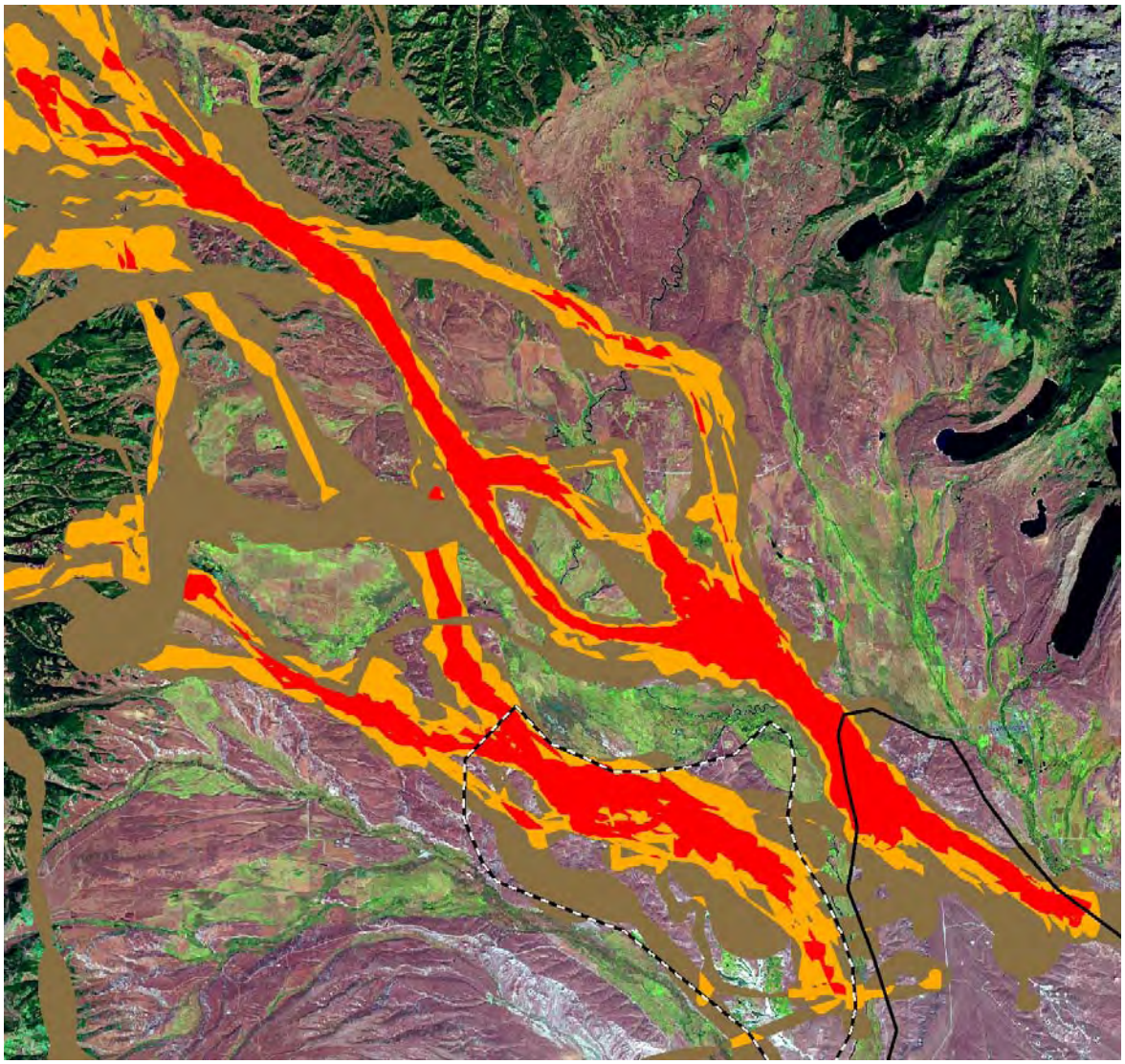
Mule deer migration routes to and from the Mesa and Ryegrass winter ranges: 2010



