



## **Influence of nutritional condition on migration, habitat selection and foraging ecology of elk (*Cervus elaphus*) in western Wyoming.**

**January 2011 Annual Report  
Wyoming Game and Fish Department  
Project WYGF 49746**

### ***Introduction and Study Plan***

The Wyoming Game and Fish Department (WGFD) and the Wyoming Cooperative Fish and Wildlife Research Unit at the University of Wyoming initiated this project on 1 July 2009. Current wildlife management practices in Wyoming offer a rare opportunity to evaluate the influence of nutritional condition on the behavioral strategies of a large, free-ranging population of elk (*Cervus elaphus*). The WGFD operate 22 winter feedgrounds (Fig 1), which create two groups of elk (fed vs. non-fed) that presumably differ in nutritional condition by the end of winter. This work views such subsidies as a landscape-scale manipulation of elk nutritional condition. Given the importance of winter starvation in temperate ungulates (Parker et al. 2009), the implications of winter nutrition on the migration and foraging behavior of elk are likely to be substantial. Still, it is unknown whether non-fed elk employ different strategies outside of winter to ameliorate winter fat losses. Such nutrition-mediated strategies may alter the migratory strategies of fed and non-fed elk, with non-fed elk migrating earlier, staying longer at stopover sites, or delaying fall migration to stay on summer range even at the risk of early fall storms. Summer



habitat selection and foraging behavior of non-fed elk may seek to maximize intake of higher quality forage through increased home ranges, selection of different habitats and increased feeding time at the expense of safer habitats and vigilance.

My research addresses these ecological and behavioral questions through the study of fed and non-fed elk populations in Sublette, Lincoln and Teton counties in central-western Wyoming and Caribou County in Idaho. This work builds off of a large effort to collect fine-scale movement data using global positioning system (GPS) collars on fed and non-fed elk in the region. Using two years of fine-scale movement data, I will evaluate the effect of nutritional condition on migration, summer habitat selection and foraging ecology. Additionally, I will assess the ability of stable isotope signatures in tissues to differentiate between fed and non-fed elk to evaluate differences in landscape-level distribution in the fall. Specific objectives include:

1. Increase surveillance of age-specific brucellosis seroprevalence in elk utilizing native winter ranges adjacent to feedgrounds
2. Evaluate interchange between fed and non-fed elk in four study areas and determine how such mixing could influence brucellosis management efforts (i.e., test and slaughter, vaccination)
3. Refine delineated parturition areas and assess potential risk of disease transmission to cattle due to spatial and temporal overlap
4. Evaluate differences in the migration patterns, summer habitat selection, and foraging ecology of fed and non-fed elk
5. Identify core winter-use areas, particularly in HA99, and evaluate their potential for habitat treatments
6. Evaluate landscape-level distribution of fed and non-fed elk during fall hunting by using stable isotope methods to identify feedground elk from hunter-killed samples

### ***Progress to Date***

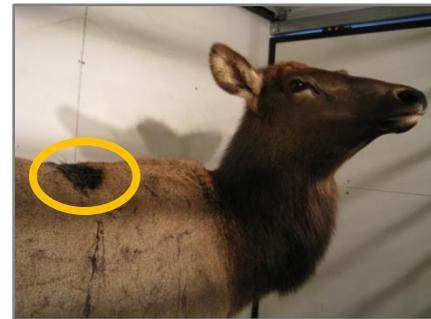
This project started on 01 July 2009. Jennifer Jones was selected as the graduate student for this project and began school work at the University of Wyoming in the fall of 2009 and will serve as the lead field technician for this project. In late January 2010, adult (>2 yrs), female elk (N=35) were captured on native winter range (non-fed) via helicopter net-gunning. The elk were captured from Spring Creek in Star Valley (N=10), the Upper Green River (N=10), and Hunt Area 99 (N=15) northeast of Farson (Fig 1). Also in January and February 2010, adult, female elk (N=36) were captured on eight different feedgrounds (fed), including: Muddy Creek, Alkali, Dog Creek, Jewett, Grey's River, Finnegan, South Park and Franz (Fig 1). A blood sample was collected from each captured elk for seroprevalence, pregnancy and chemistry analyses. Only one non-fed elk from the January 2010 capture in HA99 capture was seropositive. Other samples taken from each elk included: fecal, hair for stable isotope analysis, and an upper canine tooth for age estimation and stable isotope analysis. An ultrasound was used in the field to determine pregnancy, and all pregnant elk ( $N_{\text{non-fed}}=31$ ,  $N_{\text{fed}}=30$ ) were fitted with a vaginal implant transmitter (VIT) (Telonics Inc., Mesa, Arizona, USA) to determine parturition site location. Captured elk were fitted with a GPS store-on-board collar (3300L Lotek Wireless Inc., Newmarket,



Ontario, Canada) (Fig 2) that will collect one location every hour for 2 years on non-fed elk and one location every 30 minutes for one year for fed elk. Preliminary GPS locations from fed elk collared in 2007 and 2008 can be seen in Figure 3. Additional collars are currently being deployed on fed elk during January – March 2011 and will stay on for one year.

