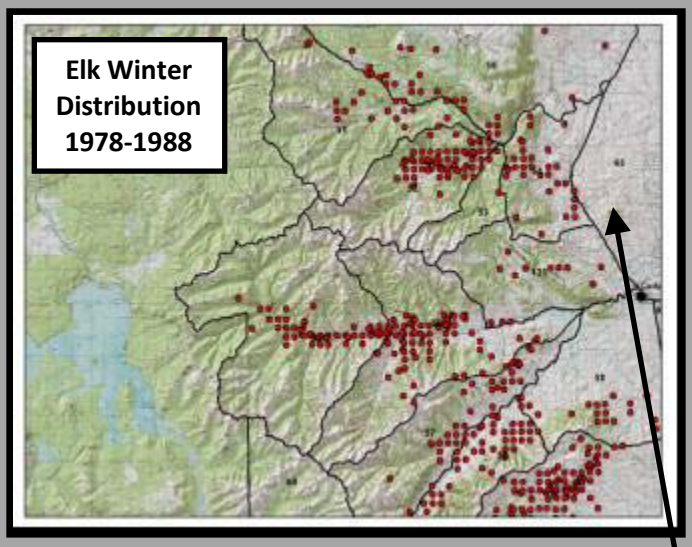
Absaroka Elk Ecology Project

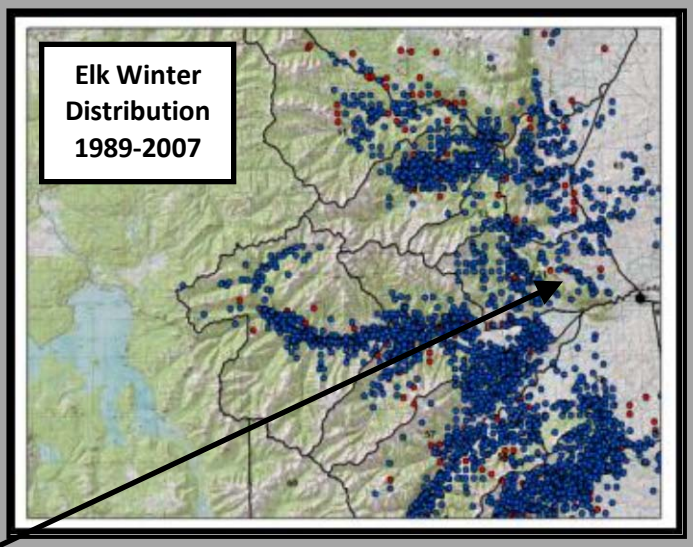
2010 Progress Update

Introduction

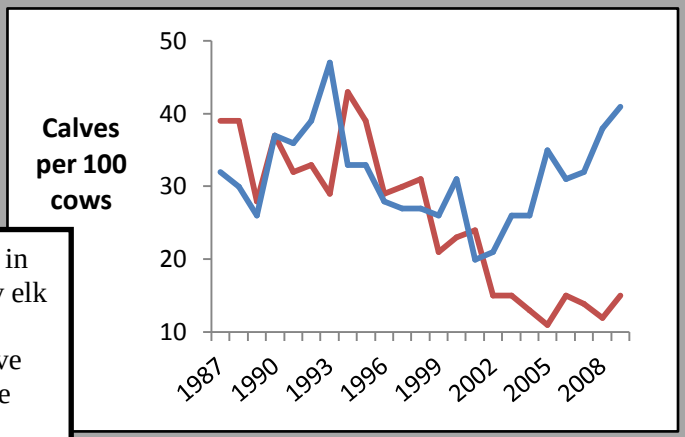
The Wyoming Game and Fish Department, the University of Wyoming, and the US Fish and Wildlife Service have been collaborating on the Absaroka Elk Ecology Project since January 2007. The original objectives were to:

- *Determine the status of migratory and non-migratory elk in the Clark's Fork Herd Unit.*
- *Determine the migration timing and routes used by migratory elk.*
- *Increase understanding of elk use of private lands.*
- *Estimate adult female survival rates.*
- *Develop habitat selection models to determine critical habitats for migratory and non-migratory elk.*
- *Evaluate the influence of wolves on elk habitat selection and movements.*

