An example of an improved road through the Fortification Creek Area. Roads are constructed and improved to facilitate increased vehicle traffic associated with energy extraction.

A spike bull elk using a copse of large junipers for cover. Juniper communities form about 10 percent of the FCA, which is dominated by Wyoming big sagebrush and grass.

Focus area research indicates elk response to energy development

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The intersection of natural gas development and elk conservation in Wyoming provides an exceptional opportunity to investigate the impacts of energy development on wildlife.

One of the main objectives of our research was to evaluate whether elk habitat selection shifted after development began in the Fortification Creek Area in northeastern Wyoming in the early 2000s.

Our research suggests development in the FCA has affected elk patterns and body condition. Through our findings, we provide suggestions to reduce the impacts and promote body condition.

Energy production is Wyoming's leading industry, and, within the U.S., is second only to Texas in total energy produced by a state. Wyoming's rich energy reserves and the fact that global energy demand is predicted to increase 56 percent by 2040 (EIA 2013) suggests Wyoming will continue to play a critical role in energy production.

Wyoming is also home to large wildlife populations, which are of great intrinsic and economic value to Wyoming residents and the large numbers of tourists attracted each year to the state's wide-open spaces.

Energy-Habitat Overlap

The distribution of energy resources in Wyoming overlaps habitat used by many wildlife populations, which raises questions about the ability of wildlife to cope with increasing impacts from energy development across shared landscapes.

Understanding how energy development influences natural resources and the economies of Wyoming and the surrounding region are focal areas of research in the College of Agriculture and Natural Resources. By improving understanding of how energy extraction affects wildlife populations, we can better inform energy extraction activities to more effectively conserve wildlife populations.

Our study was a collaborative effort with the Bureau of Land Management, energy industry companies, University of Wyoming, and the Wyoming Game and Fish Department (WGFD). We focused on the approximate 300-square mile FCA (Figure 1 page 35). Cattle ranching was the dominant land use in the FCA prior to natural gas development (primarily coal bed natural gas).

As part of the Powder River Basin, the area has seen a rapid expansion of human activity since 2000 associated with natural gas extraction including road construction, well drilling, and maintenance work.

This increased activity may be changing the availability of resources for wildlife species in the area. The FCA is home to a resident elk herd, which is one of the most highly sought-after herd units from which to draw an elk hunting license in the state and underscores the value of these elk to Wyoming citizens.

A typical natural gas drill set up for the Fortification Creek Area. These three rigs were active in late fall 2009 during a brief snow storm.

Telemetry Feeds Data

To identify environmental (e.g., vegetation cover types, topography, and distance to water) and anthropogenic (e.g., distance to roads and well pads) attributes that influencing elk landscape use, we used telemetry to obtain more than 130,000 locations from elk before (1992-1995, n = 17 elk) and during (2008-2011, n = 59 elk) energy development.

We used our elk location and habitat data to develop models identifying the most important habitat characteristics for FCA elk. In addition, we assessed elk population performance in the FCA including pregnancy and body condition from data collected during development as well as long-term demographic data collected by the WGFD.

Our research indicates development of natural gas was affecting elk in the FCA through avoidance of roads associated with natural gas development. Comparisons of high-use elk habitat before and during development identified shifts in habitat use distribution of 43 percent in summer and 50 percent in winter (Figure 2). This distributional shift was a result of indirect loss of habitat, whereby the habitat was not physically removed, but rather elk avoided the area because of proximity to development activity.

Similar avoidance behavior has been documented for other species, including mule deer (Sawyer et al., 2006) and greater sage-grouse (Kirol 2012) suggesting changes in wildlife distributions are probable following expanding energy development.

Different Habitat at Night

During development, elk in the FCA were also using habitat differently at night than during the day. These elk used areas with less-rugged terrain and closer to roads at night, suggesting elk were moving closer to roads during the time of day when there was less development activity. The ability to use different habitat at night versus day may allow elk to access forage or other resources that would otherwise be unavailable due to elk avoidance of energy development during daylight hours; however, this offset of habitat availability likely does not mitigate the overall impacts of

Female elk in the Fortification Creek Area, one of which is wearing a GPS collar.

population distributional shifts.

A secondary objective of our study was to evaluate whether energy development has affected population performance for elk in the FCA. In the face of development, calf elk recruitment in the FCA has been consistently productive with approximately 47 calves per 100 adult female elk; however, this trend may change as the rate of pregnancy, although still high, declines. Herd estimates have been consistent, if not slightly increasing, over the last 10 years.

Our assessment of elk body condition, measured through heart and kidney fat deposition from hunter-harvested animals, indicates some decline in body condition where fat content was significantly lower than for a reference elk population in the same region of Wyoming.

Declines in pregnancy and body condition may signal consequences of observed behavioral and distribution shifts.

Hunting Effects

We also developed a population simulation model that suggests regulated hunting in October is the limiting factor for FCA elk population growth. This means that elk numbers during early stages of development (2000–2011) were likely controlled or limited through hunting and not through the effects of energy development.

