving as a control where no trapping took place. Two similar sites

were located on the border of Clark and Codington Counties with one being trapped and one serving as a control. Suitable nesting habitat was located in the 4 blocks and randomly selected areas were searched within each block. Research was conducted on private, state and federal lands. Nests were located from early May to early July on these sites using nest dragging techniques. Nests were monitored weekly to determine their fate. Data was entered into an excel spreadsheet and is currently being analyzed to produce Mayfield nest success estimates.

Results: We found 949 duck nests (425 blue-wing teal, 358 mallards, 85 gadwall, 53 northern shoveler, 24 northern pintail) and 161 pheasant nests. Data analysis is ongoing, with Mayfield nest results to be available soon. Preliminary apparent duck nest success is 53.7% for the two trapped sites and 50.7% for the two control sites. Apparent pheasant nest success was 47.5% for the trapped sites and 28.9% for the control sites.

Principle Investigators: Dr. Charles Dieter, Professor, Department of Biology and Microbiology, Box 2207B, South Dakota State University, Brookings, SD 57007. Telephone (605) 688-4555. *Prepared by:* Nick Docken, Graduate Research Assistant, Department of Biology and Microbiology, Box 2207B, South Dakota State University, Brookings, SD 57007. Telephone (605) 688-6902.

Total Study Cost: $34,348.89

Study Title: Evaluation of Survival, Dispersal, and Density of Mountain Lions in the Black Hills of South Dakota

Study Number: 75106

Objectives:

1. Estimate survival and document causes of mortality of mountain lion kittens in the Black Hills, South Dakota.
2. Determine longevity of established adult mountain lions occurring in the Black Hills, South Dakota.
3. Document dispersal distances, dispersal routes, and destinations of subadult mountain lions.
4. Compare estimates of population size of mountain lions derived from home range size and overlap to those generated from probability sampling and computer modeling techniques.

Narrative: Limited information is available on mountain lions (*Puma concolor*) occurring in the Black Hills of South Dakota. Mountain lions historically occurred throughout South Dakota but were nearly extirpated around the turn of the century due to a bounty placed on the animal in 1889. Recent research has indicated that approximately 48 to 72 adult mountain lions reside in suitable habitat in the Black Hills. However, only limited information exists on survival of adult mountain lions, estimated at about 80%, and no information is available on densities, survival and sex ratios of kittens, and dispersal of subadults. An increasing number of sightings of cougars have been reported along drainages surrounding the Black Hills, however, it is not known if the animals are remaining

along the periphery of the mountain range or dispersing onto the Northern Great Plains. Information on survival and replacement of adults and dispersal of subadult male and female mountain lions is critical to assess whether the population is at carrying capacity, and to determine the extent of self-population regulation. Furthermore, although estimates of population size have been acquired based on home range size and overlap, attempts at conducting a scent-station survey to aid in documenting population trends was unsuccessful. However, a pilot study involving a helicopter snow-tracking survey using a transect-intercept probability sampling technique showed promise in obtaining additional density estimates as well as documenting population trends. Because of the incomplete information available on this species and because mountain lions can potentially harm humans, a need exists for information on adult survival and replacement, kitten survival and dispersal, and additional estimates of population size from which population growth rate can be calculated, trend monitored, and appropriate management taken.