Preliminary stable isotope analysis was initiated in spring of 2010 by taking elk hair from capture samples. The hair was divided into tip, base and underfur subsamples and analyzed at the University of Wyoming Stable Isotope Facility for both  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$ . Analysis on the preliminary hair samples is complete and failed to find distinct  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  isotopic signatures for either sample location (tip vs. base etc.) or elk (fed vs. non-fed). Potential explanations for this result may be small sample size, variation in the length of feedground attendance by individual elk that may not be long enough to register a distinct signature, incorrect assumptions regarding elk hair growth rate and timing, or that the feed is simply not isotopically distinct enough from the native winter range forage to register a distinct signature. An innovative technique using laser ablation and tooth cementum layers on ungulate teeth in general is currently being conducted. If successful at capturing isotopic signatures between layers of cementum the technique will be applied to teeth from captured elk with results anticipated for fall 2011. This analysis will determine whether teeth samples from fed elk can be isotopically distinguished from non-fed elk.

To determine if our hair location sampling was incorrect due to false assumptions regarding timing and rate of hair growth, we initiated a collaborative effort with Dr. Kreeger and his staff at the WGFD Sybille Wildlife Research Center to measure both hair and hoof growth rates using six captive elk. This portion of the project was initiated in December 2010 with the dyeing of a patch of hair on the elk's back with Nyanzol D (see black patch to right) and filing a grooved notch into one digit 10 mm below the coronary corium. These six elk will be brought in through squeeze chutes at the facility once a month for one year in order to determine both annual and seasonal growth rates. Digits will be renotched each month and total digit length will be recorded. To our knowledge this has never been done on elk before. We will then use this knowledge to accurately determine the correct location on hair and hooves to sample for growth that would have occurred while the elk was on a feedground in winter.



Fall elk hunter harvest sample collection was very successful with the collaboration of WGFD staff from the Jackson, Pinedale and Laramie regions. From the Pinedale and Jackson regions, samples were solicited from elk hunters at check stations in all hunt areas containing or adjacent to feedgrounds. Check stations in the Laramie region were prioritized based on what WGFD biologists felt would be good opportunities to sample elk that never feed on agricultural fields (this would help to serve as a base for non-fed elk). Samples from 129 different elk were collected, including one hoof, one tooth and a pinch of hair. Sampling location and isotope analysis will wait until elk hoof and hair growth rate can be determined from the captive elk at Sybille.



The 2010 summer field season was successful, obtaining 66 behavioral observations of fed elk and 43 observations on non-fed elk to detail foraging ecology. Expelled VITs (N=31 non-fed) were retrieved for parturition site identification. Behavioral observations focused on time budgets, with focal scans of collared elk and instantaneous group scans. Between June and late August 2010-2011, field crews visually relocated fed and non-fed elk as many times as logistically feasible. Attempts were made to systematically cycle through the fed and non-fed elk areas, relocating elk that had not previously been observed. Field crews located elk groups containing collared individuals and recorded the following information: time, general weather, geographic location, sex and age classification, habitat type, distance to forest, and dominant behavior (similar to Winnie and Creel 2007). Observations were conducted at all times of the

daylight hours, as observations were extremely difficult to come by and elk were observed doing every behavior at all hours, including feeding in the open in the middle of the day. To avoid influencing elk behavior, observations were made at a distance (0.5-2km) with spotting scopes. One observer conducted a continuous 30-minute focal scan of the collared individual's time budget, while the second observer conducted three instantaneous scan samples of the surrounding group (MacDonald et al. 2000, Martin and Bateson 2007). Time in view and whole group visibility were problematic and there were many instances where

focal scans were not possible or were limited to less than three. Collared elk were the priority, but when there was only one collar in the group, then two additional adult, cow elk were randomly selected for observation. The exception was elk from Muddy Creek and HA99, as groups were located that contained collared individuals representing both fed and non-fed capture sites. It was decided that only collared elk would be used for behavioral observations in these areas as wintering range for un-collared individuals could not be determined. During both focal and scan samples, elk behaviors were categorized as foraging, vigilant, standing, moving, bedded, bedded vigilant, or other (similar to Childress and Lung 2003, Liley and Creel 2007, Winnie and Creel 2007). Initial analysis shows no statistically significant difference between time budgets of fed and non-fed elk, however sample sizes were small and a general trend showed that fed elk (which are presumably in better condition) spent less time



feeding, and more time bedded and vigilant. A second summer field season will be conducted to increase sample sizes.