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Introduction

The Mesa and Ryegrass winter ranges in western Wyoming provide crucial winter habitat to approximately 5,000 mule deer (Fig. 1). More than 95% of these deer are migratory and travel 40-100 miles to summer in portions of four different mountain ranges, including the Gros Ventre Range, Wyoming Range, Snake River Range, and Salt River Range (Sawyer et al. 2005). Accordingly, land-use decisions made on or near these winter ranges and migration routes have the potential to affect a much larger region. The Mesa is located in the Pinedale Anticline Project Area (PAPA) – an area that contains one of the largest natural gas reserves in North America and has been among the most productive gas fields in Wyoming since 2000. As gas field development in the region continues to expand (Bureau of Land Management [BLM] 2000, 2008), it has become increasingly important to determine where migration routes of mule deer occur, particularly in and adjacent to large gas fields such as the PAPA. The goal of this project was to identify major migration routes and critical stopover areas (i.e., foraging & resting areas) used by mule deer in and adjacent to the PAPA, such that agencies, industry, and non-government organizations have the best available information to develop energy resources and ensure continued migration of mule deer. Recent declines in mule deer numbers on the Mesa (Sawyer and Nielson 2010) have prompted several off-site mitigation efforts. Accurate maps of migration routes and stopover habitat provided here may help identify or prioritize areas for off-site mitigation (e.g., habitat treatment, fencing modification, conservation easement, etc.). This report is a follow-up to Sawyer and Kauffman (2009), but has been updated with the latest mule deer data collected through spring 2010.

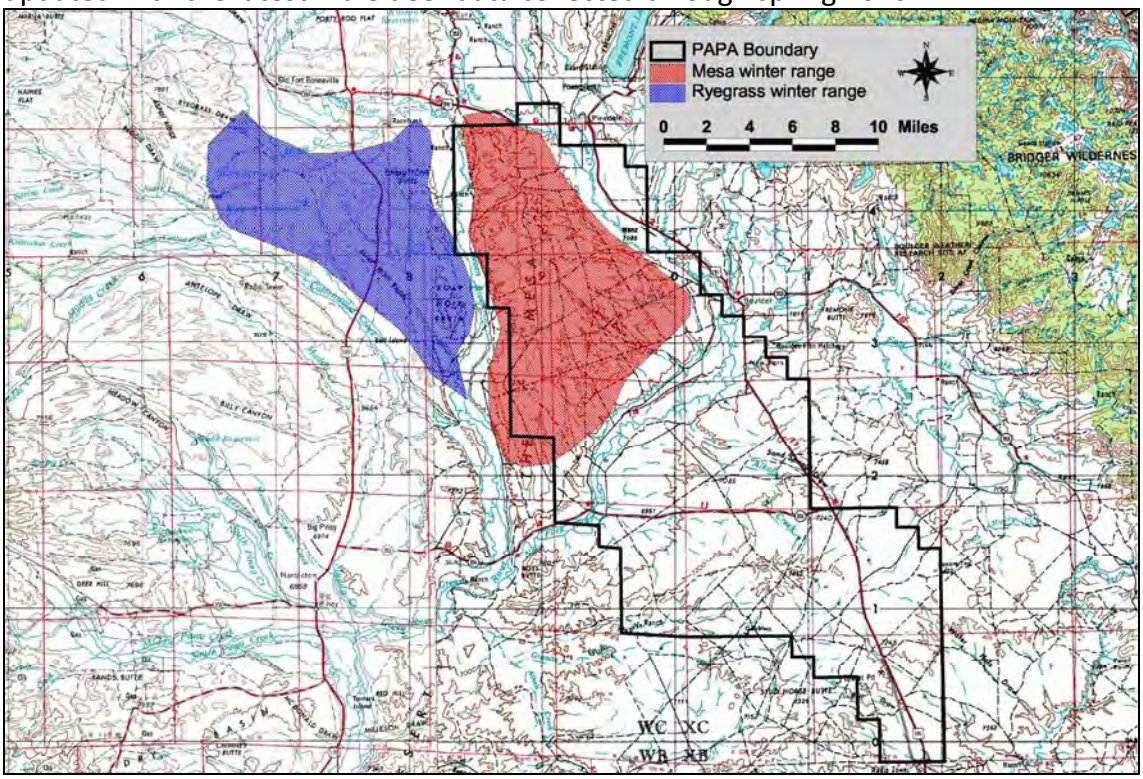

Figure 1. Location of Mesa and Ryegrass winter ranges relative to the Pinedale Anticline Project Area (PAPA) in western Wyoming.