Results: The majority of field research for this project was finished by the end of the fiscal year-2006. Several subadult male and female cougars are being tracked in conjunction with continuing research to document their dispersal movements. A total of 86 cougars was captured and radiomarked since research inception. We are currently analyzing data and writing up results. Home range size averaged 139.6 km^2 (SE=18.3km) for females (*n*=32), and 641.1 km^2 (SE=70.9 km) for males (*n*=20). We documented female home range overlap as high as 83.3 % for two radioed females, with an overall decrease in female home range size since 2003. In addition to actively capturing cougars for research purposes, we tediously documented any known mortality events throughout the study area and South Dakota in conjunction with South Dakota Department of Game Fish and Parks (SDGFP). We continue to necropsy all available carcasses to provide tissue samples, cause of death, diet, body measurements, and sex/age structure. We acquired measurements from 108 cougars through capture and necropsy efforts. Weight of adult males averaged 63.2 kg with mean length of 211.9 cm. Adult females were approximately 66% of the weight of males and averaged 17 cm shorter than males. A total of 85 mortality events was documented in South Dakota between 1998-2005. Vehicular trauma was the primary source of mortality (*n*=28) followed by departmental removal of depredation/nuisance animals (*n*=18). Of the 77 mortalities with known cause of death, 84.4% were considered to be human-induced (i.e., vehicle, removal, illegal/legal kill) (These mortality events do not include harvest, which was initiated in 2005). We documented several anomalistic mortality events such as electrocution from power lines and emaciated animals with eye trauma that are currently being investigated. We documented dispersal movements from 29 subadult cougars (*n*=19 males, *n*=10 females) captured within the Black Hills. No male cougars were recruited into the Black Hills population, with at least 5 animals dispersing > 200 km from capture/natal home range. To date the three farthest documented dispersal movements of wild cougars have been from the Black Hills cougar population. Females exhibited approximately 40% philopatry. Cougars reached independence an average of 13.5 months post parturition; with dispersal occurring 1-3 months post independence. We have submitted 176 tissue samples for genetic analyses that are currently being conducted. We will assess genetic structure of Black Hills cougars along with comparing genetic results for untagged animals collected outside the Black Hills study area.

Genetic analysis will supplement dispersal data collected from radiocollared lions.

Principal Investigator: Jonathan A. Jenks, Associate Professor, Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings. Telephone (605) 688-4783; Daniel J. Thompson, Graduate Research Assistant, Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings.

Total Study Cost: 33,333.33

Study Title: Mortality and Habitat Use of Mule Deer Fawns in the Southern Black Hills, South Dakota

Study Number: 75109

Objective: To determine mortality and habitat use of mule deer fawns in the southern Black Hills, South Dakota.

Narrative: This was the final year of a 4-year study. Results of this study will be compared to results of previous white-tailed deer fawn studies conducted in the Northern, Central, and Southern Black Hills.

Results: Eleven mule deer fawns (6 males and 5 females) were successfully captured and collared during June 2006. Age of fawns captured ranged from newborn to 4 days old. Fawns were tracked through July one of 2007. Data from the study is now being entered and analyzed for the completion report.

Principal Investigator: Dr. Lowell E. Schmitz, Wildlife Biologist, South Dakota Department of Game, Fish, and Parks, 3305 W. South Street, Rapid City, SD 57702

Total Study Cost: 52,928.95

Study Title: Distribution, Diets and Body Condition of Migrating Lesser Scaup in South Dakota

Study Number: 75110

Objectives:

1. To determine the site-specific and landscape scale variables that best describe immediate and long-term wetland use by lesser scaup spring migrants in eastern South Dakota and compare these results with models developed along other migration routes and on their breeding grounds.
2. To determine the spatial extent of habitat availability to staging lesser scaup over spring migration through eastern South Dakota based on long term wetland use data.

3. To identify site-specific and landscape variables that best describe the distribution and abundance of their preferred prey item (Amphipods).
4. To develop and test predictive habitat suitability index models based o priori and empirical data of habitat use by lesser scaup. vi
5. To develop a spatially explicit spatial model representing changes in habitat suitability for ; a) lesser scaup and ;b) their preferred prey item (Amphipods) in eastern South Dakota in response to weather cycles experienced in eastern South Dakota in the periods prior to and during vi their population declines.

