

# Wyoming Range Mule Deer Habitat Management Plan: Big Piney – LaBarge Area



17 February 2012  
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## **ABSTRACT**

The purpose of this document is to recommend specific projects for increasing habitat quality and quantity for Wyoming Range mule deer around Big Piney and LaBarge, Wyoming. These projects are recommended in response to the objectives established by the Wyoming Range Mule Deer Plan (WGFD 2011a). The plan identified winter ranges as a limiting factor for mule deer and a priority for habitat enhancement; therefore, most of the proposed projects within this document fall in those ranges. While the majority of the enhancement projects are located in arid sagebrush communities, projects are also proposed in aspen, mixed-mountain shrub, and riparian communities. In addition, recommendations are made for invasive plant species reduction and enhanced reclamation in relation to oil and gas development activities. Projects planned in shrub communities total 29,131 acres (19,132 acres within the Pinedale BLM Field Office and 9,999 acres within the Rock Springs BLM Field Office), while aspen community projects planned total 10,858 acres (Pinedale BLM Field Office). Even across differing community types, in most cases, shrubs in these areas are older age class with lack of recruitment and moderate to excessive hedging, resulting in the similar project objective of increasing productivity and regeneration of the stands. In general for most community types, disturbing shrub communities with some implement will be used to accomplish the stated objectives. Considering the overall condition of most of these communities and their location within the Wyoming Range mule deer herd's winter range, these projects are a high priority for implementation. Implementation of these projects across the landscape will enhance the long-term quality of habitat and hopefully result in a healthier mule deer herd.

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## INTRODUCTION

Concerns over decreasing mule deer (*Odocoileus hemionus*) populations and factors limiting population growth have heightened in recent decades throughout much of the Intermountain West. Factors responsible for population declines remain largely speculative; however, habitat quality and quantity continue to be identified as important factors. In response to concerns of mule deer populations in Wyoming, the Wyoming Game and Fish Commission adopted the *Wyoming Mule Deer Initiative* (MDI) (Wyoming Game and Fish Department [WGFD] 2007) with plans to develop individual management plans for key herd units based on overarching goals and objectives. This plan identified habitat as one of ten issues facing mule deer and delineated goals and strategies for how to address these issues within the plan. The Wyoming Range mule deer herd in west-central Wyoming was selected as the first herd to undergo this herd-specific planning process. The Wyoming Range mule deer herd has been a top priority for management for many years, and the *Wyoming Range Mule Deer Plan* (WGFD 2011a) was finalized in 2011 following an intensive public input process where habitat was a consistent theme brought up by the public throughout the meetings and commenting periods. Specifically, the public requested additional efforts to be made between the WGFD and federal land management agencies to implement habitat enhancement projects with a high priority placed on winter ranges. Additionally, WGFD hired Teton Science School (TSS) to complete the *Wyoming Range Mule Deer Habitat Assessments* (HAs) for important habitats used by the Wyoming Range mule deer (Smith and Younkin 2010a and b). This effort quantitatively and qualitatively assessed current habitat conditions and identified potential areas for treatment. In 2011, as a result of these efforts, WGFD hired an additional biologist to work on developing this 10 Year Habitat Plan for the northern portion of the Wyoming Range mule deer herd, primarily within the Pinedale BLM Field Office management boundary. As a result of this work, we propose 19,132 acres of shrub community projects and 10,858 acres of aspen community projects within that Field Office and 9,999 acres of shrub community projects within the Rock Springs BLM Field Office.

### **General Ecosystem Description**

The focus area for this Plan includes lands located between North Piney Creek and Fontenelle Creek, including the Little Colorado Desert on the east and west to the boundary of the Bridger Teton National Forest (Figure 1). The primary focus of this plan is on BLM-managed lands although efforts are ongoing with Bridger Teton National Forest and private landowners on additional projects including prescribed burns and conservation easements.

This area's annual precipitation varies east to west along a gradient from very low (7-9 inches) to high (20-24 inches). Crucial winter and winter ranges tend to be located on the lower precipitation areas and migration routes or transition habitat is located in the western portion of the area in relatively higher precipitation zones. The area ranges in elevation from approximately 6,500 feet in the lower areas to 9,500 feet in the Deadline Ridge and Miller Mountain focus areas. Arid rangelands are widespread throughout this area with Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) dominating the landscape intermixed with pockets of saltbush (*Atriplex spp.*). On slopes with greater moisture and favorable soil conditions, mixed mountain shrubs such as true mountain mahogany (*Cercocarpus montanus*),

serviceberry (*Amelanchier alnifolia*), chokecherry (*Prunus virginiana*), and other sagebrush (*Artemisia spp.*) become more prevalent on the landscape. Sagebrush communities are generally older age class with lack of recruitment and moderate to excessive hedging of shrubs, particularly on crucial winter ranges. Mixed mountain shrubs are highly preferred winter browse by all wintering ungulates (mule deer, pronghorn [*Antilocapra americana*], elk [*Cervus elaphus*], and moose [*Alces alces*]), and small, isolated patches have resulted in nearly 100 percent of annual leader utilization and very low recruitment in these communities. Significant land uses in the area include cattle grazing (Appendix C), oil and gas development (Appendix D), and recreation by big game and antler hunters.

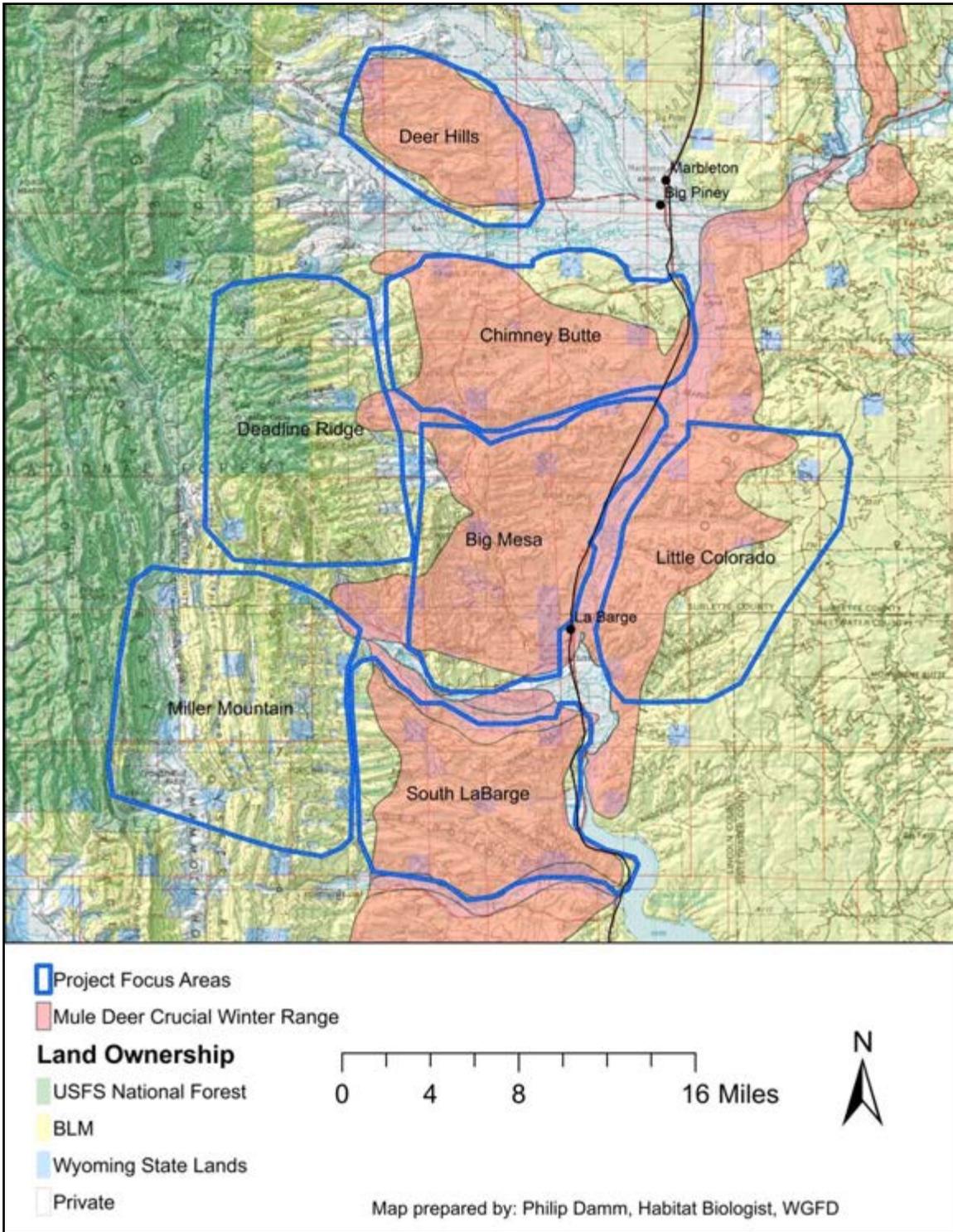


Figure 1. Focus areas for Wyoming Range mule deer crucial winter range habitat projects near Big Piney and LaBarge in western Wyoming.

## METHODS

Initial selection of potential project areas to visit was prioritized by mule deer winter use and identified crucial ranges (Figure 1), previous completed treatments, presence/absence of elk, and contiguous patches of sagebrush located by aerial imagery. These site characteristics were used in conjunction with local expert consultation, “Big Piney – LaBarge mule deer winter range evaluation” by Cundy (1989), and the TSS’s HAs (Smith and Younkin 2010a and b). Sage grouse (*Centrocercus urophasianus*) Core Area habitat was not avoided in selection of these areas; however, the majority of the focus areas is not identified as Core habitat. After potential areas were selected, site visits were conducted to determine the potential of the site for treatment and for response to treatment. If sites were deemed treatable, information collected included:

1. total species list for site as well as dominant species of shrubs, forbs, and grasses;
2. ocular estimation of age structure (particularly very young or old), structural diversity, canopy cover, and productivity (plant vigor and seed production) for dominant shrubs
3. ocular estimation of grass and shrub utilization of current and previous years
4. invasive species and other project implementation issues with the site including access considerations
5. significant evidence of animal use
6. potential objectives for the site, given all other information collected at site
7. polygon boundaries for treatable area
8. applicable TSS photo point and transect locations, data, and images

Disclaimer for site visit information: Quantities described in this section, whether numerical or categorical, are wholly subjective and tend to be relative to other locations, not absolute. Their main purpose was to determine potential treatability of a site and potential treatment methods for use at a site. They are not for use in actions such as: statistical analyses, final determination of intensity of a deployed treatment method, and making final recommendations concerning grazing management.