Methods

Until recently, the standard approach to delineating migration routes was to equip animals with global positioning system (GPS) collars and simply connect-the-dots between consecutive GPS locations (Fig. 2). This approach has been useful for identifying the timing and general location of migration routes (e.g., Sawyer et al. 2005, Berger et al. 2006, White et al. 2007). However, a major shortcoming of this approach is that it produces a line that has no area associated with it (i.e., is the route 10 feet wide or a mile wide?), which makes it difficult to consider in land-use plans or on-the-ground management (Sawyer et al. 2009). A second shortcoming is there is no means to combine routes of individual animals to assess migration at the population-level. Typically, managers are interested in the migration routes of a population, rather than a few individuals. To account for these two shortcomings, we used a new method of estimating migration routes, referred to as the Brownian bridge movement model (BBMM; Horne et al. 2007). The BBMM estimates the probability of use, or a utilization distribution (UD), along a migration route. The UDs from individual animals can be combined to estimate a population-level migration route (Sawyer et al. 2009). This approach allows route segments used as stopover sites (i.e., foraging and resting habitat) to be discerned from those used primarily for movement (Fig. 3; Sawyer et al. 2009). And, if routes do not receive equal levels of use, those used by the largest proportion of the population can be identified.

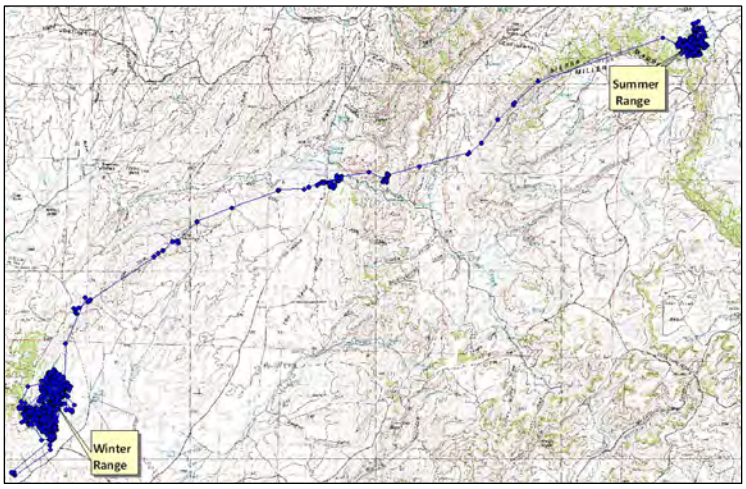

Figure 2. Example of connecting-the-dots to depict a migration route.

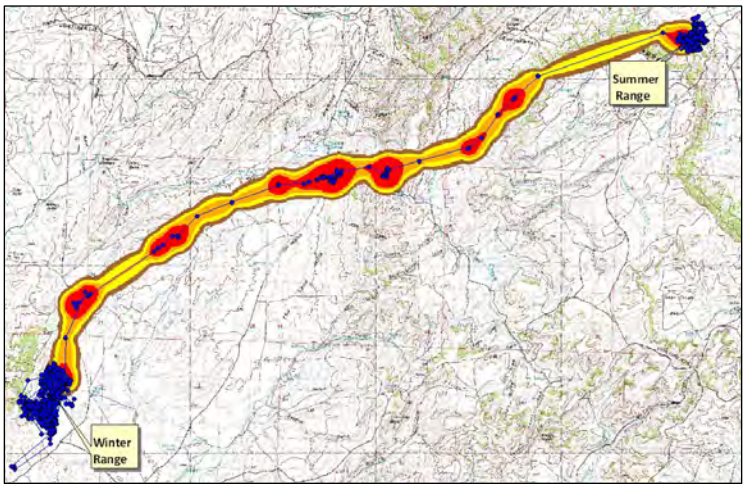

Figure 3. Example of estimating a migration route with a BBMM. Stopover sites (red) can be distinguished from movement corridors (orange and yellow).