Abstract[1]*.* The continental population of lesser scaup (*Athya affinis* [Eyton]; hereafter scaup) has been in decline since the 1980s, leading researchers to speculate that reduced feeding efficiency and subsequent lowered body condition during spring migration may have adverse impacts on reproductive success. Although scaup-habitat associations have been studied in the past, lack of long-term data concerning the quantity and quality of suitable wetland habitat has hindered the evaluation of historic trends in relation to habitat use and more importantly scaup population decline. In this study, we assessed scaup-habitat relationships to determine the variables that best described scaup use of wetlands in South Dakota's Prairie Pothole Region (PPR). Empirical data were used to develop a temporally dynamic spatial model to describe historic habitat suitability. The model was then applied to other parts of the PPR used by migrating scaup. The PPR spans from northern Iowa northward to Canada's boreal forest region where about 70% of the scaup population breeds. In 2004, a census survey of spring migrating scaup was coupled with chemical, physical and biotic variables collected from wetland habitats. Site-specific wetland use was positively related with wetland size, amphipod density and the proportion of coarse sediments (≥2000 µm diameter). Scaup use was negatively associated with chloride, potassium, and nitrate concentrations in the water and the proportion of fine sediment (≤ 150 µm diameter). Site-specific evaluations revealed negative associations between amphipod abundance and water quality (chlorides, potassium and ammonim). Higher concentrations of chlorides, potassium and ammonium were associated with roads and development (i.e., housing, boat docks, sewage treatment, etc.). Moreover, modeling efforts showed that amphipod abundance and submerged aquatic vegetation (SAV) explained an appreciable amount of variation (64%) in scaup use. At the landscape scale, scaup wetland use was positively associated with landscapes, which had high proportions of semipermanent wetlands and negatively associated with landscapes dominated by temporary wetlands. This would explain their affiliation to the Prairie Coteau, which has the highest density of semipermanent wetlands out of all the physiographic regions in eastern SD. However, wetland resources in the PPR are not static. Apart from the expected expansion of wetlands in wet periods, a comparison of wetland resources between average (1979-1986) and above-average (1995-1999) water condition years revealed that spatial configuration patterns such as proximity, clumpedness and connectivity may explain "losses" of smaller temporary and seasonal wetlands by merging with larger semipermanent wetlands.

Using data on scaup-habitat associations, we developed a spatial habitat suitability index model comprised of three sub-models: (1) a population and rule-based sub-model describing potential amphipod production (AMPROD) in

response to seasonal climate, (2) a landscape sub-model describing changes in total wetland area at broad scales and (3) a sub-model accounting for changes in open water area. Indices for each of the three sub-models were derived using WETSIM (Version 3.1), a process oriented wetland model that simulates the hydrodynamic and vegetation changes of a semipermanent PPR wetland from climate data. To our knowledge, this is the first attempt to model the population dynamics of an aquatic invertebrate in response to local climate. The model predicted high spatial and temporal variation between stations in response to local climate, however, stations that were closer together tended to be more similar. This reflected the variability observed in field data collected over three years. Based on climate alone, average long-term habitat suitability (1950-2000) was predicted to be highest in Iowa, followed by Minnesota, South Dakota and then North Dakota, which means that local weather patterns in the eastern portions of the PPR produce more favorable habitat than the west and habitat suitability got poorer as we went northward. However, continued deterioration in wetland quality and quantity by agricultural activities in the eastern portions of the PPR could place severe strains on migrant scaup, particularly in dry periods when habitats in the west are unusable. At most stations, the model predicts a decline in average habitat suitability from the 1950s to the 1960s followed by an increase in the 1970s. Habitat suitability in South Dakota then improved from the 1970s to the 1990s but steadily declined in Minnesota and North Dakota. Results from one station with more recent data (Brookings, SD 1950-2006) suggest that harsh winter conditions in 2001 resulted in a steep decline in habitat quality to levels below those experienced 30 years ago, which matches the low frequency of occurrence of amphipods in scaup diets collected from wetlands in close proximity. Although the model does not predict uniform trends across the PPR, it emphasizes the danger that habitat losses in the east pose to migrant scaup as these are located in the most favorable climates for production. The model does not fully support the spring condition hypothesis (SCH), which postulates that migration habitat suitability in the upper-Midwest has declined since the 1980s. However, it predicts that migration habitat suitability is cyclic. Interestingly, habitat suitability was predicted to have declined in those areas where the SCH was formulated. Furthermore, the model raises questions relating to the metapopulation dynamics of amphipods in the western PPR, which are presumed to experience higher local extinction rates due to higher dro ght frequency.

