2016 South Dakota Elk Aerial Survey

Sightability Modeling

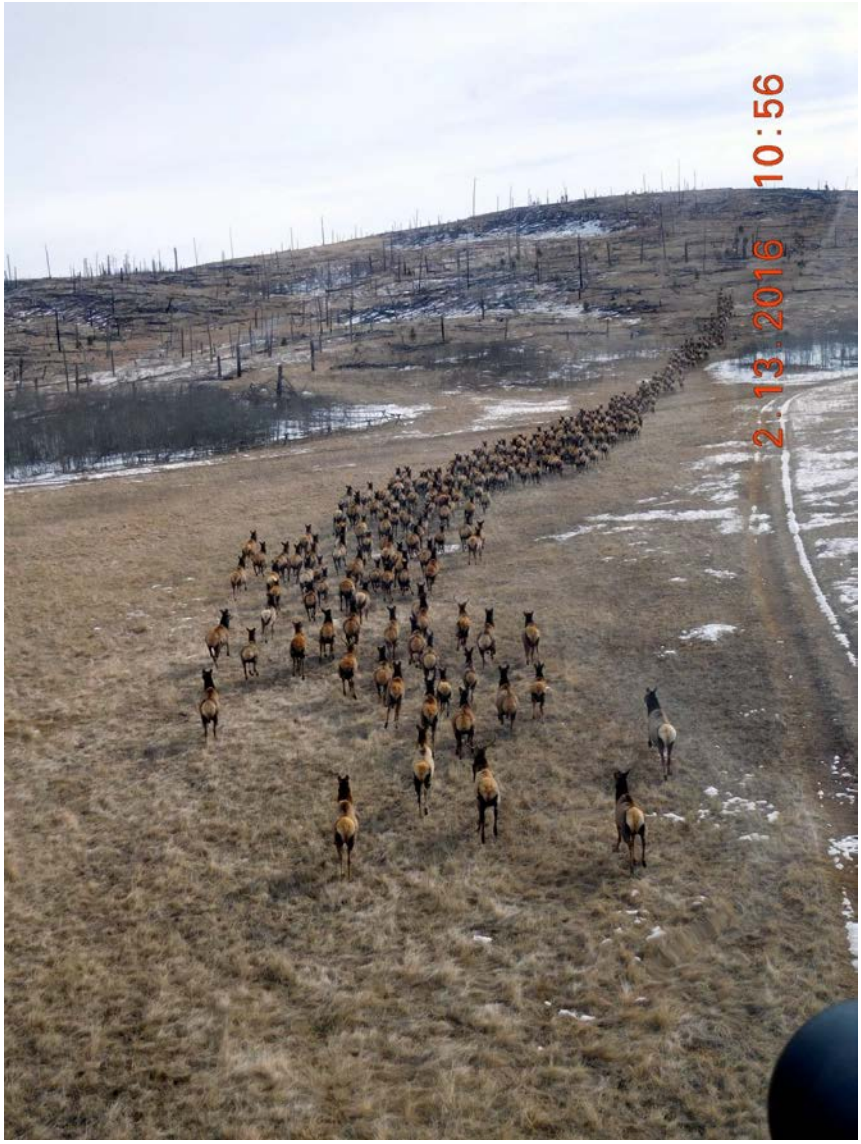
Aerial surveys are used to estimate the population size of large mammals; however, few surveys accurately count all animals. Numerous studies have reported that aerial surveys fail to detect 12-71% of animals known to be present. Total counts of ungulate populations are not feasible and numerous aerial surveys have documented biases associated with underestimates of population size. One approach used to correct for visibility bias of ungulate populations are sightability models. Sightability models are used to calculate the detection probability of individual groups and correct for groups missed during surveys by documenting factors affecting animal detection. Models are developed by flying over groups of animals containing radio-collared individuals and by recording covariates for individual groups both observed and undetected by observers. Numerous factors have been known to affect sightability and include type of aircraft, speed, altitude, transect width, group size, group activity (i.e., bedded, standing, moving), observer experience, vegetative cover, canopy cover (i.e, visual obstruction), topography, and snow cover. Logistic regression models are used to determine predictor variables based on various group-specific and environmental covariates. Detection probabilities generated through sightability models are then used to calculate the number of animals missed during the survey.

Black Hills Elk Sightabililty Model Development

Sightability trials using radio collared individuals were conducted during January and February when elk were concentrated on wintering areas during 2009, 2010, 2011, and 2012. The survey was flown using a R-44 helicopter with 2 observers and a pilot. The helicopter survey crews flew systematic search patterns following transects spaced 650-1000 feet apart, at speeds of 40-50 mph, and heights of 100-150 feet above the ground. During the four years of data collection, survey crews flew over 176 groups of elk that contained at least one radio-collared individual. Crews detected 107 of the 176 groups on the first pass, indicating an overall sightability rate of 60.8%. Once an elk group was sighted, the search pattern was interrupted to collect information on group size, activity, % visual obstruction, % snow cover, light intensity, and to record a GPS location. If a group of elk was missed during the survey trial, the survey crew would then use radio telemetry to locate the group and collect the needed information. Logistic regression analysis indicated that combined % visual obstruction, group size and % snow cover had the greatest impact on sightability, and as result, this model was selected to correct for elk missed during aerial survey work in the Black Hills.