We used GPS radio-collars to collect migratory movement data from 26 mule deer that wintered on the Mesa and 16 from the Ryegrass. Locations were collected at 2- or 3- hr intervals and GPS success was 99%. We followed the methods outlined by Sawyer et al. (2009) where: 1) the BBMM (Horne et al. 2007) was used to estimate migration routes of individual deer, 2) individual routes were then combined to estimate a population-level migration route, 3) segments within the population-level route were delineated as stopover sites or movement corridors, and 4) route segments were delineated as high, medium, or low-use based on the proportion of the sampled deer that used them. Because mule deer demonstrate a high fidelity to their migration routes across seasons and years (Sawyer et al. 2009), we estimated population-level migration routes for both the Mesa and Ryegrass winter ranges. Mule deer that migrated west off the Mesa were included in the Ryegrass migration route. Assuming a representative sample of mule deer was collared, the estimated migration routes should reflect migratory patterns of the larger wintering population(s).

Results

We calculated a population-level migration route for a sample of mule deer from the Mesa and Ryegrass winter ranges (Fig. 4 & 5). The Mesa migration route included 22 fall and 10 spring migrations, collected from 26 mule deer between 2003 and 2010. The Ryegrass migration route included 11 fall and 12 spring migrations, collected from 16 mule deer between 2005 and 2010. The population-level migration routes were characterized by a series of stopover sites where deer spent most of their time, connected by movement corridors through which deer moved quickly (Figs. 4 & 5). As mule deer moved further from winter ranges (north and west), common migration routes splintered into multiple routes, where stopover sites became smaller.

Route segments within the population-level route did not receive equal levels of use; rather, some were used by a larger proportion of the population than others (Figs. 6 & 7). For the Mesa migration, the route used by the most deer went through Trapper's Point, west across Cora Butte and US 191, crossed the Green River, then north across Webb Draw and Beaver Rim to the south Hoback Rim, and ended in Noble Basin before splintering into multiple routes. For the Ryegrass migration, there were two high-use routes (Fig.7). Both started near Grindstone Draw and moved west into the Ryegrass. At Aspen Ridge, the two high-use routes split, with one continuing westerly to Merna Butte and the other continuing north to Noble Basin. Interestingly, the north route to Noble Basin follows the same high-use route used by the Mesa deer.