Terms used with ocular estimations in field notes:

1. Low, moderate, high—these terms were used relative to other sites. For example: high amount of sagebrush reproduction means it’s high at a site relative to other sites in similar precipitation zones, but possibly still low relative to the site’s potential for sagebrush productivity and what was felt to be ideal
2. Seed production (low, moderate, high)—notes both the amount of seed on plants and the number of sagebrush plants with seed heads
3. Vigor (low, moderate, high)—corresponds with seed production generally, but includes amount of live crown (amount of wood relative to the amount of leaves) on sagebrush plants
4. Age class diversity (low, moderate, high)—notes on amount of regeneration and dead/decadent sagebrush present
5. Structure diversity (low, mod, high)—corresponds with age class diversity, generally, but discounts the fact that some shorter plants may be older plants
6. Sagebrush canopy cover (0-100%)—percentage of total canopy made up of sagebrush

7. Utilization (low, moderate, high)—shrubs were qualitatively guesstimated using overall plant form (not percent of this years' browsed leaders), grasses were estimated using current years' use and evidence of previous years' use (low grass percent canopy and high (relatively) amount of rhizomatous grasses present)

After initial visits to project areas, a list of objectives for each sagebrush project was determined and included at least one of the following:

- 1) Increase sagebrush vigor and seed production (productivity)
- 2) Increase sagebrush regeneration
- 3) Release younger sagebrush
- 4) Increase forb diversity and percent composition
- 5) Increase grass diversity and percent composition

After determining potential objectives for each sagebrush project, a treatment method was determined based on the likelihood of fulfillment of those desired objectives. Mechanical methods are split between mowing and other soil disturbing equipment (soil aerating, range pitting, chaining, dixie harrowing, seed drilling). In addition, treatment methods for some sites will not be viable due to other environmental factors such as slope grade, annual precipitation, and soil characteristics. Potential treatment methods we considered included (the numbers in parentheses correspond to the potential objectives from the preceding list):

- 1) Mechanical (mowing) (1,2,3 maybe 4,5)
- 2) Forb seeding (maybe 4)
- 3) Mechanical (soil disturbing) (1, 2, 3 maybe 4,5)
- 4) Spike (1, 2, 3 maybe 4,5)
- 5) Prescribed fire (2, 5, maybe 4)
- 6) Grazing distribution/timing, frequency, and intensity (5, maybe 4)
- 7) Fertilizer (1)

# HABITAT MANAGEMENT RECOMMENDATIONS-Pinedale BLM Field Office

## Sagebrush community projects

### Deer Hills Focus Area

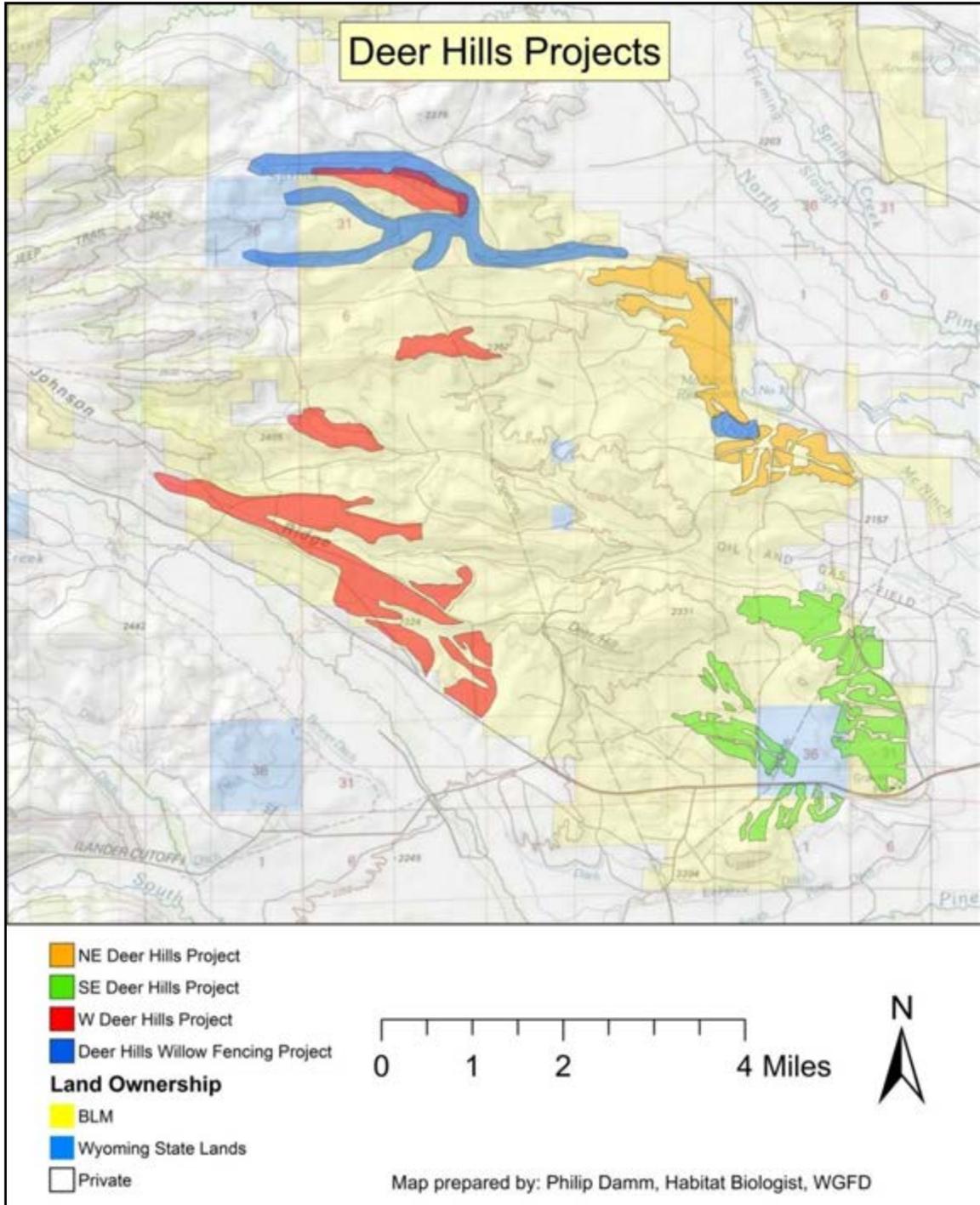


Figure 2. Deer Hills area Wyoming Range mule deer crucial winter range proposed habitat projects near Big Piney in western Wyoming.

### Southeast Deer Hills Project 1 (783 acres, Table 1, Figure 2, Appendix B-Figure 8)

This area is characterized by moderate canopy, mature Wyoming big sagebrush and large amounts of bare ground. Relatively few forb and grass species exist consistently across the site. Sagebrush is still moderately productive, although very few younger plants exist.

#### Objectives:

- 1) Increase sagebrush productivity
- 2) Increase sagebrush regeneration
- 3) Increase forb species diversity and percent composition
- 4) Increase grass species diversity and percent composition

Treatment: Soil disturbing mechanical + forb seeding

Limitations in this area are minimal, although heavy grazing may present issues in acquiring required rest for such a large area, particularly if the project is completed in one season. However, these issues would be minimized if the project were completed across several years; grazing rest would be required for a much smaller area every two years. Also, low precipitation and lower sagebrush canopy (low fuel loads) would limit use of prescribed fire in these areas unless implemented under ideal conditions. Although few smaller stature sagebrush exist on this site, mowing narrow strips (for sagebrush seed dispersal) could be an effective method for accomplishing objectives 1 and 2 if costs and/or forb seed availability were prohibitive.

### Southeast Deer Hills Project 2 (417 acres, Table 1, Figure 2, Appendix B-Figure 9)

This area is similar to Southeast Deer Hills Project 1, although Wyoming big sagebrush is more productive and younger plants exist across the site. Several forb species exist across the site, although most are in relatively low densities. Green rabbitbrush (*Chrysothamnus viscidiflorus*) is present in the understory of the sagebrush in relatively high densities.

#### Objectives:

- 1) Release younger sagebrush
- 2) Increase forb percent composition
- 3) Increase grass species diversity and percent composition

Treatment: Spike

Similar issues with grazing are present at this site as in Southeast Deer Hills Project 1, as both are located in the same allotment. The amount of rabbitbrush in the understory is troubling, as prescribed fire and mechanical treatments would likely only increase the density of this shrub.

### Northeast Deer Hills Project (946 acres, Table 1, Figure 2, Appendix B-Figure 10)

This area is characterized by moderate density, mature Wyoming big sagebrush which is moderate in productivity across the site. Several forb species exist across the site, although in low densities. Only a couple of grass species exist consistently across the site, but they exhibit high productivity. Green rabbitbrush exists in the understory, although not to the extent it is present in Southeast Deer Hills Project 2. Remarkably, abandoned well pads within this project area have recovered quite well, and sagebrush productivity on these pads relative to adjacent areas is extremely high.

#### Objectives:

- 1) Increase sagebrush productivity
- 2) Release younger sagebrush
- 3) Increase forb percent composition
- 4) Increase grass species diversity

Treatment: Mechanical (mowing)

Similar issues with grazing are present at this site as in Southeast Deer Hills Projects 1 and 2. Precipitation and lower sagebrush canopies (low fuel loads) would prevent use of prescribed fire in these areas. Due to forb species diversity being adequate and the presence of younger, smaller stature sagebrush across the site, a soil disturbing implement and seeding is probably not required.

### West Deer Hills Project (1773 acres, Table 1, Figure 2, Appendix B-Figure 11)

These areas are characterized by higher density, mature Wyoming big sagebrush which is moderate in productivity across the sites. Several forb and grass species exist across the sites, although in low densities. Only a couple of grass species exist consistently and are minimal in terms of percent composition. Severely browsed antelope bitterbrush (*Purshia tridentata*) is present at two of the sites in fairly low densities.

#### Objectives:

- 1) Increase sagebrush productivity
- 2) Increase sagebrush regeneration
- 3) Increase bitterbrush percent composition (in West Deer Hills 1 and 3)
- 4) Increase forb percent composition (in West Deer Hills 1, 2, and 4)
- 5) Increase grass species diversity and percent composition (in West Deer Hills 2)

Treatment: Spike or mechanical

Although the four sites contain some variation in terms of species composition and aspect, they are similar enough to be treated in the same fashion. Either Spike or prescribed fire could address the stated objectives; however, less control is had in terms of mosaic treatment patterns with prescribed fire. Treated areas need to be fairly narrow to promote sagebrush seed dispersal and establishment in a reasonable time. Although in fairly small patches, cheatgrass (*Bromus tectorum*) does exist near a couple of the sites (Table 2, Figure 26) and must be considered prior to implementing any soil-disturbing treatments.

### Chimney Butte Focus Area

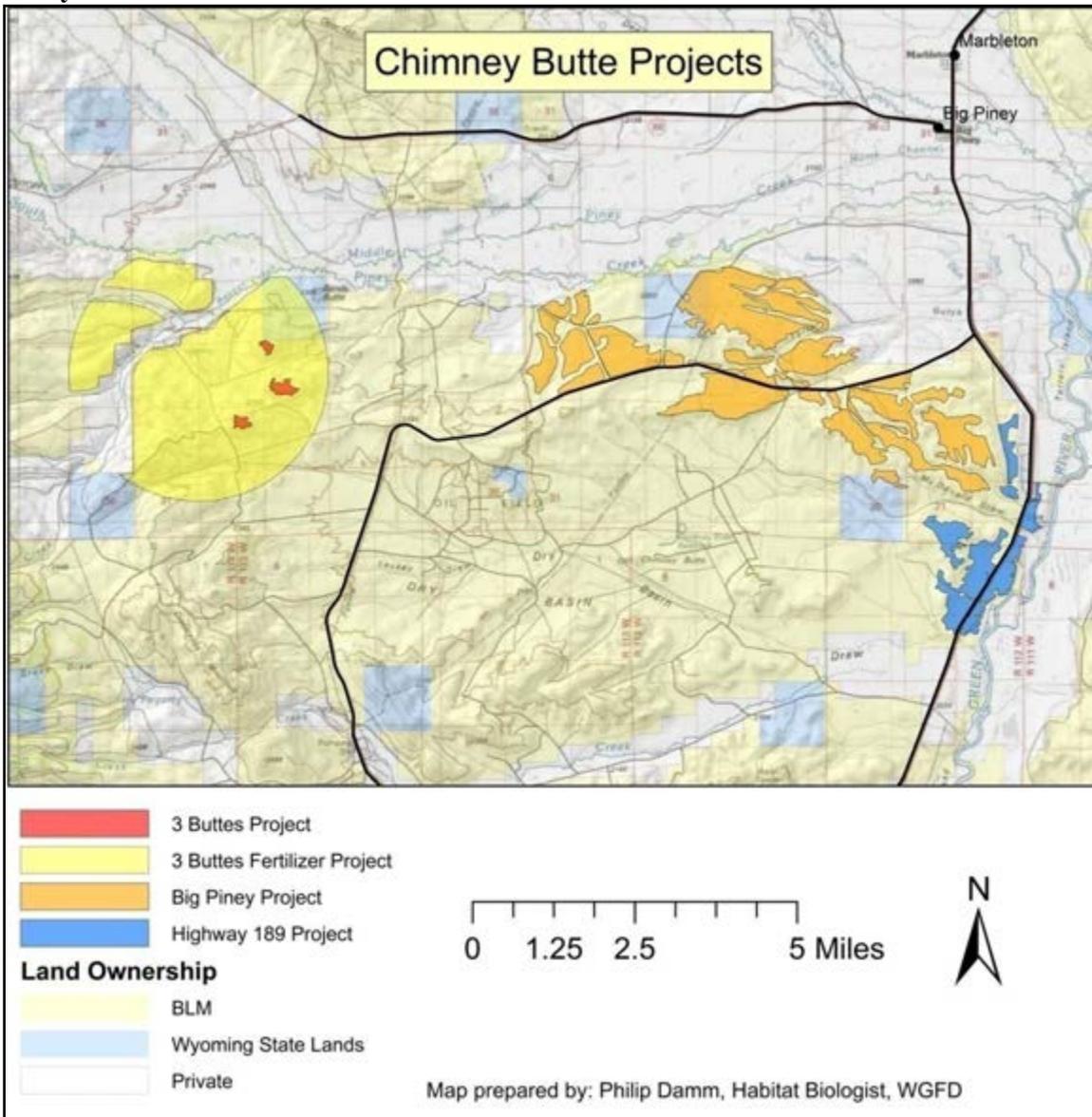


Figure 3. Chimney Butte area Wyoming Range mule deer crucial winter range proposed habitat projects near Big Piney in western Wyoming.