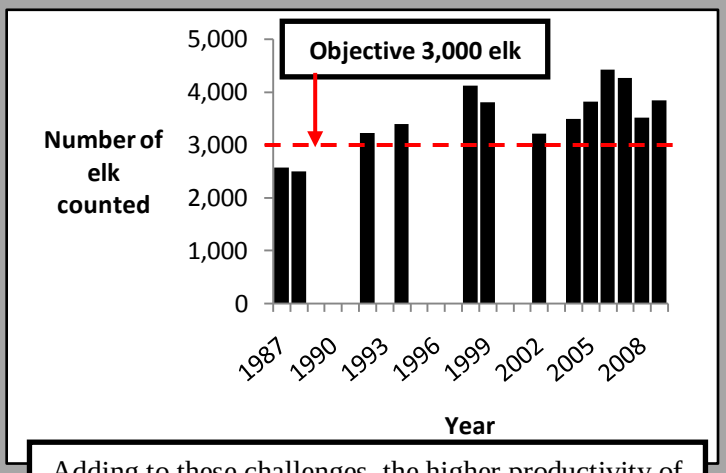




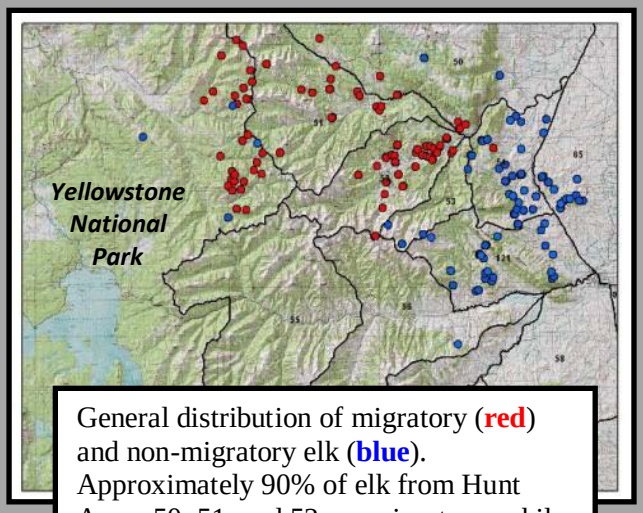
Over the past 20 years, a dramatic shift in elk distribution has occurred along the Absaroka Front, with more elk frequenting low-elevation areas in the foothills. Most of these areas are on private land.



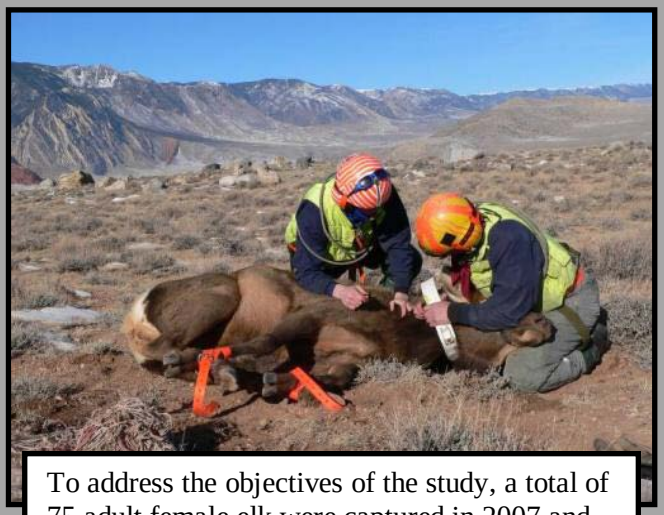
This distribution shift is largely attributable to a growing gap in the calf production of the two subpopulations, with migratory elk (red) producing fewer calves than nonmigratory elk (blue) in recent years. These trends in distribution and productivity have raised numerous challenges for biologists and managers in the Wyoming Game and Fish Department.



Adding to these challenges, the higher productivity of non-migratory elk in recent years has obscured the migratory decline and allowed the Clark's Fork herd to grow beyond the population objective of 3,000 elk.

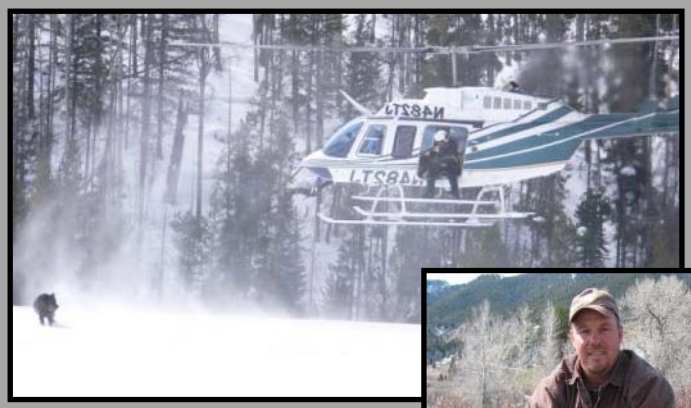


General distribution of migratory (**red**) and non-migratory elk (**blue**). Approximately 90% of elk from Hunt Areas 50, 51, and 52 are migratory, while 90% of the elk captured in Hunt Areas 54, 65, and 121 are non-migratory.

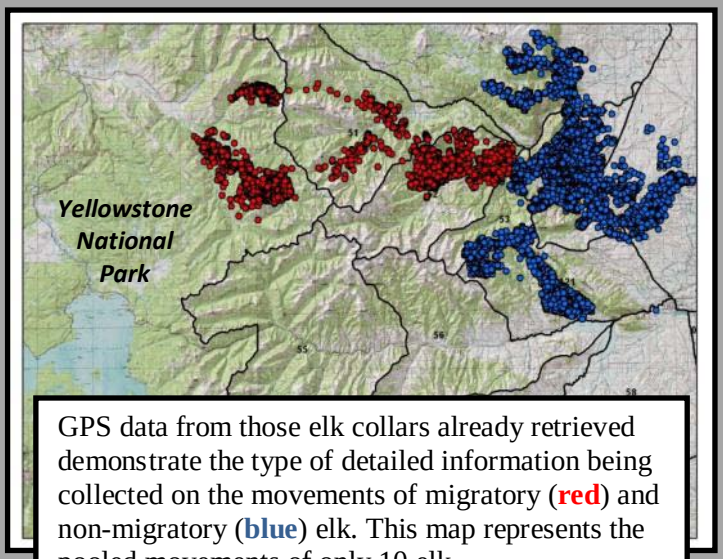


To address the objectives of the study, a total of 75 adult female elk were captured in 2007 and 2008 and fitted with GPS radio collars. An additional 20 adult females were captured and fitted with conventional VHF radio-collars.