[1] Abstract from Ph.D. dissertation by S. Kahara entitled MODELING WETLAND USE BY SPRING-MIGRATING LESSER SCAUP (ATHYA AFFINIS) IN EASTERN SOUTH DAKOTA, August 19, 2007.

Principal Investigators: Dr. Steve R. Chipps, Assistant Professor, Department of Wildlife and Fisheries Sciences, Box 2140B, South Dakota State University, Brookings, SD 57007. Telephone (605) 688-6121. Prepared by: Sharon N. Kahara, Graduate Research Assistant, Department of Wildlife and Fisheries Sciences, Box 2140B, South Dakota State University, Brookings, SD 57007. Telephone (605) 688-6121.

Total Study Cost: $12,639.33

Study Title: Use of Natural Vegetative Barriers to Limit Expansion of Black-tailed Prairie Dog Towns

Study Number: 75120

Objectives:

1. To evaluate effective width of vegetative barriers in limiting prairie dog town expansion in western South Dakota.
2. To document the effect of height of native vegetation on expansion of prairie dog towns in western South Dakota.

Narrative: In 2000, the U. S. Fish and Wildlife Service designated the black-tailed prairie dog (*Cynomys ludovicianus*) a candidate species for listing as threatened. Public opinion on the possible listing included concern over landowner rights, control responsibilities, and species concerns for both prairie dogs and other associated species. This designation prompted South Dakota as well as other states and agencies to modify prairie dog management plans. Prairie dog control has historically consisted of lethal methods to maintain, reduce, or eliminate populations in South Dakota and throughout the range of the species. Non-lethal methods of control are in need to meet changing management objectives for the black-tailed prairie dog. These objectives include long-term, self-sustaining populations of prairie dogs and benefits for species closely associated with prairie dog communities. The use of buffer strips of naturally occurring vegetation as barriers may be effective in limiting prairie dog expansion. However, no information exists on use and success rate of this technique at limiting expansion of prairie dog towns. Knowledge gained in this study will supplement existing non-lethal methods for managing prairie dogs.

Results: Prairie dog (*Cynomys ludovicianus*) control has historically consisted of lethal methods to maintain, reduce, or eliminate populations. Non-lethal methods of control for prairie dogs are desired to meet changing management objectives. Use of naturally occurring buffer strips as vegetative barriers may be effective in limiting prairie dog town expansion. Objectives of this study were to evaluate effective width of vegetative barriers in limiting prairie dog town expansion, document characteristics of natural vegetation that affect expansion of prairie dog towns, and examine vegetation characteristics associated with prairie dog towns in western South Dakota. Five study sites were established in western South Dakota on rangelands containing prairie dog towns of adequate size (≥ 10 ha). Electric fences were constructed to exclude cattle and create buffer strips of naturally occurring grasses and shrubs. Buffer strips were 100 m long and 10, 25, and 40 m wide. Zero meter controls were included on all study sites. Prairie dogs were poisoned to create prairie dog free buffer zones within control areas. Grazing was allowed on both sides of buffer strips. When grazing pressure was not sufficient, mowing was used to simulate grazing. To quantify vegetation characteristics, quadrats (25) were randomly distributed throughout buffer strips. Evaluation of study sites included visual obstruction (VOR), vegetation cover (%), vegetation frequency, vegetation height, and vegetation identification. Burrow density adjacent to buffers was quantified as an index to prairie dog population. Barrier penetration was evaluated by presence of new active burrows behind vegetative barriers (Breakthrough). Breakthrough was minimized with 40-cm vegetation height and 10-cm VOR. The predictive model for vegetation height