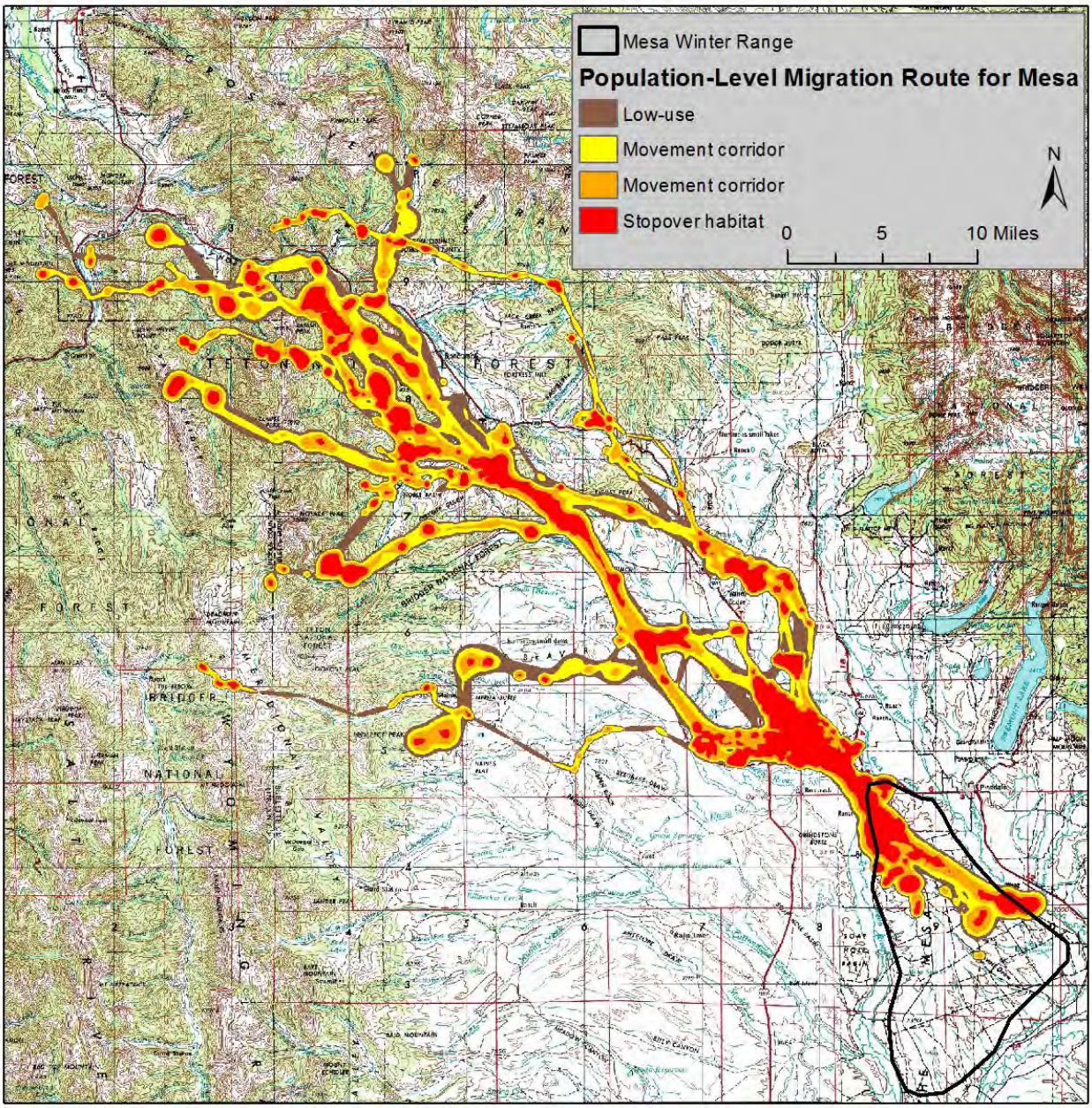

Figure 4. Population-level migration route for mule deer (n=26) from the Mesa winter range. Red areas represent migratory segments where deer spent most of their time are termed stopover sites. Orange and yellow segments represent migratory corridors where deer spent less time and moved relatively quickly.