Our study includes data from different time periods (i.e., before and during natural gas development) but does not necessarily span the lifetime of an elk. As a result, we may be missing some ability to detect long-term impacts of development on this wildlife population. However, continued monitoring of elk in the FCA in conjunction with energy development provides an opportunity to address these questions at a time scale relevant to elk life spans.

Additional Research Possible

Measuring the impact of density dependence will also be interesting, because future development may push elk into more restricted habitat within the FCA; this could elicit increased behavioral and population changes resulting in use of areas closer to development or possibly overgrazing and depletion of forage in areas farther from development.

To reduce impacts and promote healthy elk populations, we suggest maintaining large, undeveloped areas within the footprint of energy developments so elk may obtain sufficient forage while avoiding development.

In addition, implementing practices during energy development such as directional drilling, telemetered well monitoring, and piping of energy products (Sawyer et al., 2009) are promising because they reduce costs for energy producers while reducing the impacts of energy development on elk.

Using a wider lens, elk are robust animals. Documenting impacts on these large, mobile animals may suggest greater impacts on more sensitive and/or species that do not freely move. Continued energy development will necessitate efforts from diverse stakeholders to conserve wildlife populations across Wyoming.

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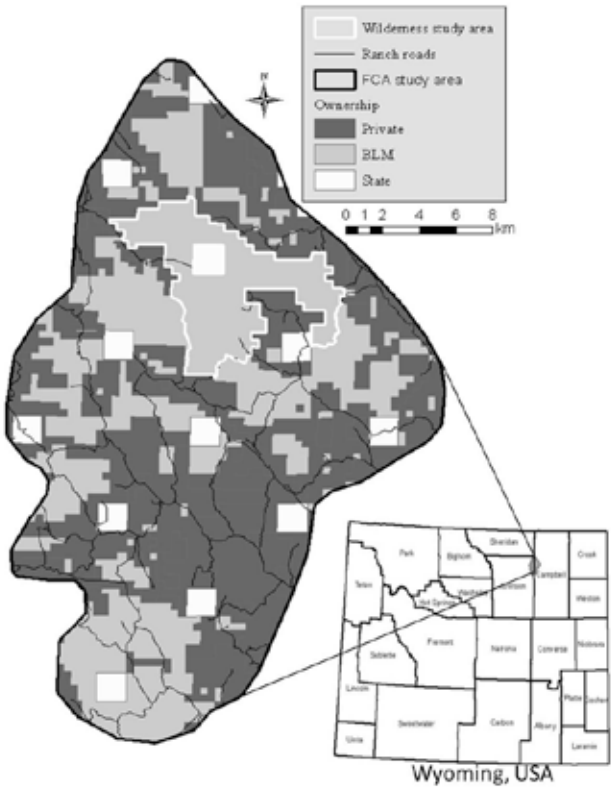

Figure 1. The Fortification Creek Area (FCA) encompasses approximately 300 square miles in northeastern Wyoming. Land ownership within the FCA is approximately 50 percent private and 50 percent public.

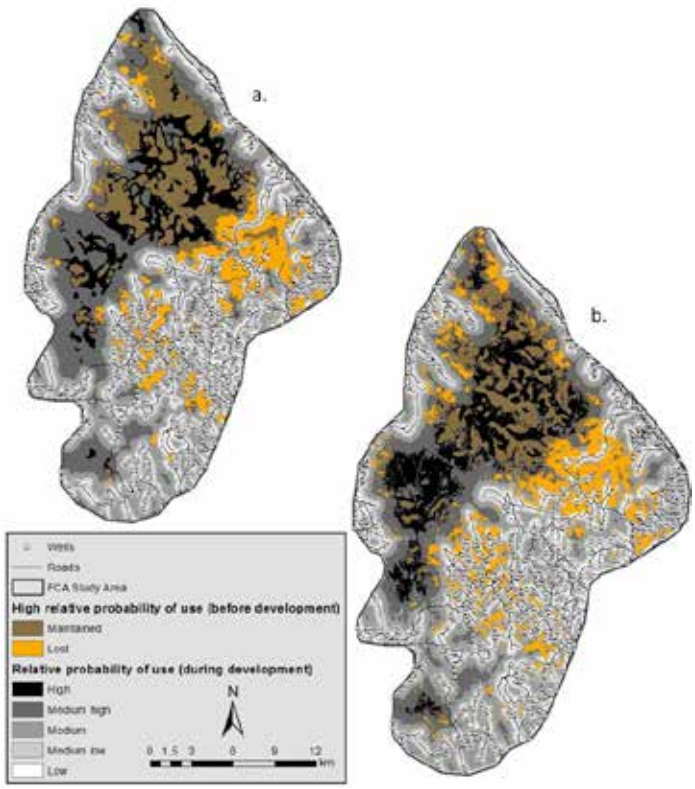

Figure 2. Population-level model and categories of elk use in summer (a) and winter (b) during coal bed natural gas development overlain with areas identified as high relative probability of use before development within the Fortification Creek Area of northeastern Wyoming. Loss of habitat previously identified as high use was approximately 43 percent in summer (a) and 50 percent in winter (b).

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