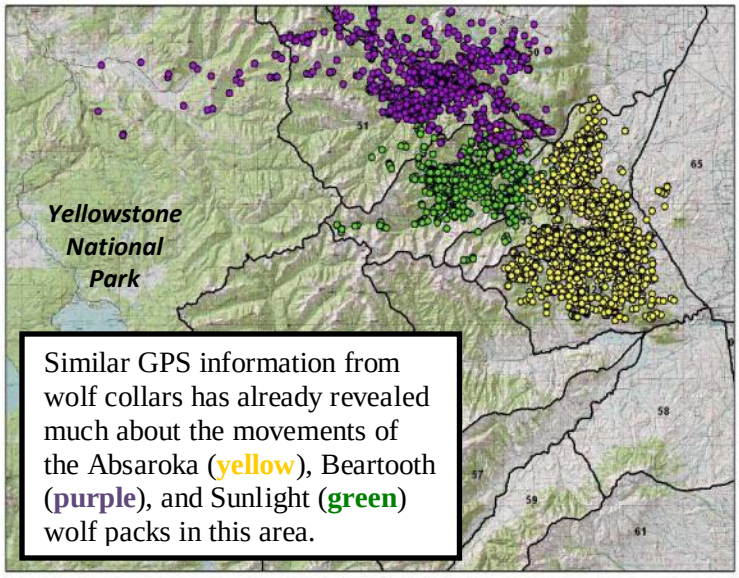
Numerous mortalities of collared elk cows have been documented thus far. Preliminary findings suggest that factors affecting reproduction and calf survival, rather than adult female survival, will be the key to understanding recent changes in the Clarks Fork herd.



A number of wolves in packs that hunt Clarks Fork elk have been captured by USFWS, USDA Wildlife Services, and UW and fitted with GPS collars for simultaneous monitoring of elk and wolves.



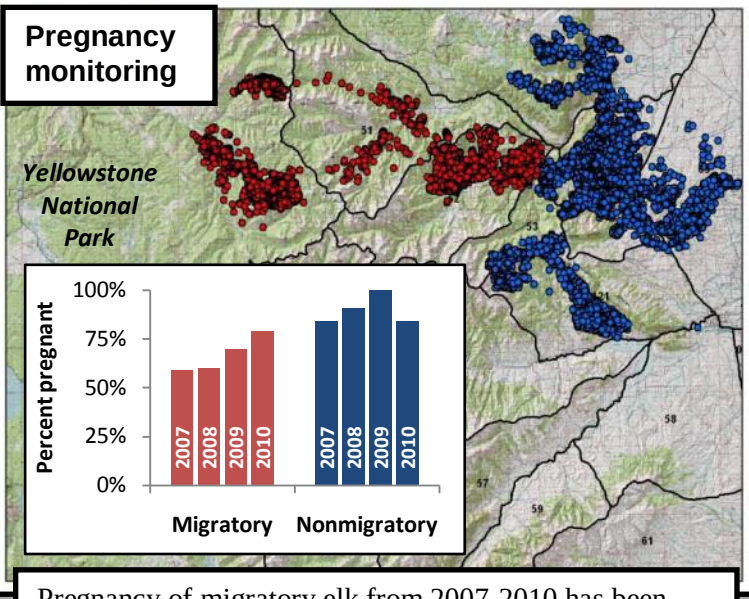
GPS data from those elk collars already retrieved demonstrate the type of detailed information being collected on the movements of migratory (**red**) and non-migratory (**blue**) elk. This map represents the pooled movements of only 10 elk.



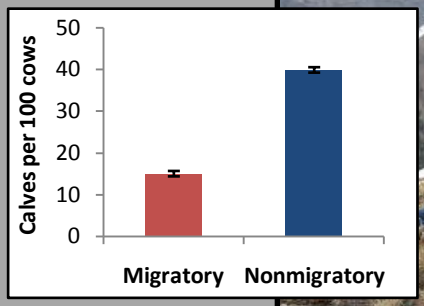
Similar GPS information from wolf collars has already revealed much about the movements of the Absaroka (**yellow**), Beartooth (**purple**), and Sunlight (**green**) wolf packs in this area.

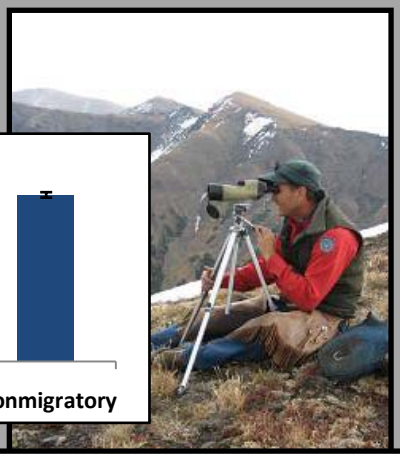
Hunter checks and blood and tooth samples from hunter-harvested elk give data on age, pregnancy status, lactation status, and body condition. Information from hunter-killed elk is an important contribution to this study.