### Big Piney Project (4047 acres, Table 1, Figure 3, Appendix B-Figures 12 and 13)

This area is characterized by high density, mature Wyoming big sagebrush and large amounts of bare ground, likely as a result of a 2,4-D herbicide application in the 1960s. Only a couple forb and grass species exist consistently across the site. Sagebrush is still moderately productive and younger, smaller stature sagebrush is present across the site.

#### Objectives:

- 4) Increase sagebrush productivity
- 5) Release younger sagebrush
- 6) Increase forb species diversity and percent composition
- 7) Increase grass percent composition

Treatment: Soil disturbing mechanical + forb seeding

Limitations in this area are minimal, although heavy grazing may present issues in acquiring required rest for such a large area if the project is completed in one season. However, these issues would be minimized if the project were completed across several years; grazing rest would be required for a much smaller area every two years. Also, precipitation and lower sagebrush canopy (low fuel loads) would limit use of prescribed fire in these areas unless implemented under ideal conditions. Since smaller stature plants are present across the site, mowing alone could be a viable second alternative treatment method if costs and/or forb seed availability were prohibitive.

### Highway 189 Project (922 acres, Table 1, Figure 3, Appendix B-Figure 14)

This area is characterized by moderate density, mature Wyoming big sagebrush which is low in productivity across the site. Only a couple forb and grass species exist consistently across the site; however, grass productivity, particularly needle and thread (*Hesperostipa comata*), is high.

#### Objectives:

- 1) Increase sagebrush productivity
- 2) Increase sagebrush regeneration
- 3) Increase forb species diversity and percent composition

Treatment: Soil disturbing mechanical + forb and sagebrush seeding

Similar issues with grazing are present at this site as in the Big Piney Project, as both are located in the same allotment. Precipitation and lower sagebrush canopy (low fuel loads) would prevent use of prescribed fire in these areas. Although this site is similar to the Big Piney Project, low sagebrush productivity may require seeding of the species to regenerate the stand. Low probability of ideal seed establishment conditions (timing and quantity of precipitation) in the year of seeding will be problematic for regenerating this stand; therefore, seeding sagebrush may be required in multiple years for desired establishment rates. A preferred alternative to seeding sagebrush would be planting potted or bare-root plants, although cost might be prohibitive in regenerating the stand by this method.

### Three Buttes Fertilizer Project (6065 acres, Table 1, Figure 3, Appendix B-Figure 15)

This area is characterized by Wyoming big sagebrush-green rabbitbrush stands with some mahogany stand inclusions on steeper north and east facing slopes.

#### Objectives:

- 1) Increase sagebrush and mahogany productivity
- 2) Increase forb productivity
- 3) Increase grass productivity

Treatment: fertilizer

A recent prescribed fire mosaic in the east end of the project containing mostly green rabbitbrush and a few grass species should be avoided with treatment (Appendix B-Figure 15). Also, areas with steeper slopes and shallow soils will have to be avoided with fertilizer. However, some of the burned areas are mahogany stands which potentially could benefit in the short term from fertilizer application.

### Three Buttes Project (84 acres, Table 1, Figure 3, Appendix B-Figure 15)

This area is characterized by moderate to high density, mature, moderately productive Wyoming big sagebrush. Several forb and grass species exist consistently across the site, although species diversity could be improved.

#### Objectives:

- 1) Increase sagebrush productivity
- 2) Increase sagebrush regeneration
- 3) Increase forb diversity
- 4) Increase grass diversity

Treatment: Spike

Access to the tops of these buttes is problematic, and as such, mechanical treatments are probably limited. Cattle grazing issues should be minimal at this site since the treatment areas are on top of small buttes where water development is limiting, although winter elk use is higher in these areas. Lower sagebrush canopy (low fuel loads) would prevent use of prescribed fire in these areas with less than ideal conditions. Other treatments in areas surrounding the buttes could be possible, but a recent prescribed fire mosaic surrounding them precludes such treatment in the near future. The location of these buttes within the fertilizer project area provide an ideal opportunity to test the application of Spike followed by fertilizer to determine the value of such a combination prescription.

## Big Mesa Focus Area

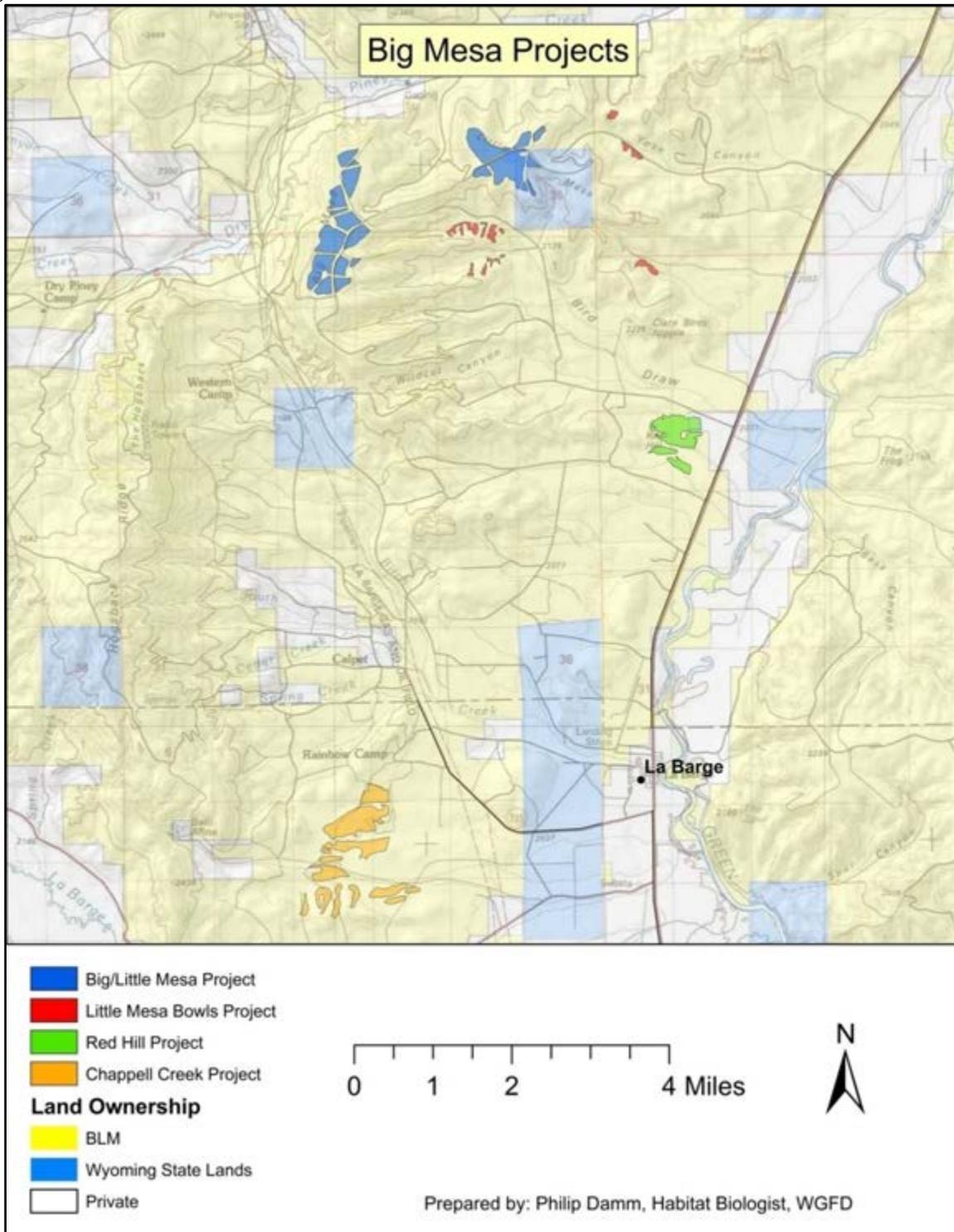


Figure 4. Big Mesa area Wyoming Range mule deer crucial winter range proposed habitat projects near Big Piney and LaBarge in western Wyoming.

Big/Little Mesa Project (547 acres, Table 1, Figure 4, Appendix B-Figure 16)

This area is characterized by moderate canopy, mature Wyoming big sagebrush with younger, smaller stature sagebrush plants scattered throughout the site. Only a couple forb and grass species exist consistently across the site. Inclusions of lower density sagebrush exist within the proposed treatment area, particularly near the edges of the mesas.

Objectives:

- 1) Release younger sagebrush
- 2) Increase forb species diversity and percent composition
- 3) Increase grass species diversity and percent composition

Treatment: Mechanical (mowing)

Lower sagebrush canopy (low fuel loads) and high natural gas well densities would limit use of prescribed fire in this area. In addition, care must be taken to buffer areas currently disturbed by natural gas development activities to avoid any current invasive species issues (note Figure 27 and Table 2 for cheatgrass locations). Even though increasing forb and grass species diversity are stated objectives, relatively high well densities limit efficacy of treatments to address these objectives. Soil disturbing activities required for seedbed preparations and establishment should be limited due to high potential of invasive species encroachment in these sites. In addition, high rock prevalence could severely limit mechanical equipment use, depending on its durability.

Little Mesa Bowls Project (73 acres, Table 1, Figure 4, Appendix B-Figure 17)

This area is characterized by moderate to high canopy, mature Wyoming big sagebrush with several grass and forb species present in relatively low densities across the site. These wetter, north-facing slopes contain some of the only treatable Wyoming big sagebrush in the immediate area.

Objectives:

- 1) Increase sagebrush productivity
- 2) Increase sagebrush regeneration
- 3) Increase forb percent composition
- 4) Increase grass percent composition

Treatment: Spike

The steeper slopes of most of these polygons and low precipitation zone relegate the treatment method to Spike, which with a proper mosaic, should accomplish the four stated objectives. Since in this area, larger expanses of contiguous Wyoming big sagebrush are infrequent, regenerating this stand should have a relatively substantial positive impact on mule deer.

Chappell Creek Project (391 acres, Table 1, Figure 4, Appendix B-Figure 18)

This area is characterized by higher canopy, mature Wyoming big sagebrush. Limited quantities of forb and grass species exist consistently across the site. The site has several soil inclusions conducive to harboring rubber rabbitbrush, which occurs frequently in surrounding areas.

Objectives:

- 1) Increase sagebrush regeneration
- 2) Increase forb species diversity and percent composition
- 3) Increase grass species diversity

Treatment: Spike

High natural gas well densities in the area and low precipitation would prevent use of prescribed fire at this site. Even though increasing forb and grass species diversity are stated objectives, relatively high well densities limit efficacy of treatments to address these objectives. Soil disturbing activities required for seedbed preparations and establishment should be limited due to high potential of invasive species encroachment in these sites (note Table 2 and Figure 27 for cheatgrass locations). In addition, due to the soils, invasion of rubber rabbitbrush seems likely.

Red Hill Project (154 acres, Table 1, Figure 4, Appendix B-Figure 19)

This area is characterized by moderate canopy, mature Wyoming big sagebrush with several forb and grass species existing consistently across the site, although in relatively low densities.

Objectives:

- 1) Increase sagebrush productivity
- 2) Increase sagebrush regeneration
- 3) Increase forb percent composition
- 4) Increase grass percent composition

Treatment: Soil disturbing mechanical

Lower sagebrush canopy (low fuel loads) and precipitation zone would prevent use of prescribed fire in this area. Although natural gas wells are not contained within the polygons, care must still be taken to buffer areas currently disturbed by road development to avoid any current invasive species issues. Surrounding lower areas consist of a saltbush flat that should be avoided with equipment. Since in this area, larger expanses of contiguous Wyoming big sagebrush are infrequent, regenerating this stand should have a substantial positive impact on mule deer.