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***Literature Cited***

- Childress, M. J. and M. A. Lung. 2003. Predation risk, gender and the group size effect: does elk vigilance depend upon the behaviour of conspecifics? *Animal Behaviour* **66**:389-398.
- Liley, S. and S. Creel. 2007. What best explains vigilance in elk: characteristics of prey, predators, or the environment? *Behavioral Ecology* **19**:245-254.
- MacDonald, D.W., P.D. Stewart, P. Stopka, and N. Yamaguchi. 2000. Measuring the dynamics of mammalian societies: an ethologist's guide to ethological methods. Pages 333-388 in L. Boitani and T. K. Fuller (eds). *Research techniques in animal ecology: controversies and consequences*. Columbia University Press, New York, USA.
- Martin, P. and P. Bateson. 2007. *Measuring Behaviour*. 3<sup>rd</sup> edn. Cambridge University Press, Cambridge.
- Winnie, J. and S. Creel. 2007. Sex-specific behavioral responses of elk to spatial and temporal variation in the threat of wolf predation. *Animal Behaviour* **73**:215-225.

Figure 1: General study area in Sublette and Lincoln counties. Feedgrounds where fed elk were captured are denoted with yellow stars and native winter range capture locations are denoted by blue circles (Spring Creek, Riley Ridge, Hunt Area 99, Upper Green).

## Study Area: Fed vs Non-Fed Elk

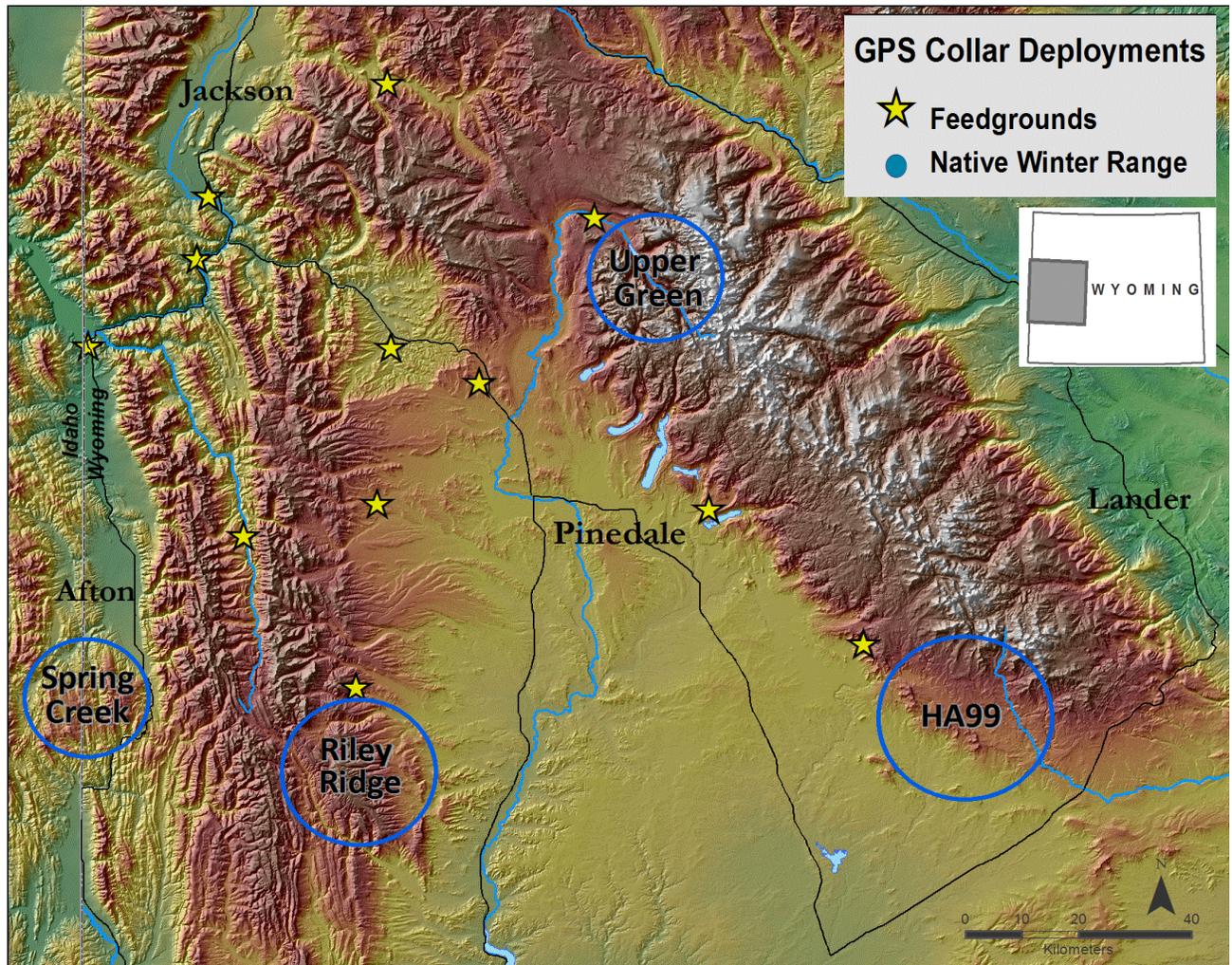


Figure 2: January 2010 capture of 35 adult, female, elk on native winter range represent the non-fed component of this study.



Figure 3: Locations from GPS collars deployed on feedground elk by WGFD in 2007 and 2008.