Pregnancy monitoring



Pregnancy of migratory elk from 2007-2010 has been consistently lower than that of non-migratory elk. This pregnancy difference accounts for some of the difference in calf-cow ratios between the two herd segments.



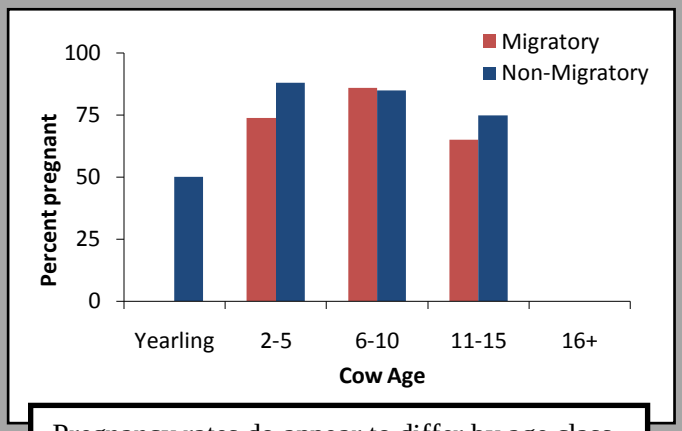


Classifications of elk at summer's end indicate that most of the annual decline in migratory recruitment occurs due to factors affecting cow pregnancy and summertime calf survival. Calf-cow ratios of migratory elk were between 14:100 and 16:100 from 2007-2009, versus non-migratory elk calf-cow ratios between 38:100 and 41:100 during that same period.

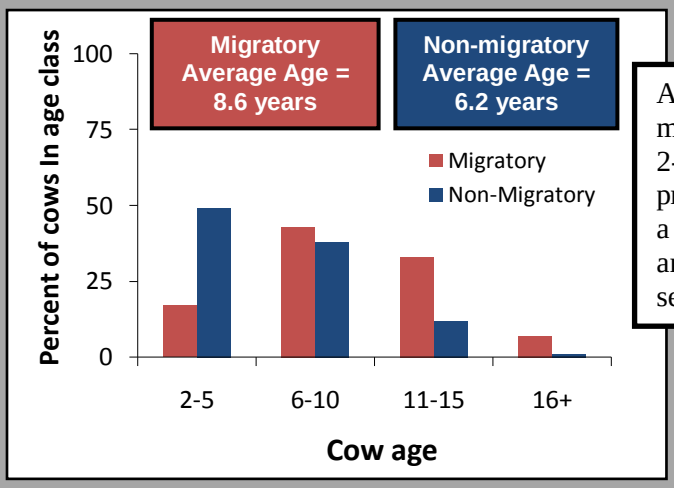
Whereas Rocky Mountain elk are typically pregnant at a rate of 90%, Clarks Fork migrants have an exceptionally low pregnancy rate of 68%. But why? To address this question, **additional project objectives** were developed and include evaluation of how pregnancy is influenced by:

- *Bull availability during the breeding season.*
- *Female age structure.*
- *Elk habitat selection.*
- *Elk body condition.*
- *Summer forage conditions.*
- *Wolf predation risk.*

End-of-summer classifications have also revealed that migratory adult bull-cow ratios (21:100) are not low enough to affect pregnancy rates. Yearling bull-cow ratios, however, are quite low (3:100) as a result of poor calf production (versus a non-migratory yearling ratio of 11:100). In spring 2009, the Sunlight-Crandall Elk Working Group relied on this and other information to recommend harvest management changes before the Wyoming Game and Fish Commission.