**South LaBarge Focus Area**

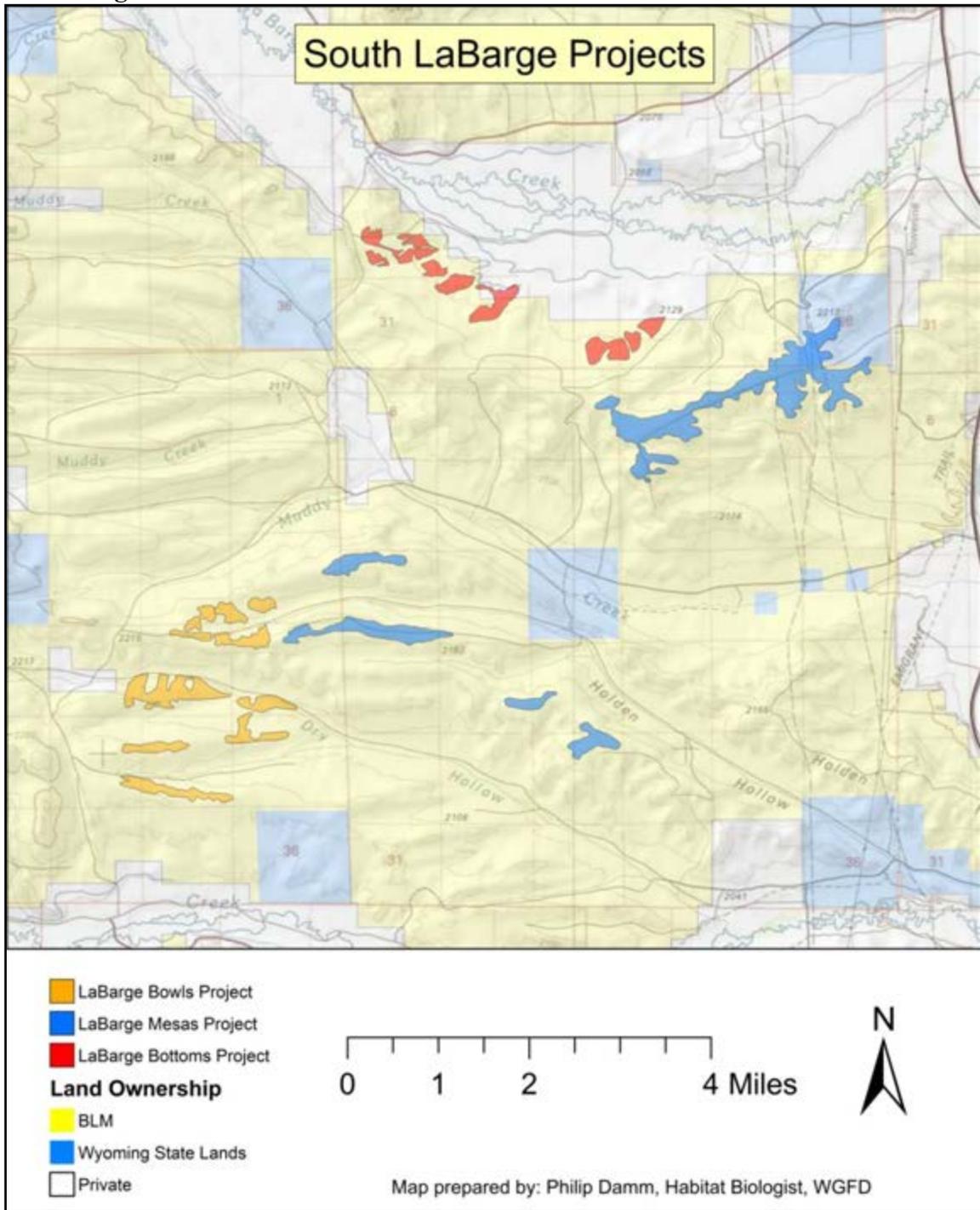


Figure 5. South LaBarge area Wyoming Range mule deer crucial winter range proposed habitat projects near LaBarge in western Wyoming.

### LaBarge Mesas 1 Project (643 acres, Table 1, Figure 5, Appendix B-Figure 20)

This area is characterized by moderate canopy, mature, moderately productive Wyoming big sagebrush. Several forb and grass species exist consistently across the site. Large quantities of moose (*Alces alces*) pellets were found on the mahogany slopes on the north end of this area.

#### Objectives:

- 1) Increase sagebrush productivity
- 2) Increase sagebrush regeneration
- 3) Increase forb percent composition
- 4) Increase grass percent composition

Treatment: soil disturbing mechanical

Equipment access to the tops of this mesa is problematic, unless access is granted from the east end through private property. Cattle grazing issues should be minimal at these sites since the treatment areas are on top of mesas where water development is limiting; although, elk use in this area is high. Areas of lower canopy sagebrush mostly occur near the edges of the mesa and should be avoided in treatment. Although just outside of moose crucial winter range, this project should be beneficial to moose as well as mule deer.

### LaBarge Mesas 2 Project (238 acres, Table 1, Figure 5, Appendix B-Figure 21)

This area is characterized by moderate canopy, mature, moderately productive Wyoming big sagebrush. Few forb and grass species exist in relatively low densities across the site.

#### Objectives:

- 1) Increase sagebrush productivity
- 2) Release younger sagebrush
- 3) Increase forb diversity and percent composition
- 4) Increase grass diversity and percent composition

Treatment: Spike

Equipment access to the tops of these mesas is problematic at best, and therefore treatment methods are limited to Spike or prescribed fire. Sagebrush canopy is likely too low for prescribed fire in all but ideal conditions. Cattle grazing issues should be minimal at this site since the treatment areas are on top of mesas where water development is limiting; although, elk use in this area is high. Areas of lower canopy sagebrush mostly occur near the edges of the mesa and should be avoided in treatment.

LaBarge Mesas 3 Project (72 acres, Table 1, Figure 5, Appendix B-Figure 21)

This area is characterized by higher canopy, mature, moderately productive Wyoming big sagebrush. Several forb and grass species exist relatively consistently across this mesa.

Objectives:

- 1) Increase sagebrush productivity
- 2) Increase sagebrush regeneration
- 3) Increase forb percent composition

Treatment: soil disturbing mechanical

Equipment access to the top of this mesa is reasonable from the east end, although increased levels of green rabbitbrush are present. Cattle grazing issues should be minimal at this site since the treatment area is on top of a mesa where water development is limiting, although elk use in this area is high. Areas of lower canopy sagebrush mostly occur near the edges of the mesa and should be avoided in treatment. Soils are highly erodable here, so edges and smaller valleys should be avoided with equipment as well.

LaBarge Bowls 1 and 2 Project (514 acres, Table 1, Figure 5, Appendix B-Figure 22)

This area is characterized by moderate to high canopy, mature Wyoming big sagebrush with few grass and forb species present in relatively low densities across the site. These wetter, north-facing slopes contain some of the only treatable Wyoming big sagebrush in the immediate area.

Objectives:

- 1) Increase sagebrush productivity
- 2) Increase sagebrush regeneration
- 3) Increase bitterbrush percent composition
- 4) Increase forb species diversity and percent composition
- 5) Increase grass species diversity and percent composition

Treatment: Spike

The steeper slopes of most of these polygons, loose soils, and low precipitation zone relegate the treatment method to Spike. With a proper mosaic and application rate, Spike could accomplish the five stated objectives, with the exception of increasing forb and grass species diversity.

LaBarge Bottoms Project (310 acres, Table 1, Figure 5, Appendix B-Figure 23)

This area is characterized by moderate canopy, mature Wyoming big sagebrush with a fair amount of younger, smaller stature sagebrush throughout the site. Inclusions of rubber rabbitbrush (*Ericameria nauseosa*) are present on hilltops, as well as some antelope bitterbrush located upslope. In addition, small patches of winterfat (*Krascheninnikovia lanata*) are located throughout the area. Large quantities of moose pellets were found on the mahogany slopes on the south end of this area.

Objectives:

- 1) Release younger sagebrush
- 2) Increase winterfat productivity and regeneration
- 3) Increase forb species diversity and percent composition
- 4) Increase grass percent composition

Treatment: soil disturbing mechanical and forb seeding

Rabbitbrush inclusions should be avoided with equipment, as disturbance will likely increase its prevalence. In most cases, areas with higher densities of rubber rabbitbrush do not contain canopies concurrent with sagebrush treatment parameters. Bitterbrush patches are likely too far upslope to see increases in percent composition post treatment, but are still notable. Heavily used cattle trails through the area are concerning, but use in the area is not severe. Although just outside of moose crucial winter range, this project should be beneficial to moose as well as mule deer.

## Other projects

Mahogany Drift Fence Pilot Project—Big Mesa/Chimney Butte Focus Areas (57 acres, Table 1, Appendix B-Figure 24)

Both the north and south sites consist of primarily true mountain mahogany with interspersions of black sagebrush (*Artemisia nova*) and occasional serviceberry. These project polygons are located on gently sloping generally north facing aspects, with one of the south polygons being located on a more easterly facing slope. For the most part, mahogany shrubs within these sites are severely hedged with little regeneration. The objective of this project is to increase mahogany productivity and regeneration by limiting winter ungulate use and increasing water availability during the early spring growing season. Hopefully, placement of drift fencing perpendicular to prevailing winter wind direction within the stands will increase snow depth, making shrubs unavailable for use, depending on snow accumulation. To our knowledge, using drift fencing to accomplish these objectives with mahogany has not been documented. If this method is successful in meeting either objective, it should be considered for other mahogany stands on similar sites across the Wyoming Range.

Deer Hills Willow Fencing Project—Deer Hills Focus Area (1153 acres, Table 1, Figure 2, Appendix B-Figure 25)

The areas within these polygons consist of primarily an ephemeral stream within a riparian willow (*Salix spp.*) community. Additionally, the southeastern polygon consists of a man-made reservoir primarily for cattle use. While these willows could regenerate under moderate browsing, current levels of use from presumably both cattle and wildlife have severely diminished the productivity of this riparian community, particularly the willow species. However, aside from a small portion on private property, streambanks seem fairly well stabilized, and grasses present are productive, albeit heavily used.

Objectives:

- 1) Increase willow productivity
- 2) Increase willow regeneration
- 3) Restore function to riparian community

Treatment: Fencing/grazing management/water development

Some of the highest quality feed for cattle in the area allotments is likely in this location, as they hold the majority of the water. This fact may cause issues due to the reduced access for grazing that fencing would result in. Fencing these areas as a small pasture within the allotments and continued grazing on a limited basis might alleviate these concerns, and still achieve the stated objectives. Obviously, access to water for cattle would have to be maintained for each pasture, or new upland water sites could be developed. Sections of the reservoir could be fenced while maintaining access for cattle. Although just outside of moose crucial winter range but still within moose habitat, this project will likely be beneficial to moose as well as mule deer.