and buffer width was Breakthrough=exp $^{(2.410-0.004*\text{Veg Height}-0.036*\text{Buffer Width})}$. The predictive model for VOR and buffer width was Breakthrough=exp $^{(2.48-0.048*\text{VOR}-0.031*\text{Buffer Width})}$. Percent grass cover, percent forb cover, percent bare ground, percent litter cover, and burrow density did not add significantly to the model. Models were used to predict buffer width needed to prevent breakthroughs. Estimated buffer width to minimize breakthroughs ranged from 85.1 – 103.1 m. Vegetation characteristics indicated that visual obstruction was greater on buffers than on controls. Vegetation height was higher on treatment than control plots, and higher on eastern sites than western sites. Western wheatgrass (*Pascopyrum smithii*) was greater on eastern than western site. Bare ground was significantly greater on control areas compared to buffer areas. Vegetation characteristics associated with relative percent grass cover, forb cover, and litter indicated minor or no differences between controls and buffer, and eastern sites and western sites. Plant species richness was not different from control to buffer area, but was greater on eastern sites than western sites.

Principal Investigator: Jonathan A. Jenks, Associate Professor, Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings. Telephone (605) 688-4783; David F. Terrall, Graduate Research Assistant, Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings.

Total Study Cost: $20,000.00

Study Title: Movement patterns of white-tailed deer in east-central South Dakota relative to winter ranges and management unit boundaries

Study Number: 75124

Objectives:

1. Evaluate seasonal movements of white-tailed deer relative to traditional winter ranges and management unit boundaries in east central South Dakota.
2. Document annual cause specific survival of white-tailed deer in east central South Dakota.
3. Document seasonal movements of white-tailed deer relative to physiographic regions and management unit boundaries in east central South Dakota.

Narrative: Currently, political boundaries (counties) are used as unit boundaries for hunter harvest of white-tailed deer (*Odocoileus virginianus*) in eastern South Dakota. Potential problems with this management system are that pre-harvest counts of white-tailed deer may not coincide with actual populations within each unit during hunter harvest. Variability in harvestable deer within unit boundaries is due to dispersal patterns and migration of deer from summer to winter ranges. This study will evaluate factors affecting temporal patterns of movement of white-tailed deer relative to current harvest unit boundaries. Previous research has indicated that deer management units might be more effective as a management tool if they were based on physiographic features rather than on counties. Deer movements in this region of the Northern Great Plains generally follow stream

systems that are not associated with management unit boundaries or road systems. Furthermore, deer in eastern South Dakota have relatively large home rages in Fall-Winter. Thus, information gained in this study will assist managers by determining temporal relationships between behavior and climatic patterns that affect movements of white-tailed deer in east central South Dakota. This information will allow a reassessment of management unit boundaries and timing of surveys for estimating population parameters of white-tailed deer.