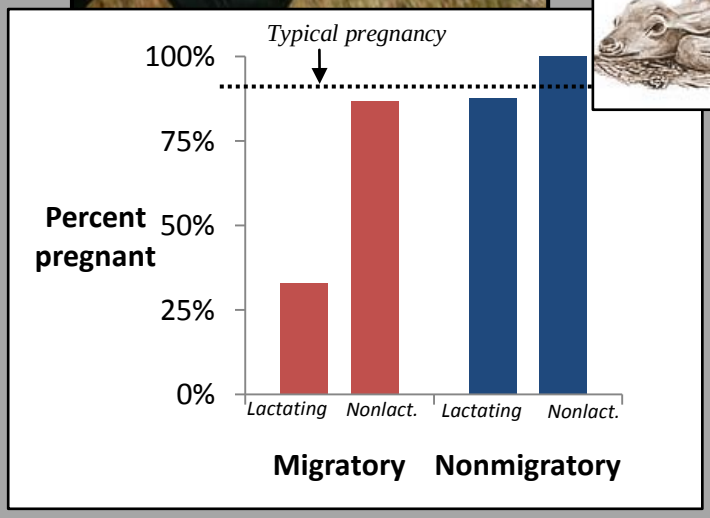


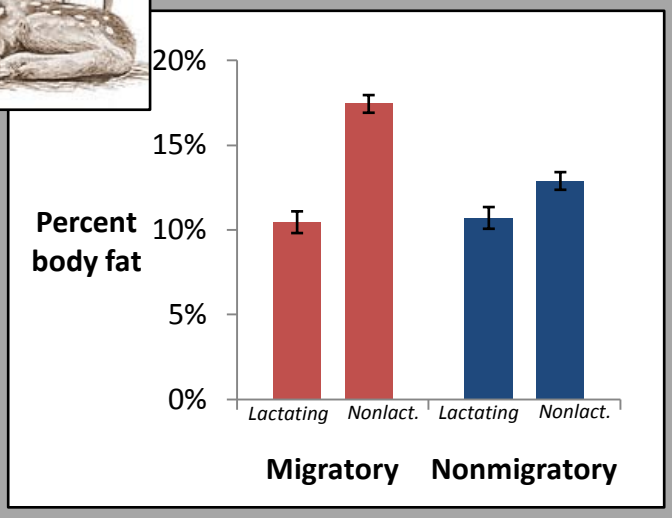
Pregnancy rates do appear to differ by age class for migratory versus non-migratory elk. Though pregnancy rates are similar for cows between 6 and 10 years old, non-migratory elk show higher pregnancy in the younger and older age classes. Higher pregnancy for younger cows suggests better nutrition for non-migratory elk, while lower pregnancy for older cows might indicate earlier reproductive senescence in migratory elk.



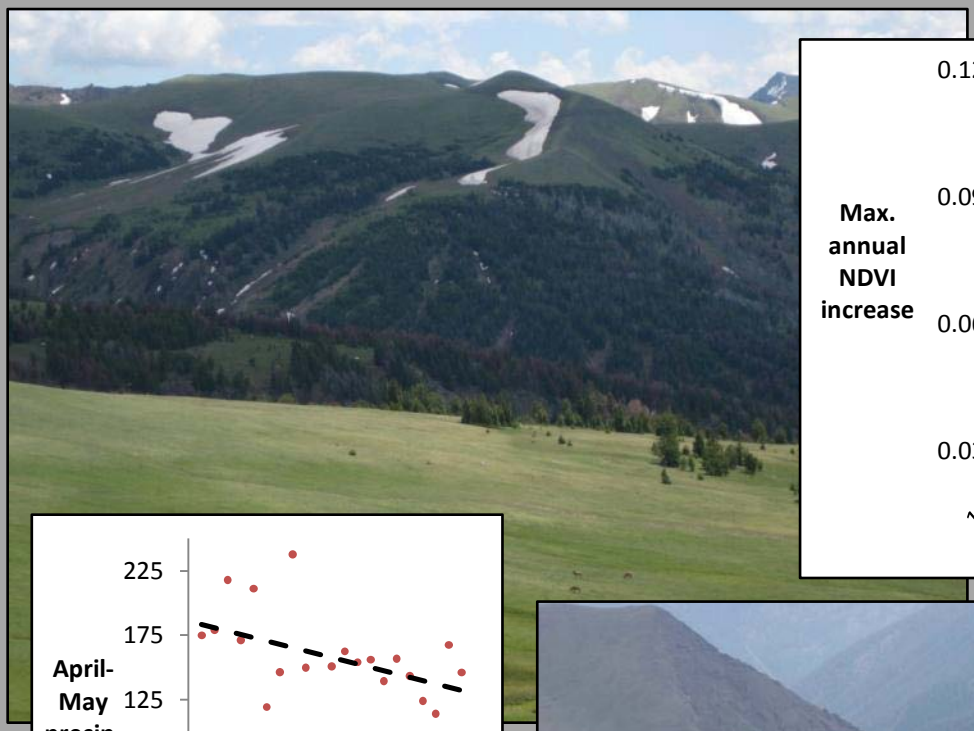
Age data from captured and hunter-killed cow elk show that non-migratory elk are younger, with a higher proportion of cows in the 2-5 year age class than migratory elk. There are similar proportions of cows in the 6-10 year class, and migratory elk have a much higher proportion of cows older than 11 years. Future analyses will explore the potential role of age and reproductive senescence in limiting the pregnancy rates of migratory elk.