Aspen community projects—Deadline Ridge Focus Area

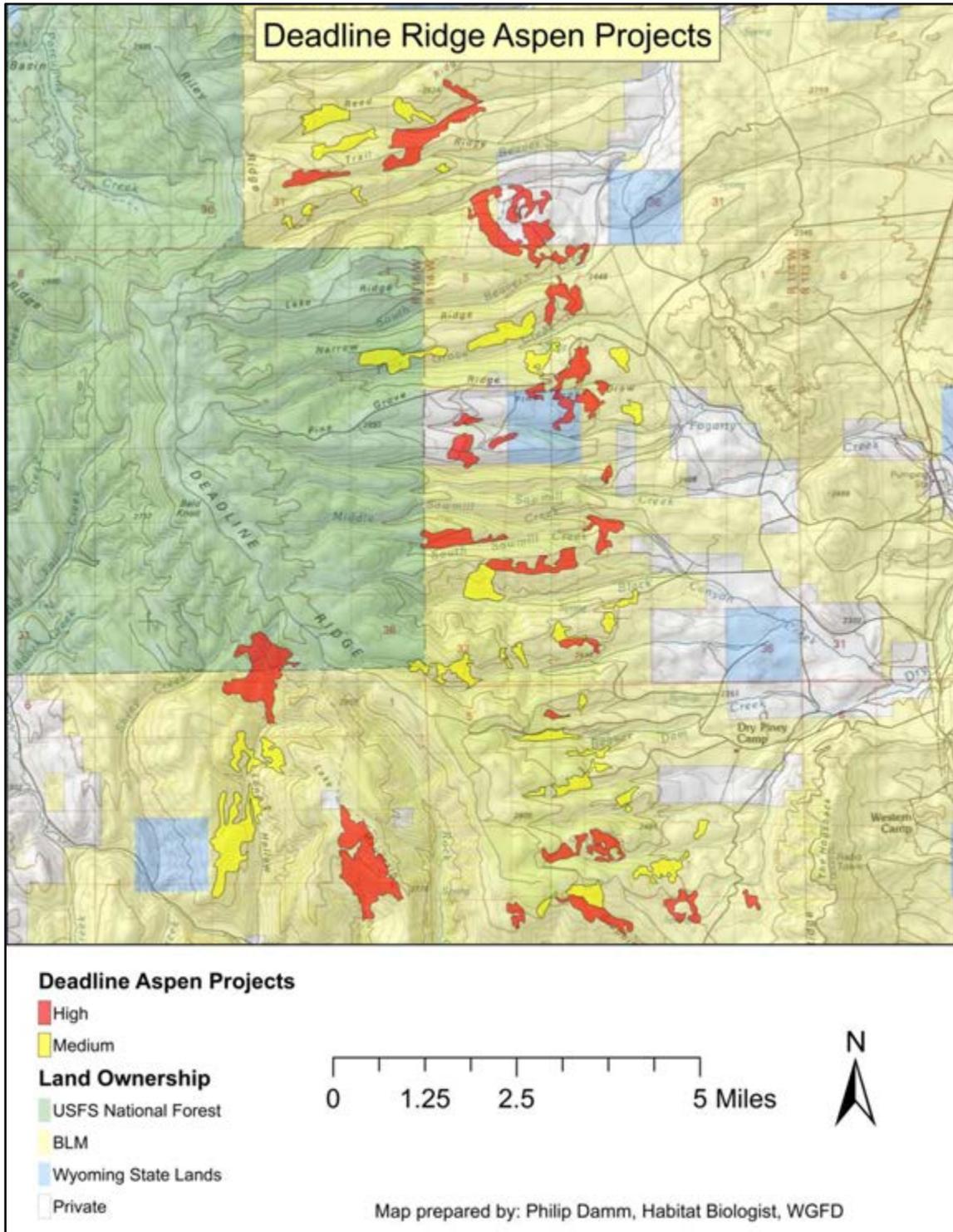


Figure 6. Deadline Ridge area Wyoming Range moose crucial winter range and mule deer spring, summer, and fall range proposed habitat projects by priority near Big Piney and LaBarge in western Wyoming.

Aspen community projects—Miller Mountain Focus Area

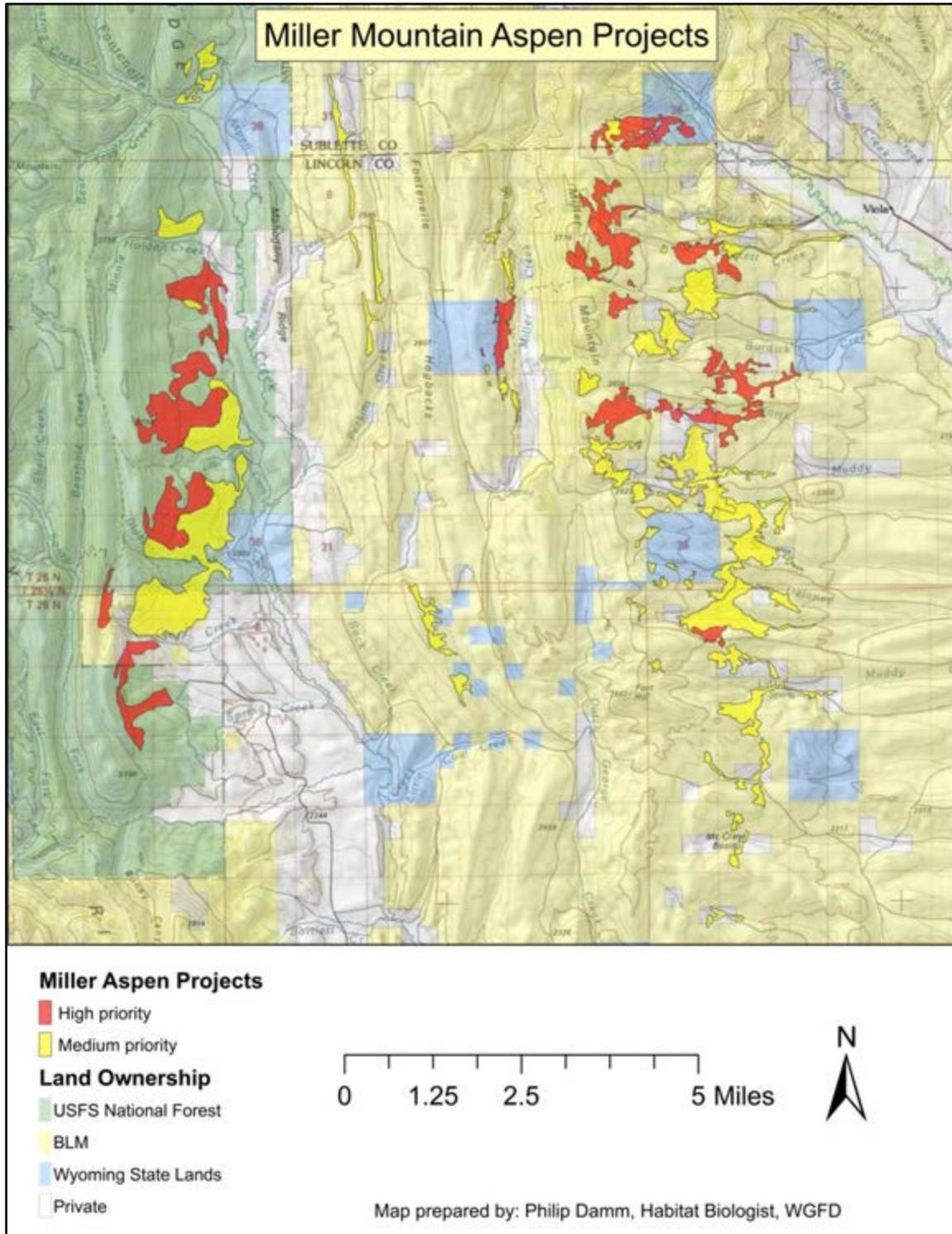


Figure 7. Miller Mountain area Wyoming Range moose crucial winter range and mule deer spring, summer, and fall range proposed habitat projects by priority near Big Piney and LaBarge in western Wyoming.

Aspen community projects (4180 and 6678 acres, Figures 6 and 7, respectively)

Over 10,000 acres of aspen stands have been identified as high or medium priority for treatment based on the Deer Hills, Calpet and Little Colorado Desert Study Area and South LaBarge Study Area HAs (Smith and Younkin 2010a and b). This assessment used the Risk Assessment methodology from Campbell and Bartos (2001) to assign a prioritization for treatment of aspen based on density of suckers, invasion from conifers and other criteria to help managers assign priority when management actions are being proposed. Specific objectives for each stand are also identified within the HAs. Aspen communities are used from the spring through fall by mule deer, particularly by does and fawns, and many of these stands are located within moose crucial winter range. Additionally, a diversity of age classes within aspen stands has watershed-scale benefits for a wide variety of additional species. The objective for treating aspen is typically to induce suckering by inducing mortality on mature or decadent trees, and possibly removal of conifers to increase available resources for aspen. In many instances within the two focus areas, the stands identified for treatment are adjacent to high density, older age class mountain big sagebrush (*Artemisia tridentata vaseyana*) stands. Since the implement for treating aspen is frequently prescribed fire, where applicable we suggest burning these adjacent, late-seral stage sagebrush stands.

Cheatgrass will be an issue at least for the Miller Mountain Aspen Projects, as patches were found along a main access road at the east end of the area (Figure 27). These patches should be fairly easily controlled as they seem to be located mostly along roadsides, and as such, should be dealt with prior to and following a treatment application to the area. Given the large cheatgrass “patch” along the LaBarge Creek Road (Figure 27) and its proclivity for spreading into adjacent disturbed areas, both the Miller Mountain and Deadline Ridge Areas should be examined more thoroughly for cheatgrass prior to aspen project implementation.

The Wyoming Range Front Aspen Restoration Project may be the most appropriate avenue to implement treatments for these polygons. The identification of polygons, many photo points and several transects have already been established which should expedite the planning process. The largest management challenge will be livestock grazing management. Post treatment rest will most likely have to be accomplished with riders or temporary fencing of specific drainages or stands because many of the polygons are within the North and South LaBarge Common Allotments (Figure 39 and Figure 40). Although some of the proposed treatment polygons overlap into Forest Service administered lands, we are not proposing for the BLM to implement treatments in those areas.

### Cheatgrass/other invasives control project (Table 2, Appendix B-Figure 26 and 27)

Cheatgrass is present across the focus areas (Figures 26 and 27), although the bulk of the locations were along approximately twenty miles of the LaBarge Creek Road that basically divides the Big Mesa and South LaBarge focus areas. Also, a fairly significant portion of the locations were in the southern portion of South Labarge. While these patches are close to some proposed projects, these projects are generally located on north facing aspects, which have a lower probability of cheatgrass establishment. Although for the most part, cheatgrass within the focus areas does not pose a serious threat to completing project objectives, it should be considered a priority to monitor and control these patches while they remain relatively small. The LaBarge Creek Road “patch” must be a priority as well, as this appears to be the primary seed source for areas to the north and south of the road. This “patch” extends into riparian areas, hay fields, and pastures along the road as well, which will make control difficult, at best. Halogeton (*Halogeton glomeratus*) was found along most all roads and other soil-disturbed, developed areas. Although this plant is widespread, it could be relatively easy to control in these areas because of its roadside location.

### Natural gas development enhanced reclamation projects (Appendix B-Figures 28-31)

A relatively high density of natural gas wells and other development activities occur across the focus areas (Figure 41). Since plugged and abandoned wells (P-As) have little chance for future disturbance, they are an ideal starting point for these enhanced reclamation projects (527 wells; Figures 29-31). Deadline Ridge and Miller Mountain focus areas were not included in this section since they contain a limited number of P-As and due to their location in higher precipitation zones resulting in higher probability of initial reclamation success. Little Colorado was not included because of lack of data for that area. In general P-As were reclaimed to satisfy stipulations of permits, but could use further enhancement to become more suitable for long term mule deer habitat. These locations typically contain a low diversity of desired grasses and high number of undesirable and/or invasive species such as halogeton, black henbane (*Hyoscyamus niger*), rubber rabbitbrush, and cheatgrass. Often, a significant portion of the land in a given area could benefit from enhanced reclamation. For example, the polygons in Figure 28 represent the enhanceable area within an imaginary square, which equates to approximately 10% of the area within that square. This example is only one location within the greater focus areas, and these enhanced reclamation efforts could be applied throughout the oil and gas fields.

Focus on these areas should be placed on eliminating (or reducing) invasive species and re-establishing the appropriate shrub species for the site which in this case could include Wyoming big sagebrush, saltbush, or winterfat. Low productivity of surrounding sagebrush may require seeding of the species to regenerate the stands. A preferred alternative to seeding sagebrush would be planting potted or bare root plants, although costs might be prohibitive in regenerating the stand by this method. At the same time of sagebrush seeding/planting, a native forb and grass mix would be drilled in to complete the plant community and alleviate concerns of invasive re-establishment post-sagebrush planting. In cases where invasive species are absent and grasses are already established, shrub establishment should be the main priority. Incorporating WGFD, industry, BLM, or NRCS reclamation experts would facilitate success with this important project.