2016 Elk Survey

Aerial surveys of elk populations in the Black Hills were conducted from February 1-22, 2016, using three R-44 helicopters, each carrying 2 observers and a pilot. The entire Black Hills was surveyed, including Wind Cave National Park, Custer State Park, and 100% of all elk hunting units in South Dakota. A total of 195 survey hours were flown in South Dakota and an additional 35 hours were flown on the Wyoming side of the Black Hills in suspected elk winter range. The entire survey area was delineated into 253 smaller subunits and helicopter survey crews flew systematic search patterns within each subunit, spaced 650-1,000 feet apart, at speeds of 40-50 mph, and heights of 100-150 feet above ground level. Adjacent subunits were flown with minimal time delays to minimize elk movements between subunits and the potential of elk herds being missed completely or double sampled. Once a group of elk was detected the survey transect was interrupted to record GPS location, group size, percent visual obstruction, and percent snow cover. Pictures were taken of any elk group that exceeded 50 animals and later analyzed to ensure accurate counts.



Total Counts and Sightability Model Estimates

Black Hills Hunting Units (excludes Custer State Park and Wind Cave National Park)

- Total count = 6,356 elk (no model correction)
- Sightability Model estimate = **7,200** (95% CI 6,700 - 9,100)

Custer State Park

- Total count = 378 elk (no model correction)
- Sightability Model estimate = **460** (95% CI 400-730)

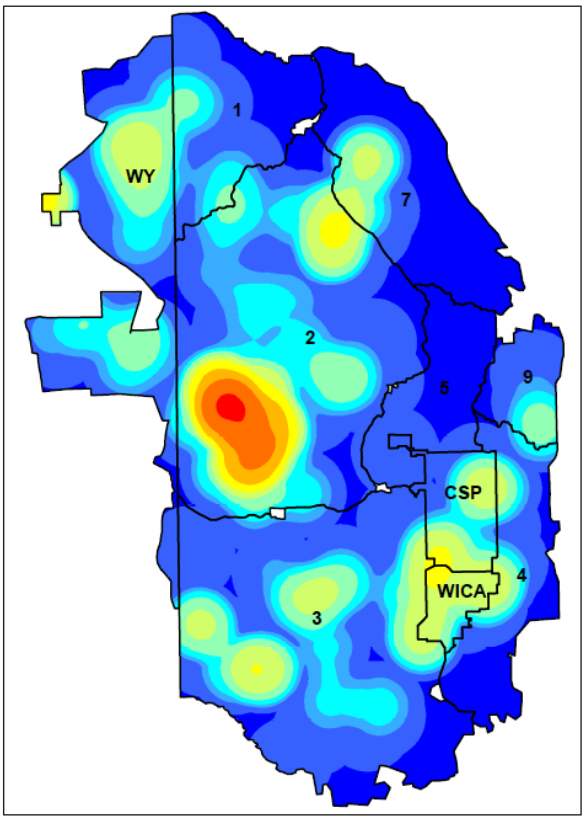
Wind Cave National Park

- Total count = 484 elk (no model correction)
- Sightability Model estimate = **700** (95% CI 570-1270)

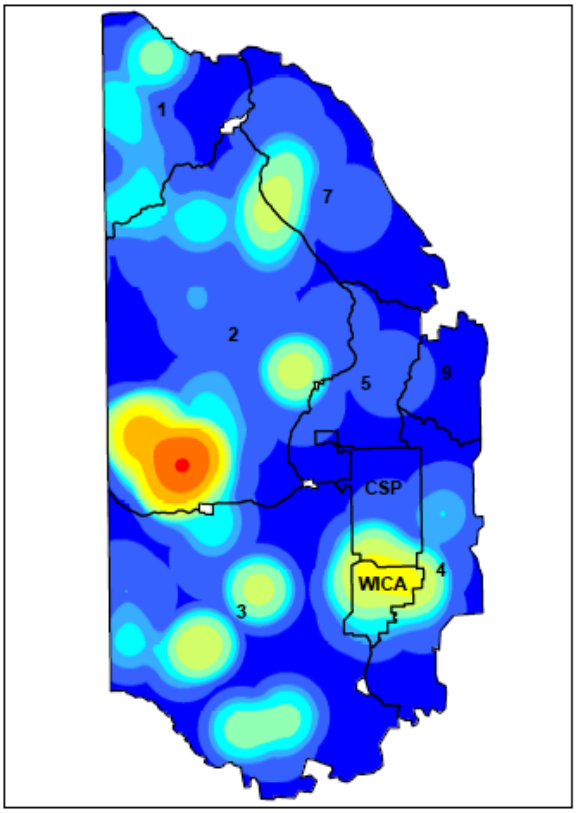
Wyoming Black Hills

- Total count = 923 elk (no model correction)
- Sightability Model estimate = **1,100** (95% CI 990-1500)

2016 Aerial Survey



2013 Aerial Survey



These maps represent winter population elk densities in the Black Hills. Based on previous radio telemetry research, elk within the Black Hills commonly display migratory behavior; therefore, winter estimates do not represent fall hunting unit estimates. Elk commonly cross unit boundaries and the Wyoming border during spring departures from their wintering area and thus; these densities only apply to the survey period.

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