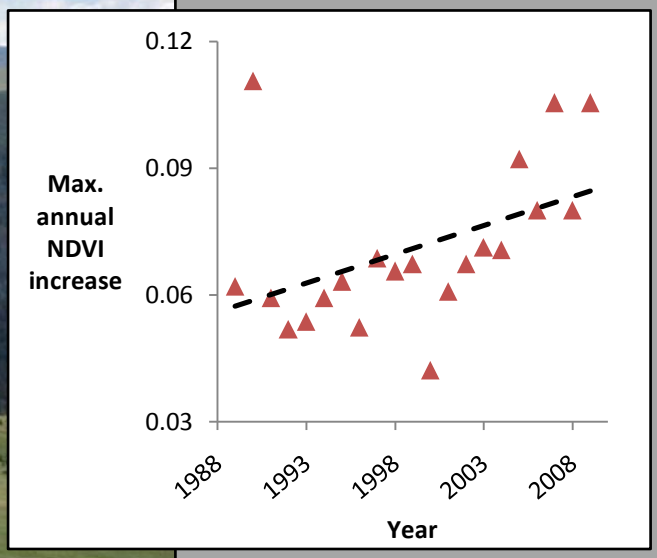
In many ungulates, including elk, pregnancy is most commonly influenced by the nutritional quality of summer range. To investigate the role of nutrition, we recaptured collared Clarks Fork elk at two critical times of the year – in late summer, after the annual period of fat gain, and in late winter, after the period of fat loss. On this dimension of the project, we have been collaborating with elk nutrition experts John and Rachel Cook. The Cooks have developed methods to directly and rapidly assess elk nutritional condition in the field using a combination of ultrasound, manual palpation, and key body measurements. They developed their approach using captive elk, and have proven them in studies of free-ranging elk and caribou throughout North America. In addition to estimating percent body fat of collared elk at both times of the year, the Cooks have also been determining whether cows are pregnant in winter and nursing a calf in summer.

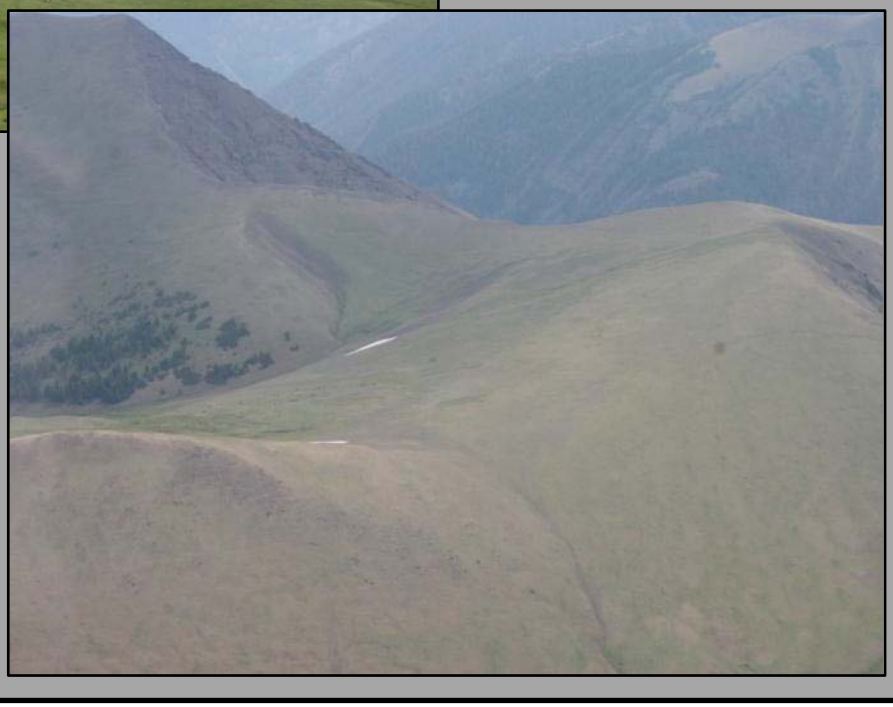


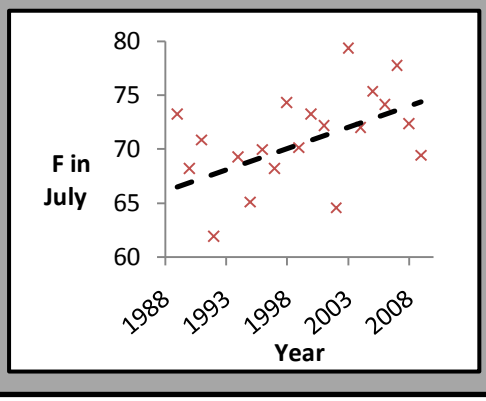


From the elk recaptures, we learned that only 33% of lactating migratory females in the Clarks Fork herd were pregnant the following winter, compared with more typical pregnancy rates for migratory nonlactators and for non-migratory elk (above left). These findings help to explain the annual depression in migratory elk pregnancy, indicating that migratory females who pay the high costs of nursing a calf are likely to skip breeding in the following year. Indeed, lactation is a costly undertaking: migratory females that nursed a calf to September had ~7% less body fat than females who did not (above right). What remains unclear is how females in the non-migratory herd segment are able to become pregnant again *regardless* of whether they nursed a calf in the prior year. It is possible that non-migratory elk gain a well-timed nutritional subsidy from irrigated fields on private lands along the Absaroka Front (below), allowing them to maintain steadier nutrition than migratory cows immediately prior to the rut, despite relatively low body fat. Future analyses of elk movements and nutrition will evaluate this possibility.