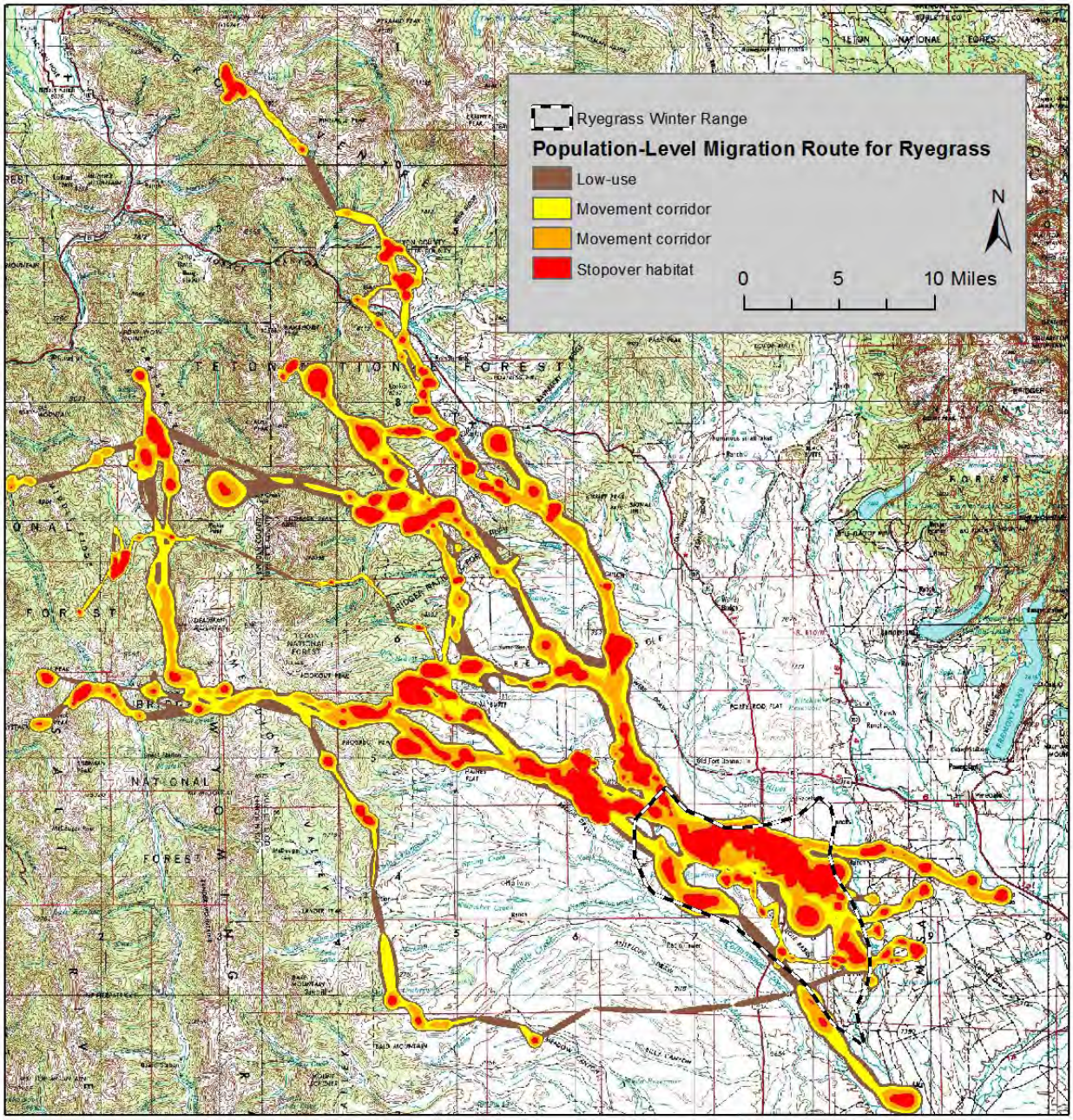

Figure 5. Population-level migration route for mule deer (n=16) from the Ryegrass winter range. Red areas represent migratory segments where deer spent the most time are termed stopover sites. Orange and yellow segments represent migratory corridors where deer spent less time and moved relatively quickly.