Results: White-tailed deer were captured using modified clover traps, drop nets, tranquilizer darts fired from a modified delivery system, and net guns fired from helicopters from January-April 2005 (22 animals) and on 27 January 2006 (20 animals) at three capture locations in east central South Dakota (Edmunds County). From January 2005 to January 2007, 42 adult, female white-tailed deer were monitored for movement and mortality using radio telemetry in Brown, Edmunds, Faulk, and McPherson counties, South Dakota. A total of 2,822 locations was collected, with a mean 95% error ellipse of 6.6 ha. I documented a total of 49 seasonal movements during 4 migration periods; spring 2005 (n = 5), fall 2005 (n = 8), spring 2006 (n = 20), and fall 2006 (n = 16). Temperature was the primary cause of seasonal migration. Mean migration distance between seasonal home ranges was 19.4 km (SE = 2.0). Percentage of migrants crossing management unit boundaries ranged from 12.5 to 60.0%. Percentage of migrants crossing physiographic region boundaries ranged from 60.0 to 81.3%. Mean spring migration direction was 294.3°(SE = 12 .2°, n = 25). Mean dispersal distance was 59.9 km (SE = 11.9, range 36.2, n = 3). A total of 83 individual home ranges was calculated during 3 periods of seasonal home range use; summer 2005 (n = 21), winter 2005-06 (n = 32), and summer 2006 (n = 30). Mean 95% home range size was 6.5 km² (SE = 0.9, n = 32) during winter and 7.1 km² (SE = 0.9, n = 51) during summer. Mean 95% home range during winter and summer ranged from 3.9-9.1 km² and 3.6-15.6 km², respectively. Mean movement between relocations was 977.9 m (SE = 36.2, n = 83). During this study, 18 deer died, and the overall (25 month) survival rate was 0.48 (SE = 0.08, n = 42). Annual survival rates during 2005 and 2006 were 0.84 (SE = 0.08, n = 22) and 0.65 (SE = 0.08, n = 40), respectively. Seasonal survival rates for post-hunt, pre-hunt, and hunting seasons during 2005 and 2006 were 1.00 (SE < 0.001, n = 22), 1.00 (SE < 0.001, n = 22), 0.80 (SE = 0.08, n = 42) and 0.97 (SE = 0.03, n = 37), 0.97 (SE = 0.03, n = 36), 0.64 (SE = 0.09, n = 32), respectively. Survival was predominantly dependant on human-related factors (i.e., hunting, vehicle collisions, wounding loss), which caused 88.9% of all mortalities. Hunting (including wounding loss) accounted for 77.8% of all mortalities. The best fit model for winter survival included the covariates tree stands (β = -114.68, SE = 94.77), wetlands (β = -21.33, SE = 14.61), and standing corn (β = -8.89, SE = 4.02), indicating that white-tailed deer with higher percentages of tree stands, wetlands, and standing corn in their seasonal home range had lower survival. The best fit model for summer survival included grassland (β = 15.85, SE = 9.4), indicating that white-tailed deer with higher percentages of grasslands in their seasonal home range had higher survival. Twenty habitat categories were mapped encompassing the winter home ranges of 30 animals with 868 locations gathered via radio telemetry. When analyzing the population as a whole (design I) my findings indicated that white-tailed deer were selecting fields of standing corn ($\hat{w}$ = 4.067), over all other habitat categories. Animals also were selecting for trees/shrubs ($\hat{w}$ = 2.820) and tall grass/wetlands ($\hat{w}$ = 1.838), while selecting

against harvested crops ($\hat{w}$ = 0.555) and roads/development ($\hat{w}$ = 0.367). Analysis using design II of pairs of selection ratios demonstrated that no single habitat was selected with a higher probability ($P < 0.05$) when compared to all of the other habitats. Design III analysis of comparisons of pairs of selection ratios indicated significant differences in selection between selected habitat pairs. Data for design III were sampled on the selection of resource units by individual animals, and extensive variation existed between animals in available proportions of habitat categories for individual animals as well as for use by individual deer. Functional response results using logistic regression for the fitted model (G = 31.16, P = 0.119, G/df = 1.35, α = 0.69, β = 1.20) indicated that there was a significant increase in use of cover habitat by deer as the availability of cover habitat increased. While the initial model using all 30 animals was not a good fit, results for the intercept and parameter were similar as to direction of selection across all 6 models. Thus, a reliable inference can be concluded about cover habitat selection for white-tailed deer in this study. Functional response results (G = 32.04, df = 22, P = 0.077, G/df = 1.46, α = 1.15, β = 1.58) for standing corn indicated an increase in use of standing corn habitat as the availability of standing corn increased. The distribution of animals was strongly influenced by composition and spatial pattern of resources within individual home ranges and results illustrated the importance of habitat interspersion to white-tailed.

Principal Investigators: Dr. Jonathan A. Jenks, Professor, South Dakota State University, Department of Wildlife and Fisheries Sciences, Telephone: (605) 688-6121, Email: Jonathan_Jenks@sdstate.edu, and Troy W. Grovenburg, Graduate Research Assistant, Department of Wildlife and Fisheries Sciences, Telephone: (605) 688-6121, Email: tgrove@abe.midco.net.

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TOTAL AGREEMENT COST $736,877.66