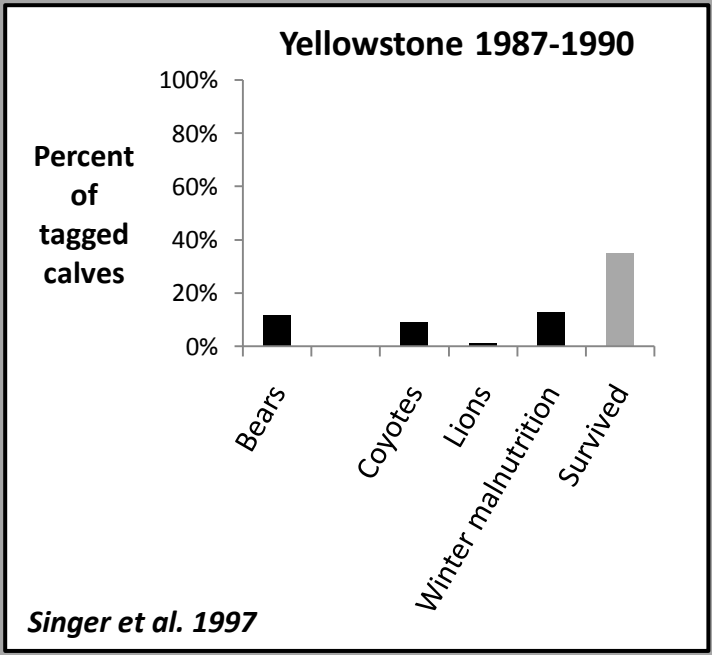




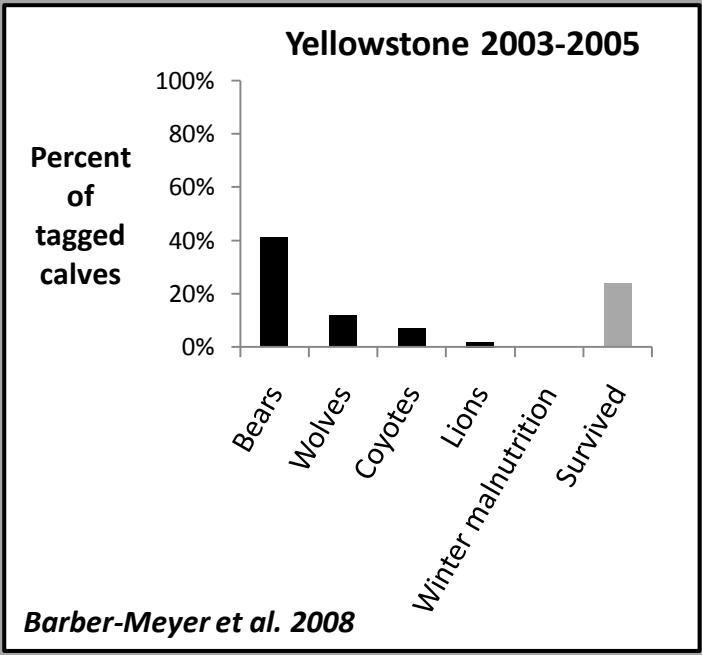


What would cause migratory elk to skip reproductive years? To address this question, we evaluated habitat conditions from 1989-2009 using greenness metrics taken by satellite (Normalized Differential Vegetation Index, or NDVI). Whereas we documented no significant changes in annual greenness patterns on the year-round range of non-migratory elk, we documented an increasingly rapid and compressed green-up (top right) on migratory elk summer range. The green period is the time during which elk can most readily gain fat to support nursing and breeding; therefore, a long-term shortening of this period is likely to compromise migratory females' ability to recover the costs of lactation, and helps explain their alternate-year reproduction. We have further learned that these changing greenness patterns are well-explained by a reduction in spring precipitation and snowpack and increasing spring and summer temperatures, particularly in July (above left). In general, the Yellowstone area has experienced a severe drought in the past decade, and it appears to have influenced high-elevation areas disproportionately. For example, the photograph at right was taken along the Yellowstone Park boundary on migratory elk summer range on July 23, 2007, in a harsh drought year. It suggests that a substantial amount of browning had already occurred by that time.

Although habitat changes help account for an unusual reduction in the pregnancy among migratory elk, a large amount of summertime calf loss remains to be explained. While we have not studied predation directly as part of the Absaroka Elk Project, we are fortunate that researchers in Yellowstone Park have twice studied elk calf mortality and survival by tagging and monitoring a large number of elk calves – once from 1987-1990 and once from 2003-2005. Both studies were conducted at sites within 5-50 km of migratory Clarks Fork elk summer range. In both study periods, bears were the leading cause of predation mortality for elk calves. However, in the more recent study period (below right), bears caused a higher proportion of calf mortality that they did previously (below left). Additionally, by the second study period, wolves had been re-introduced and became the second leading cause of calf mortality. The large increase in bear predation between these study periods appears to be consistent with monitoring that shows growth in grizzly bear numbers over recent decades. If the rates of predation indicated by the recent Yellowstone study are applicable to migratory Clarks Fork elk summering at nearby sites in the Park, they can account for the post-calving summertime decline to 15 calves per 100 cows that we have documented in recent years (p. 3).