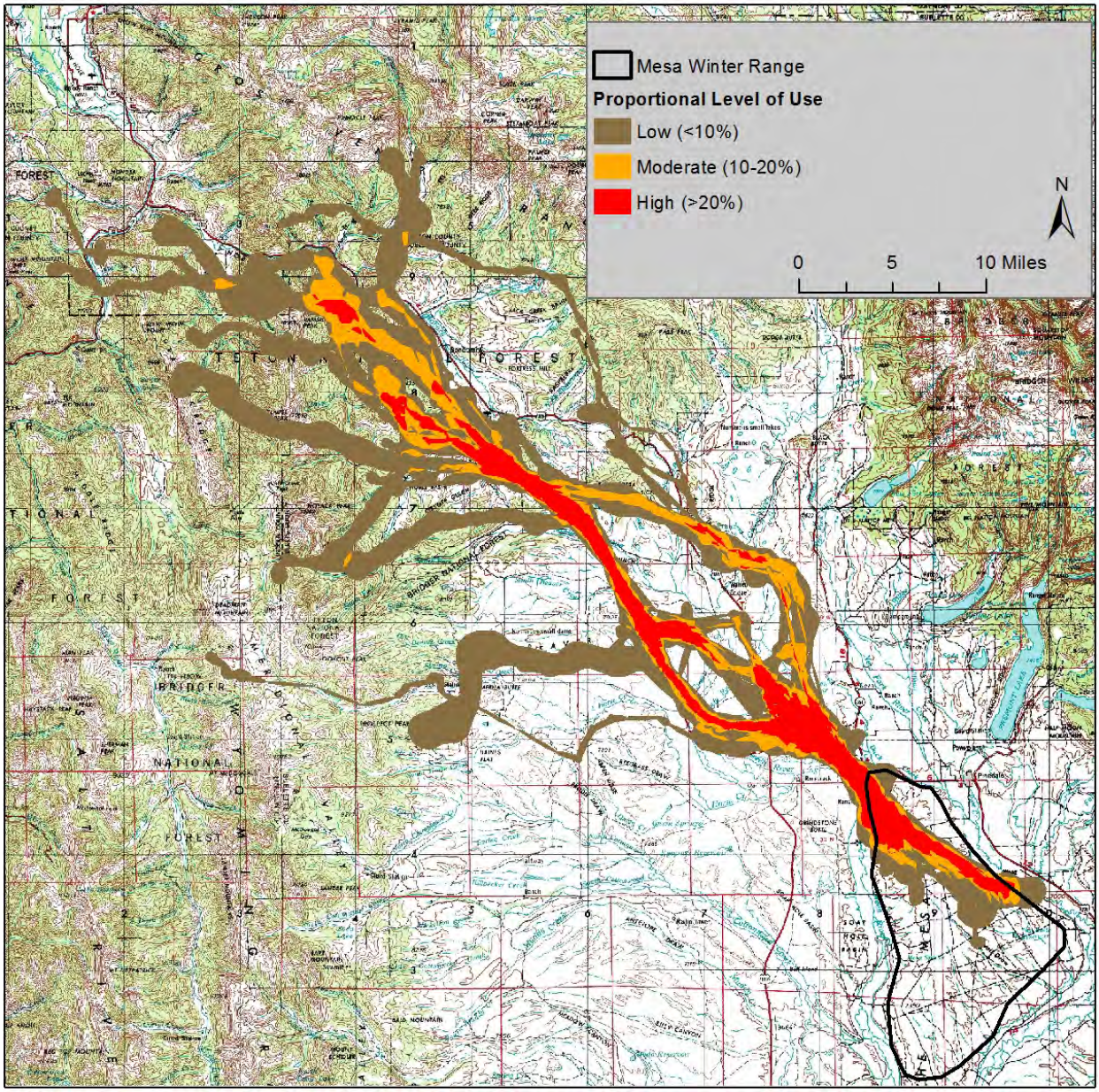

Figure 6. Population-level migration route for mule deer (n=26) that migrate northwest from the Mesa winter range. Red areas represent migratory segments that were used by the largest proportion (>20%) of the sampled population.