**HABITAT MANAGEMENT RECOMMENDATIONS-Rock Springs BLM Field Office**

**Little Colorado Focus Area**

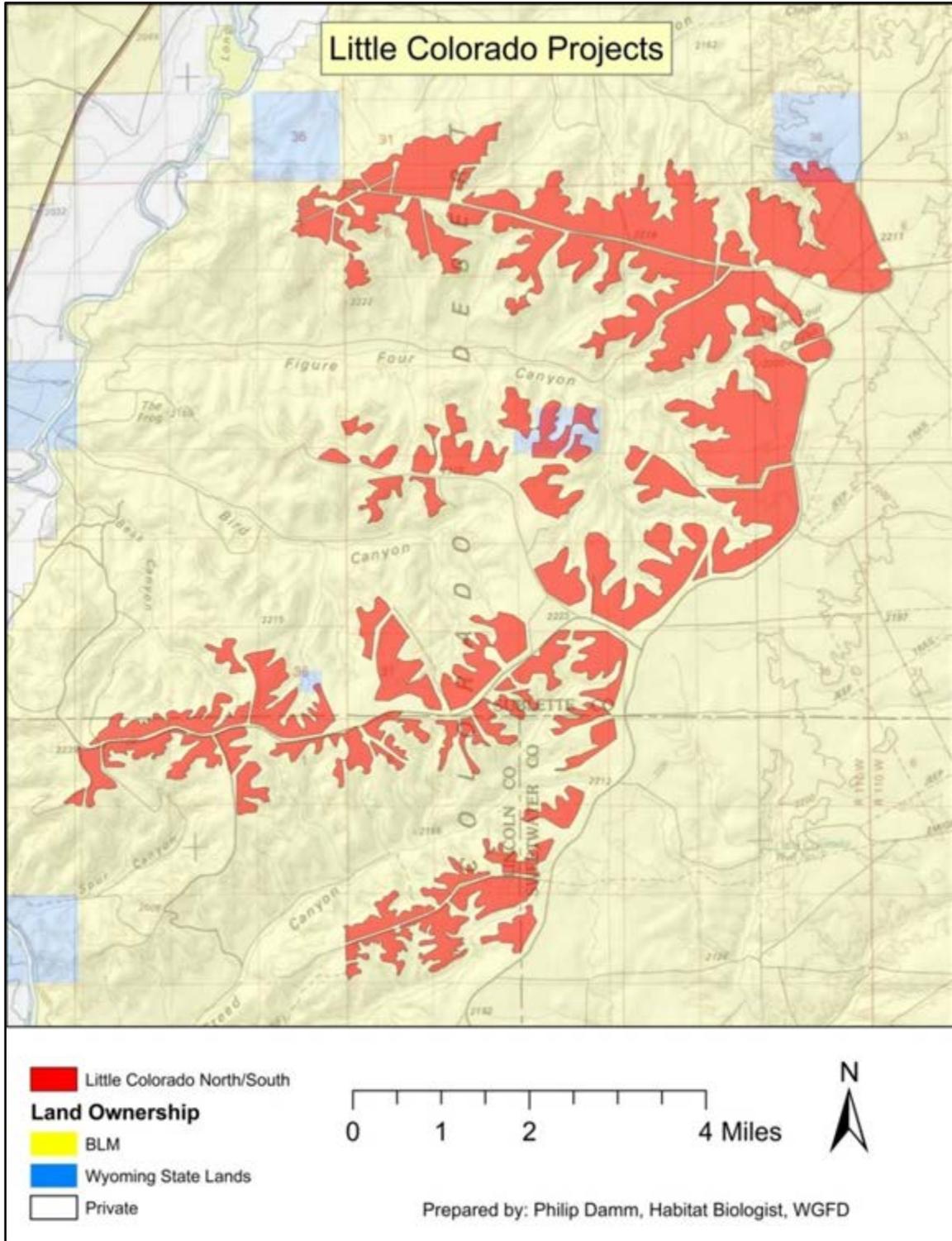


Figure 8. Little Colorado area Wyoming Range mule deer crucial winter range proposed habitat projects near LaBarge in western Wyoming.

Sagebrush community project—Little Colorado Project (9999 acres, Table 1, Figure 8, Appendix B- Figures 32 and 33)

This area is characterized by moderate density, mature Wyoming big sagebrush and large amounts of bare ground. Limited quantities of forb and grass species exist consistently across the site. Sagebrush is only moderately productive, and in many areas, is minimally productive in terms of both seed production and live canopy, likely due to a combination of use, lower amounts of precipitation, and shrub age.

Objectives:

- 1) Increase sagebrush productivity
- 2) Increase sagebrush regeneration
- 3) Increase forb species diversity and percent composition
- 4) Increase grass species diversity and percent composition

Treatment: Soil disturbing mechanical + forb seeding

Issues could surface in terms of acquiring required rest for such a large area due to grazing in a single allotment, if the project is completed in one season. However, these issues would be minimized if the project were completed across several years; grazing rest would be required for a much smaller area every two years. Also, precipitation and lower sagebrush canopy (low fuel loads) would limit use of prescribed fire in this area. In addition, care must be taken to buffer areas currently disturbed by natural gas development activities to avoid any current invasive species issues (note Figure 34 and Table 2 for cheatgrass locations). Cheatgrass was present sporadically across the project area, and halogeton was found on most all roadways. Sagebrush seeding may be necessary in areas where current seed production may limit seed dispersal and seedling establishment post treatment. A preferred alternative to seeding sagebrush would be planting potted or bare-root plants, although cost might be prohibitive in regenerating the stand by this method.

Cheatgrass/other invasives control project (Table 2, Appendix B-Figure 34)

Cheatgrass was found in relatively small patches along several roads in the Little Colorado focus area. While these patches are close to and within some of the proposed project area, they could be buffered and avoided with treatment. Although for the most part, cheatgrass within the focus area does not pose a serious threat to completing project objectives, it should be considered a priority to monitor and control these patches while they remain relatively small. If this species were allowed to proliferate, it has potential to overtake the steeper, mixed-mountain shrub slopes that mule deer tend to favor in this area.

Halogeton was found along most all roads and other soil-disturbed, developed areas. Although this plant is widespread, it should be relatively easy to control in the Little Colorado because of its roadside location.

## PROJECT IMPLEMENTATION

The next steps require BLM and WGFD personnel to work with grazing permittees to solidify livestock rest logistics (Appendix C). Sorting out multiple uses on federal land is always challenging. In no way does WGFD intend to cause undue hardship on permitted livestock operations through this proposal to implement treatments, nor should implementation of these treatments result in increases of AUMs. The proposed habitat treatments should result in improvement in overall rangeland health and generate improved foraging conditions for both wildlife and livestock. Mechanical, Spike and re-seeding treatments will require two years of rest after implementation, and prescribed fires may require a year of rest prior to treatment as well as two years post-implementation for optimal results. The *Protocols for Treating Sagebrush to be Consistent with Wyoming Executive Order 2011-5* (WGFD 2011b) will need to be followed for both Core and non-Core Areas occupied by sage grouse.

National Environmental Policy Act work will need to be completed for these recommended treatments including cultural, threatenend and endangered species, other environmental considerations, and potential social and economic factors. Due to current work loads and other priorities within the federal land management agencies, much of the work could be contracted to the private sector to assemble the required information, including assessing environmental impacts and drafting alternatives for an Environmental Assessment. Fortunately some funding has already been secured to initiate this process. The next step prior to treatment requires pre- and post-treatment monitoring points to be established and read in addition to controls. Fortunately, many permanent transects are already located within many project areas from TSS's efforts, but undoubtedly, additional sites will need to be established. This monitoring effort may exceed the time availability of WGFD and federal land management agencies, so it may also need to be contracted to the private sector over the next 10-20 years. Monitoring methodology should be consistent with locally established methods in order for data to be comparable between historic treatments.

Implementation of treatments will involve a wide variety of tools, selected specifically for site-specific conditions and objectives. Additional funding will be required for implementation with potential sources including Wyoming Wildlife Natural Resource Trust Fund, Wyoming Landscape Conservation Initiative, WGFD Trust Fund, and many others. Costs per acre will vary greatly between different tools and who is conducting the work. Both Pinedale BLM and WGFD have a tractor with mower and WGFD also has implements such as Lawson aerator, pitter, Dixie harrow, and Truax drill seeder. Utilizing these resources should keep mechanical implementation costs under \$25/acre. Spike projects will require chemical to be purchased as well as contracting the aerial application, totaling approximately \$30-50/acre. Prescribed fire costs are highly variable and are based on adjacent fuel types and proximity to private land or energy development. The implementation range will be \$60-100/acre for shrub-dominated communities and up to \$130/acre for aspen communities. Aspen communities may require conifer slash work which could cost up to \$300/acre as well. In general, treating greater acreage at once will keep cost/acre at a minimum. Opportunities may also be available to partner with energy companies in the LaBarge area for mechanical treatments or enhanced reclamation project work.

Implementation of these projects on a landscape scale will enhance the long-term quality of habitat for mule deer. As with many treatments, immediate vegetation response may temporarily decrease quantity of sagebrush available to deer in winter months, but those short-term impacts are greatly off-set by long term benefits to species composition, vigor of the stand and forage quality for many years in the future.

**APPENDIX A-Tables**

Table 1. Proposed habitat enhancement projects for Wyoming Range mule deer crucial winter ranges near LaBarge and Big Piney in western Wyoming. Pertinent Teton Science School (TSS) habitat assessment information is noted including management recommendations and photo-point and transect numbers. Shrubs, forbs, and grass are listed using USDA plant symbols (USDA – NRCS 2012) and include ones observed frequently in each project area. Objectives for each plant form are listed (prod.=productivity; regen.=regeneration; div.=diversity; comp.=composition). Under Treatment, ‘\_soil disturbance’ indicates a mechanical implement used to kill sagebrush that also disturbs the soil. Reference Table 3 for species symbols and common and scientific names.

Project	Acres	TSS recommendation	TSS photo-point	TSS transect	Shrub	Forb	Grass
<b>DEER HILLS</b>	5072						
Deer Hills Willows	1153	Reaffirm seasonal closures	DH-012A-NW-NF	none	SALIX		
NE Deer Hills	946	Reaffirm seasonal closures	DH-019B-NE-NB, DH-019A-N-ND	DH-TR002	ARTRW8-CHVI8	ERIOG-TOLY	PASM-POA
SE Deer Hills 1	783	Reaffirm seasonal closures	DH-019D-NW-ND	none	ARTRW8	ERIOG-TOLY-PHHO	POA-PASM
SE Deer Hills 2	417	No action	none	none	ARTRW8-CHVI8	CORDY-PHHO-TOLY	PASM
W Deer Hills 1	141	Reaffirm seasonal closures	DH-012A-W-ND	see W Deer Hills 3	ARTRW8	CORDY-ERIOG-TOLY	POA-PASM
W Deer Hills 2	158	Reaffirm seasonal closures	DH-012A-W-ND	see W Deer Hills 3	ARTRW8	ERIOG	POA
W Deer Hills 3	249	No action	DH-012A-W-ND	DH-TR001	ARTRW8	ERIOG-CORDY	POA-PASM
W Deer Hills 4	1225	Evaluate grazing practices	DH-001A-E-NF	none	ARTRW8	ERIOG-CORDY-PHHO-TOLY	POA
<b>CHIMNEY BUTTE</b>	11118						
Big Piney NW and SE	4047	Reseeding	CB-005D-S-PA, CB-005H-NW-ND, CB-005C-S-ND	CB-TR006	ARTRW8	PHHO	PASM
Highway 189	922	Reseeding	CB-005E-SW-ND	none	ARTRW8-CHVI8	PHHO-TOLY	HECO26-PASM
Three Buttes	84	Evaluate grazing practices	none	none	ARTRW8	PHHO-TOLY	POA
Three Buttes Fertilizer	6065	Evaluate grazing practices	HB-039B-N-ND, HB-38A-SW-ND	HB-TR-017	ARTRW8-CHVI8-CEMO2	ERIOG-TOLY	POA--PASM
<b>BIG MESA</b>	1165						
Big/Little Mesa	547	Evaluate grazing practices	BN-007B-SW-ND	none	ARTRW8	CORDY-PHHO	PASM
Chappell Creek	391	Evaluate grazing practices	BN-009B-W-PA, BN-TR004W	BN-TR004	ARTRW8	CORDY-PHHO-TOLY	POA-PASM
Little Mesa Bowls	73	Evaluate grazing practices	BN-TR005S, BN-003D-S-PA	none	ARTRW8	PHHO	POA-ELEL5-ACHY
Red Hill	154	Evaluate grazing practices	none	none	ARTRW8	PHHO	POA-ACHY
Drift Fence Pilot	57	Evaluate grazing practices	HB-004A-SE-ND, HB-034A-S-PA	HB-TR009	CEMO2-ARNO4	PHHO-ERIOG	PASM
<b>SOUTH LABARGE</b>	1777						
LaBarge Bottoms	310	Mechanical thinning	MC-004A, MC-004E-E, MC-004D-N	none	ARTRW8-CHVI8-KRLA2	PHHO-CORDY	POA-PASM
LaBarge Bowls 1	151	Mechanical thinning	MC-023L-S, MC-027E-NE, MC-027C-E, MC-027B-NE	none	ARTRW8-CHVI8	CORDY	PASM
LaBarge Bowls 2	363	Mechanical thinning	MC-023L-S, MC-027E-NE, MC-027C-E, MC-027B-NE	none	ARTRW8-CHVI8	PHHO-CORDY	POA
LaBarge Mesas 1	643	Mechanical thinning	MC-006A-W, MC-006B-E, MC-006C-E	none	ARTRW8	PHHO-CORDY-TOLY	PASM-POA-ACHY
LaBarge Mesas 2	238	Evaluate wildlife browsing	MC-008A-S, MC-TR015N, MC-TR015W	MC-TR015	ARTRW8	PHHO	ACHY-POA
LaBarge Mesas 3	72	Mechanical thinning	MC-003D-W	MC-TR011	ARTRW8	PHHO-ERIOG	POA
<b>LITTLE COLORADO</b>	9999	Mechanical thinning	LC-001D-S-LD	LC-TR005, 6, 10	ARTRW8	PHHO	ACHY-PASM