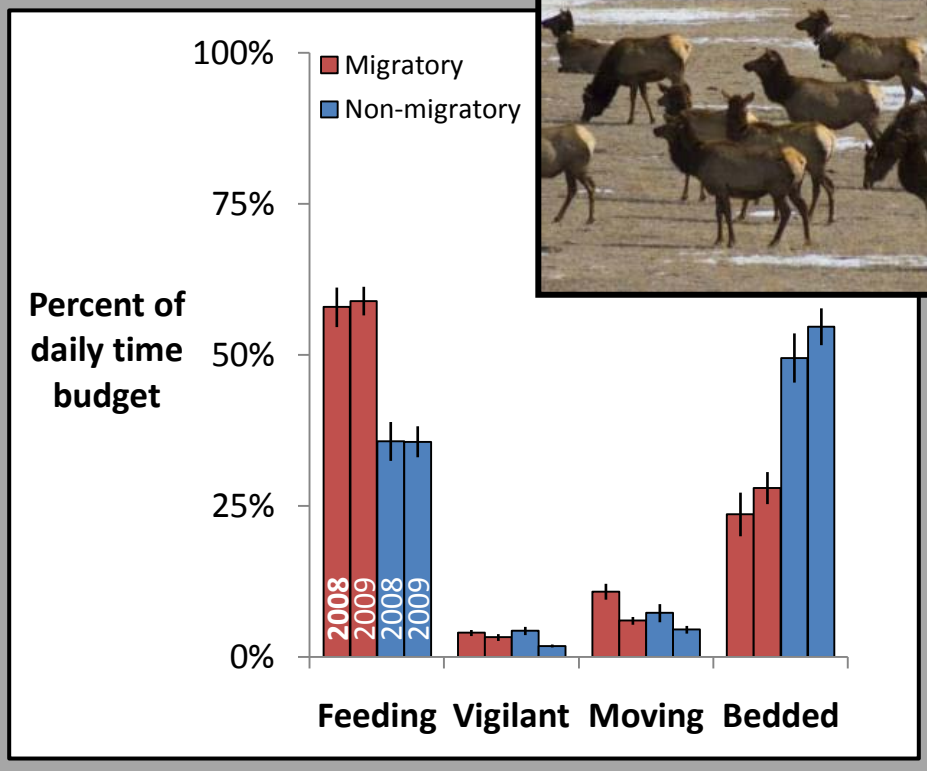


Singer et al. 1997



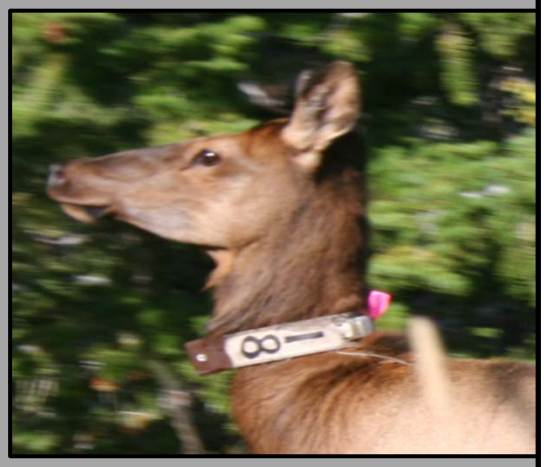
Barber-Meyer et al. 2008

Several studies indicate that poor nutrition of elk cows, such as that we have seen among migratory Clarks Fork elk, can lead to lower calf birth weights and slower calf growth rates. This can in turn increase calves' vulnerability to predators like bears and wolves. Two regional calf survival studies have highlighted the influence of birth weight on calves' probability of survival – including the 1987-1990 Yellowstone Park study – but this factor was not found to be significant in the more recent Yellowstone study.



Much is yet to be learned on this project; we will conduct several more in-depth analyses in the coming two years. For example, field crews have been gathering information on the time budgets of collared elk cows from early January to late March each winter. This information will be used to investigate how and to what extent the risk of wolf predation influences elk behavior. Coupled with our monitoring of body fat and reproductive status (pp. 3-4), this information will help us determine whether wolves influence the nutrition and reproduction of elk – a subject warranting further study in this region. At a glance, during winters 2008 and 2009, migratory elk spent a greater proportion of time feeding but little or no additional time vigilant, despite facing higher wolf risk than non-migratory elk. Additional observations were made during winter 2010, and we will also address these questions for summertime, particularly for lactating versus nonlactating females.

In addition to the information we have gathered on large-scale, long-term habitat changes, collaborators Dan Tinker and Sara Beaver in UW's Department of Botany been conducting a finer-scale, two-year comparative study of plant composition and nutrition on migratory versus non-migratory elk ranges. This information will help us better understand relationships between elk habitat selection, nutrition, and reproduction, and the potential influence of wolves and climate upon them.



Lastly, we are very pleased to report that all our Telonics elk GPS collars dropped off, on schedule, at 6 a.m. on April 1, 2010! Most of these collars have now been successfully retrieved. They hold detailed movement information that is critical to much of our upcoming work. In the coming years, we will conduct our analyses using ~400,000 elk and ~60,000 simultaneous wolf locations, helping this project shed new light on the complicated relationships between elk, their habitat, and wolves – with the ultimate goal of improving elk population and habitat management in the Absaroka Mountains of Wyoming.

THANKS FOR ONGOING SUPPORT FROM MANY COOPERATORS AND CONTRIBUTORS!

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USDA Wildlife Services
National Park Service
Bureau of Land Management
US Forest Service

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Bowhunters of Wyoming
Cody Country Outfitter & Guides Association
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