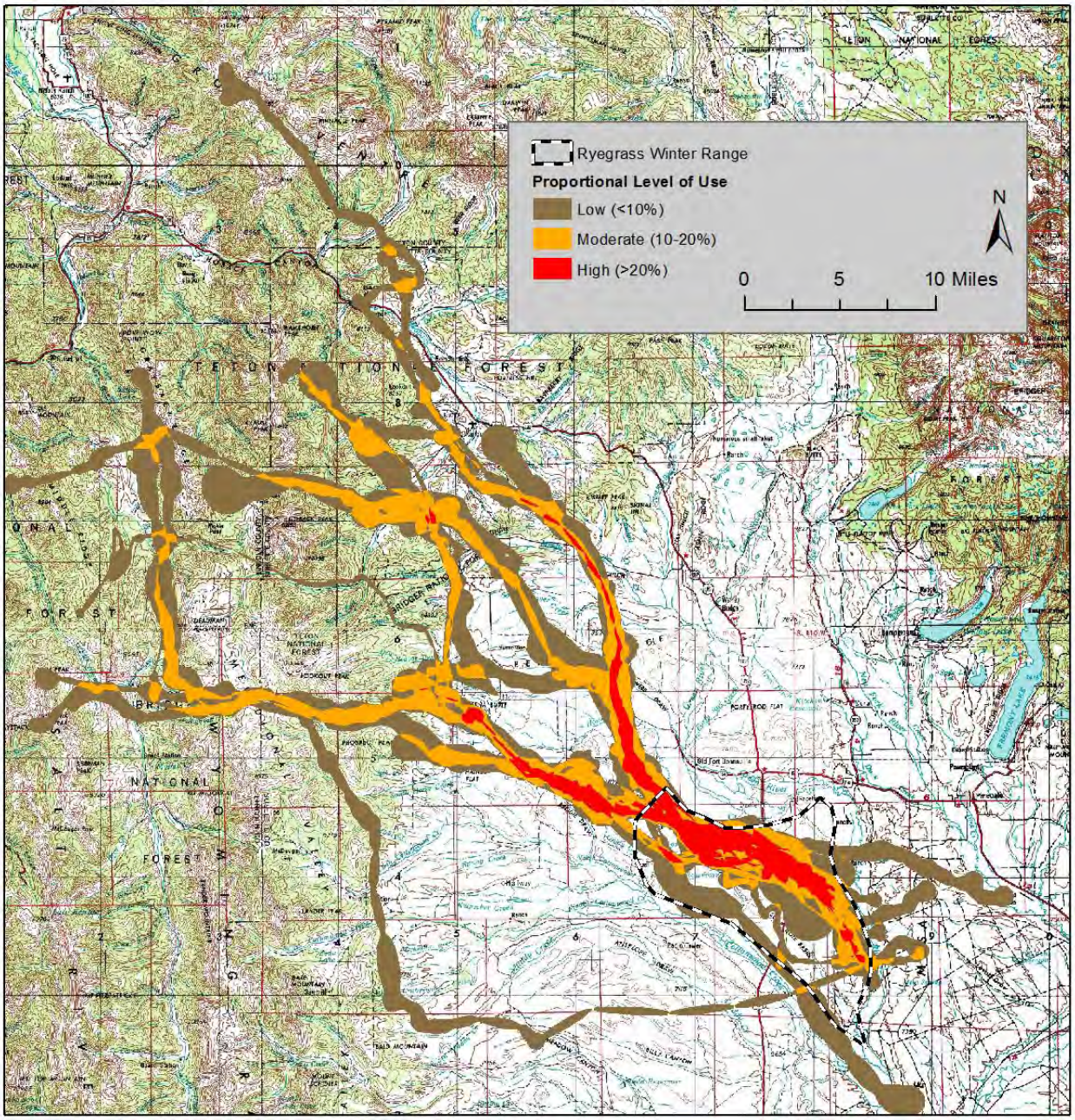

Figure 7. Population-level migration route for mule deer (n=16) that migrate in northwest from the Ryegrass winter range. Red areas represent migratory segments that were used by the largest proportion (>20%) of the sampled population.

Discussion and Management Implications

The management of migratory ungulates is difficult because of the long distances travelled, the mix of land ownership, and the various habitat types involved. Our results provide stakeholders with a science-based tool that allows them to consider mule deer migration routes in landscape-level planning, management, mitigation, and conservation efforts. Population-level migration routes provide two key benefits. First, they distinguish between route segments that are used as stopover sites versus those used primarily for movement. Stopover sites and movement corridors may warrant different management strategies (Sawyer et al. 2009), as one is used for foraging and resting, whereas the other is used for movement. Sawyer et al. (2009) recommended that stopover sites be managed to minimize habitat loss and human disturbance, whereas movement corridors be managed to maintain connectivity (i.e., ensure animal movement is not impeded). Stopover sites are important to migrating ungulates because they provide better foraging opportunities than are available on winter ranger, thereby allowing ungulates to recover body condition earlier in the spring and maintain it late into the fall.

A second benefit of population-level migration routes is that they can be used to prioritize routes based on the amount of use (i.e., number of deer) they receive. Although multiple migration routes originated from both Mesa and Ryegrass winter ranges, some routes were used by more deer than others. Routes that receive the most use are especially important because a large proportion of the deer population relies on them.

Recognizing where migration routes occur and how much use they receive will improve the ability of stakeholders to maintain migratory mule deer populations in areas managed for multiple-use. Population-level migration routes for Mesa and Ryegrass winter ranges (Figs. 4-7) will be provided in digital format to the BLM Pinedale Field Office, Pinedale Anticline Project Office (PAPO), and Wyoming Game and Fish Department. As more mule deer data is collected in monitoring efforts administered by the PAPO, these migration routes will be updated annually to ensure the best available data are used and accessible.

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