Table 1 (continued)

Project	Shrub objective(s)	Forb objective(s)	Grass objective(s)	Treatment	Core area	Land ownership	Allotment(s)
<b>DEER HILLS</b>							
Deer Hills Willows	Inc. SALIX prod. and regen.			fencing	y	BLM, private	McNinch Deer Hill; Guio Sections Ind.; Deer Hills Ind.; West of Ranch Ind.
NE Deer Hills	Inc. ARTRW8 prod.; release younger ARTRW8	Inc. forb % comp.	Inc. grass div.	mowing	y	BLM, private	Deer Hills Ind.; McNinch Deer Hill; West of Ranch Ind.
SE Deer Hills 1	Inc. ARTRW8 prod. and regen.	Inc. forb div. and % comp.	Inc. grass div. and % comp.	soil disturbance+seeding	n	BLM, WY	West of Ranch Ind.; Deer Hills Com.
SE Deer Hills 2	Release younger ARTRW8	Inc. forb % comp.	Inc. grass div. and % comp.	Spike	n	BLM, WY, private	Spence Place Ind.; Deer Hills Com.
W Deer Hills 1	Inc. ARTRW8 prod. and regen.; inc. PUTR2 % comp.	Inc. forb % comp.		Spike	y	BLM	Deer Hills Ind.
W Deer Hills 2	Inc. ARTRW8 prod. and regen.	Inc. forb % comp.	Inc. grass div. and % comp.	Spike	n	BLM, private	Deer Hills Ind.; Johnson Ridge Ind.; D Budd Deer Hill
W Deer Hills 3	Inc. ARTRW8 prod. and regen.; inc. PUTR2 % comp.			Spike	y	BLM, private	Guio Sections Ind.
W Deer Hills 4	Inc. ARTRW8 prod. and regen.	Inc. forb % comp.		Spike	n	BLM, private	Johnson Ridge Ind.; D Budd Deer Hill; Piney Unit Fenced
<b>CHIMNEY BUTTE</b>							
Big Piney NW and SE	Inc. ARTRW8 prod.; release younger ARTRW8	Inc. forb div. and % comp.	Inc. grass % comp.	soil disturbance+seeding	n	BLM, WY, private	Oneil Ind.; N. LaBarge Com.
Highway 189	Inc. ARTRW8 prod. and regen.	Inc. forb div. and % comp.		soil disturbance+seeding	n	BLM, private	N. LaBarge Com.
Three Buttes	Inc. ARTRW8 prod. and regen.	Inc. forb div.	Inc. grass div.	Spike	n	BLM, WY	LaBarge Unit Ind.; N. LaBarge Com.
Three Buttes Fertilizer	Inc. shrub prod.	Inc. forb prod.	Inc. grass prod.	fertilizer	n	BLM, WY	N. LaBarge Com.; Beaver Cr. Meadow Ind.; Beaver Cr. Ind.; LaBarge Unit Ind.; S. Piney Ind.
<b>BIG MESA</b>							
Big/Little Mesa	Release younger ARTRW8	Inc. forb div. and % comp.	Inc. grass div. and % comp.	mowing	n	BLM, WY	N. LaBarge Com.
Chappell Creek	Inc. ARTRW8 regen.	Inc. forb div. and % comp.	Inc. grass div.	Spike	n	BLM	N. LaBarge Com.
Little Mesa Bowls	Inc. ARTRW8 prod. and regen.	Inc. forb % comp.	Inc. grass % comp.	Spike	n	BLM	N. LaBarge Com.
Red Hill	Inc. ARTRW8 prod. and regen.	Inc. forb % comp.	Inc. grass % comp.	soil disturbance	n	BLM, private	N. LaBarge Com.
Drift Fence Pilot	Inc. CEMO2 prod. and regen.			drift fencing	n	BLM	N. LaBarge Com.
<b>SOUTH LABARGE</b>							
LaBarge Bottoms	Release younger ARTRW8	Inc. forb div. and % comp.	Inc. grass % comp.	soil disturbance+seeding	n	BLM, private	LaBarge Creek Ranch Ind.; S. LaBarge Com.
LaBarge Bowls 1	Inc. ARTRW8 prod. and regen.; inc. PUTR2 % comp.	Inc. forb div. and % comp.	Inc. grass div. and % comp.	Spike	n	BLM	S. LaBarge Com.
LaBarge Bowls 2	Inc. ARTRW8 prod. and regen.	Inc. forb div. and % comp.	Inc. grass div. and % comp.	Spike	y	BLM	S. LaBarge Com.
LaBarge Mesas 1	Inc. ARTRW8 prod. and regen.	Inc. forb % comp.	Inc. grass % comp.	soil disturbance	n	BLM, WY	Eubank S. LaBarge Ind.; S. LaBarge Com.
LaBarge Mesas 2	Inc. ARTRW8 prod.; release younger ARTRW8	Inc. forb div. and % comp.	Inc. grass div. and % comp.	Spike	n	BLM	S. LaBarge Com.
LaBarge Mesas 3	Inc. ARTRW8 prod. and regen.	Inc. forb % comp.		soil disturbance	n	BLM	S. LaBarge Com.
<b>LITTLE COLORADO</b>	Inc. ARTRW8 prod. and regen.	Inc. forb div. and % comp.	Inc. grass div. and % comp.	soil disturbance+seeding	n	BLM, WY	Figure Four (Rock Springs)

Table 2. Cheatgrass (*Bromus tectorum*) patches located during summer 2011 Wyoming Range mule deer habitat project planning activities near LaBarge and Big Piney in western Wyoming. Coordinates are NAD83, Zone 12. Note: cheatgrass locations from LaBarge Creek Road were omitted for brevity (Figure 27).

<u>Northing</u>	<u>Easting</u>	<u>Northing</u>	<u>Easting</u>	<u>Northing</u>	<u>Easting</u>
4673526	545698	4676557	549948	4661519	551843
4677410	547596	4676559	549988	4667515	556557
4677108	547824	4665245	550081	4676695	557104
4676932	547901	4665218	550117	4676693	557152
4676870	547958	4665178	550167	4674659	557450
4676859	547976	4665125	550219	4679132	557928
4676856	548028	4676604	550187	4679513	558076
4676862	548059	4676613	550221	4678128	558177
4676883	548106	4676621	550251	4679672	558385
4676901	548128	4676665	550304	4675349	558783
4669732	548271	4676698	550393	4679030	560701
4676985	548231	4676696	550434	4677267	561686
4677144	548325	4664953	550540	4677476	562084
4677195	548352	4676708	550491	4717928	557405
4676908	548735	4664873	550587	4682605	578405
4676848	548761	4664717	550640	4683743	578103
4676826	548772	4663263	550986	4681674	578580
4665320	549832	4663665	551063	4681180	580132
4665321	549848	4665331	551568	4680386	579938
4665323	549881	4665846	551662	4678567	579340
4676558	549928	4666191	551714	4677113	576911
4665286	550020	4665563	551725	4690333	559096

Table 3. Common and scientific names and plant species codes (USDA–NRCS 2012) for species used within Table 1.

<b>Common name</b>	<b>Plant symbol</b>	<b>Scientific name</b>
Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>
Black sagebrush	ARNO4	<i>Artemisia nova</i>
Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata wyomingensis</i>
True mountain mahogany	CEMO2	<i>Cercocarpus montanus</i>
Green rabbitbrush	CHVI8	<i>Chrisothamnus viscidiflorus</i>
Bird's beak	CORDY	<i>Cordylanthus ramosus</i>
Squirreltail	ELEL5	<i>Elymus elymoides</i>
Buckwheat spp.	ERIOG	<i>Eriogonum spp.</i>
Needle and thread	HECO26	<i>Hesperostipa comata</i>
Winterfat	KRLA2	<i>Krascheninnikovia lanata</i>
Western wheatgrass	PASM	<i>Pascopyrum smithii</i>
Phlox	PHHO	<i>Phlox hoodii</i>
Bluegrass	POA	<i>Poa spp.</i>
Willow spp.	SALIX	<i>Salix spp.</i>
Lyall's goldenweed	TOLY	<i>Tonestus lyalli</i>

## APPENDIX B-Individual project maps

### Deer Hills Focus Area sagebrush projects

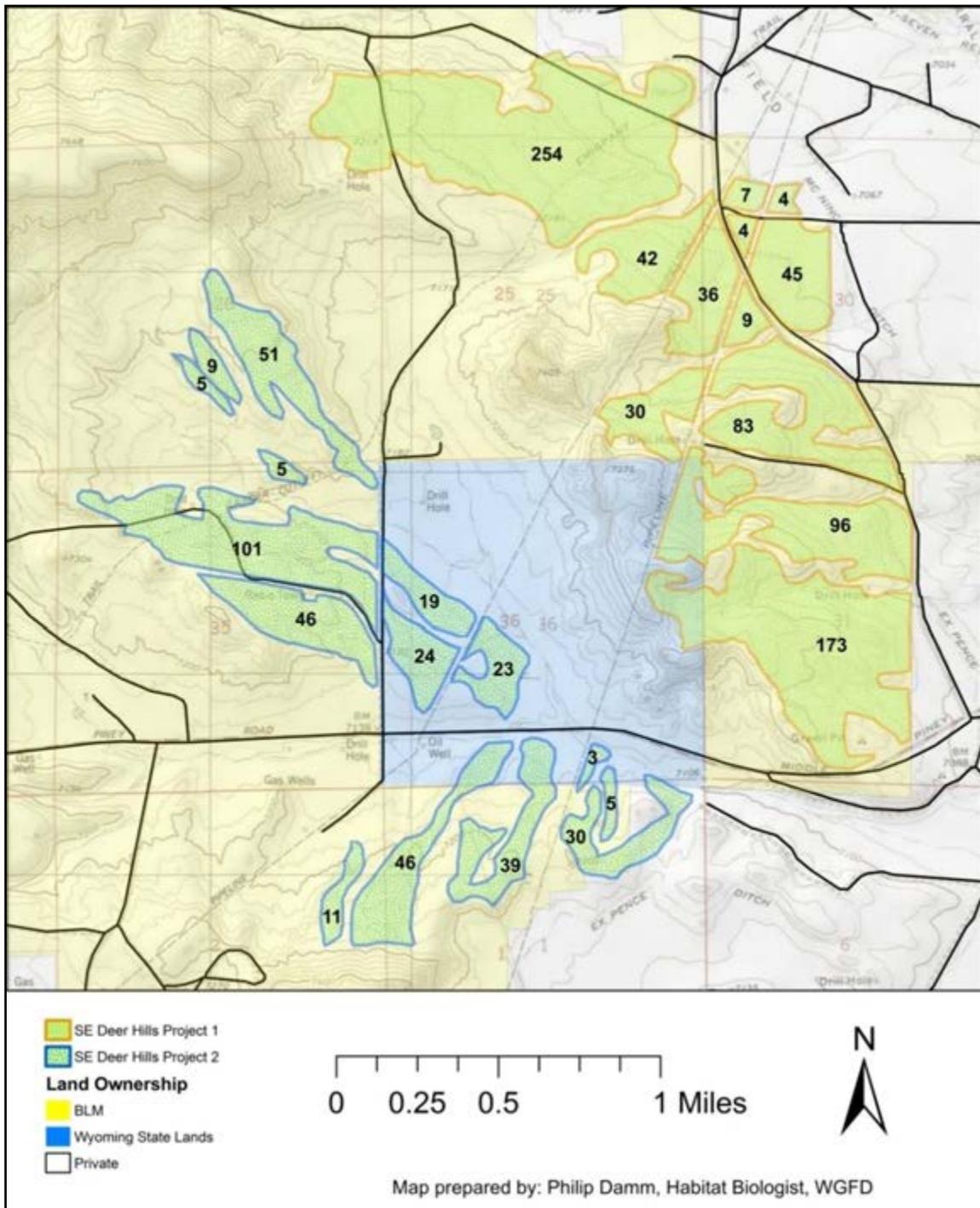


Figure 9. Southeast Deer Hills Project located within Deer Hills area of Wyoming Range mule deer crucial winter range near Big Piney in western Wyoming. Number labels indicate acreage for the respective polygon.

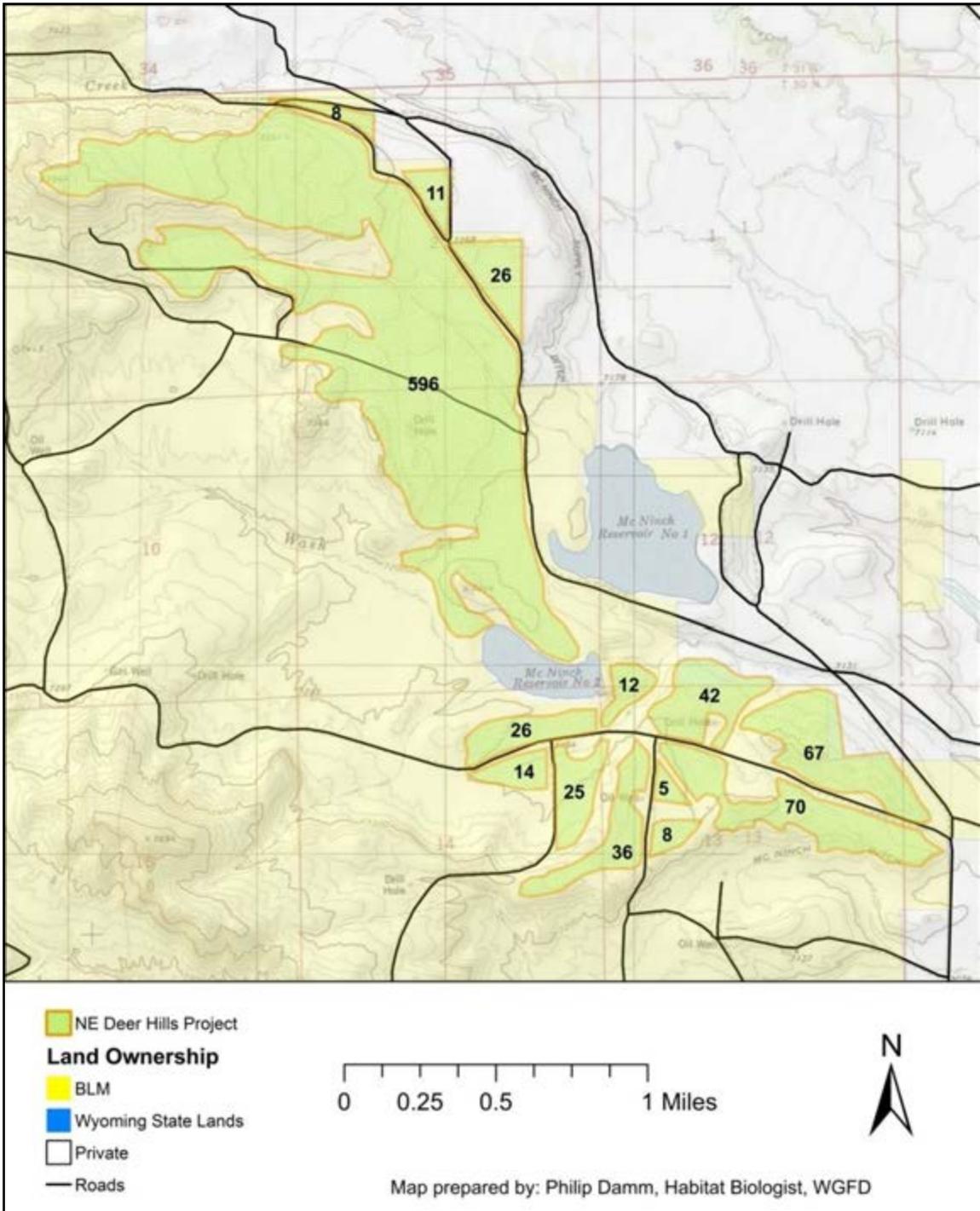


Figure 10. Northeast Deer Hills Project located within Deer Hills area of Wyoming Range mule deer crucial winter range near Big Piney in western Wyoming. Number labels indicate acreage for the respective polygon.

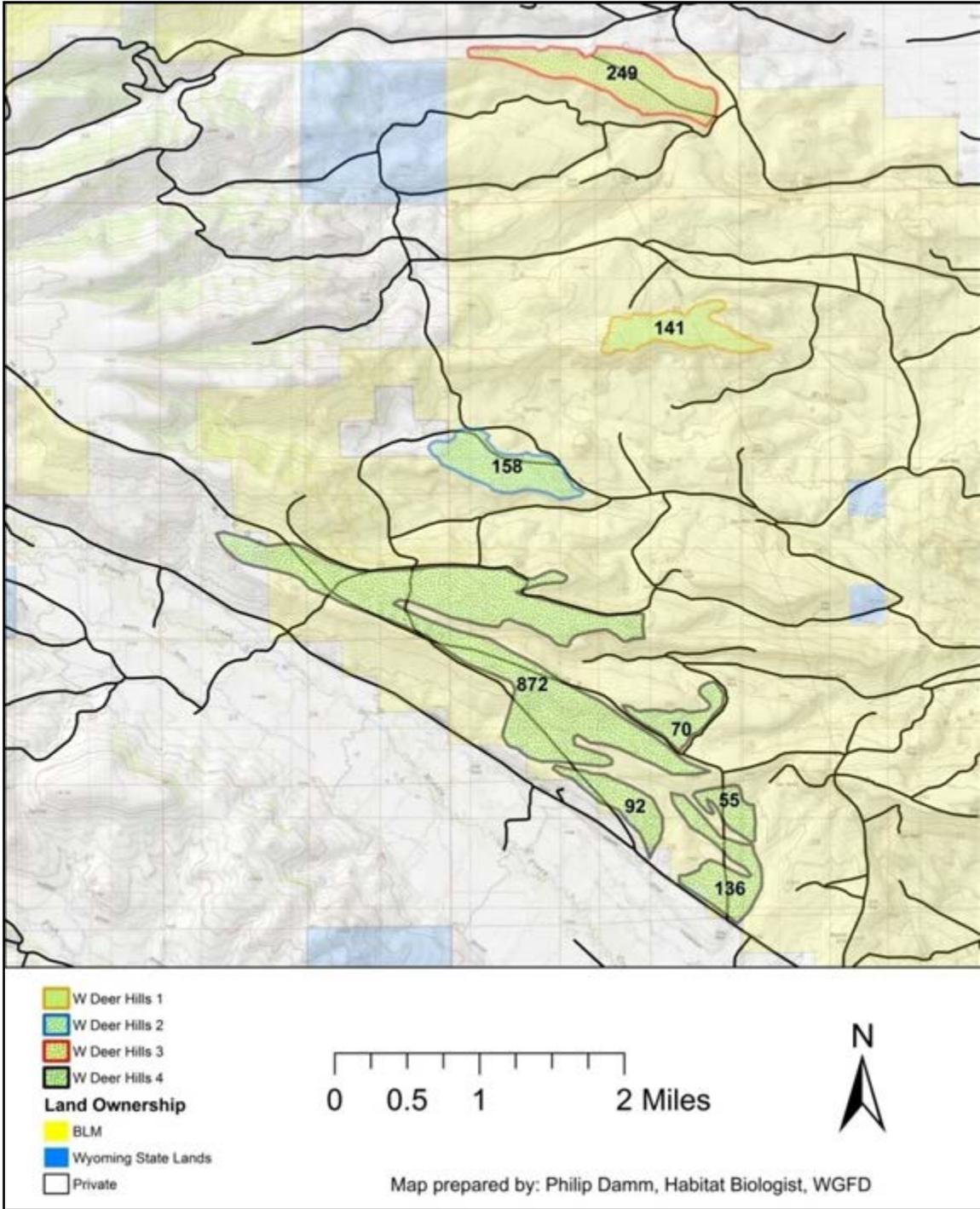


Figure 11. West Deer Hills Project located within Deer Hills area of Wyoming Range mule deer crucial winter range near Big Piney in western Wyoming. Number labels indicate acreage for the respective polygon.

Chimney Butte Focus Area sagebrush projects

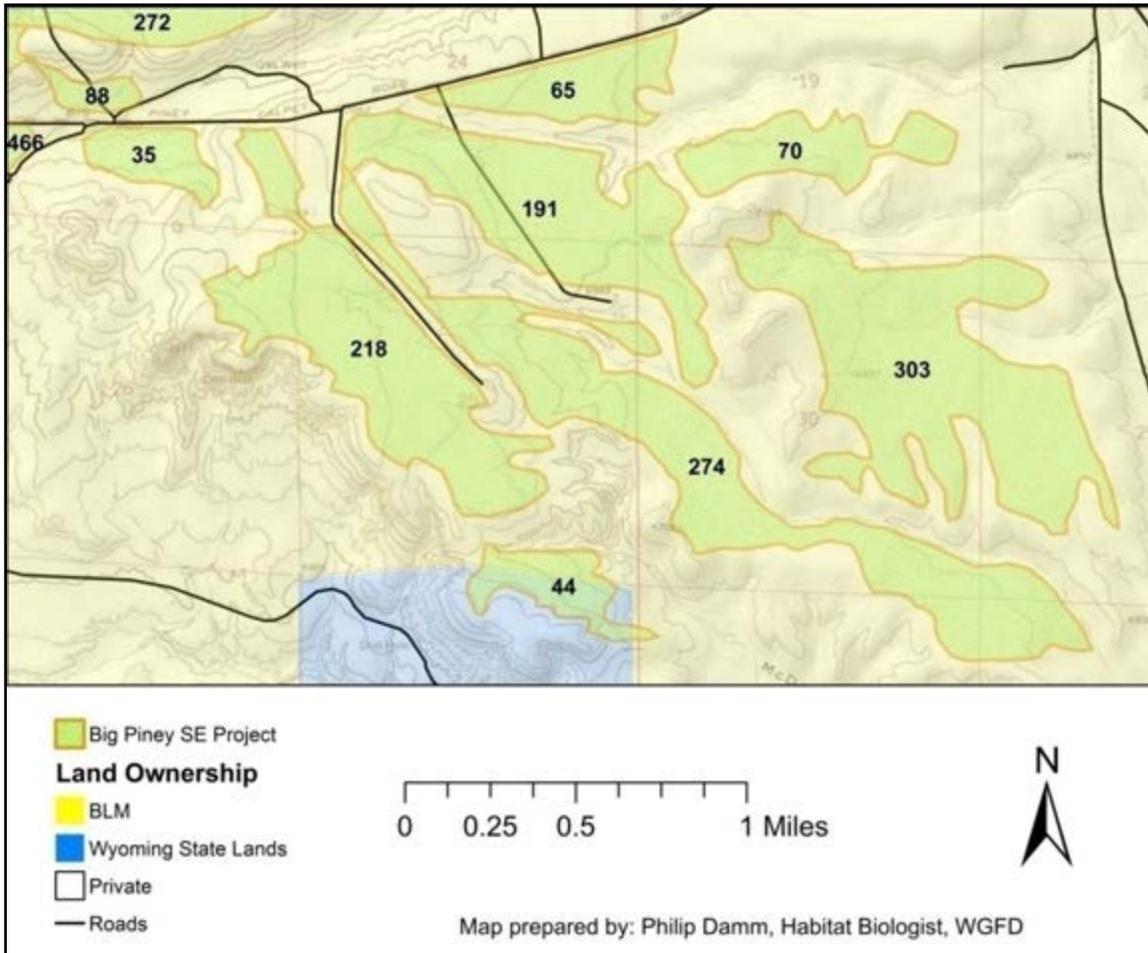


Figure 12. Southeastern portion of the Big Piney Project located within Chimney Butte area of Wyoming Range mule deer crucial winter range near Big Piney in western Wyoming. Number labels indicate acreage for the respective polygon.

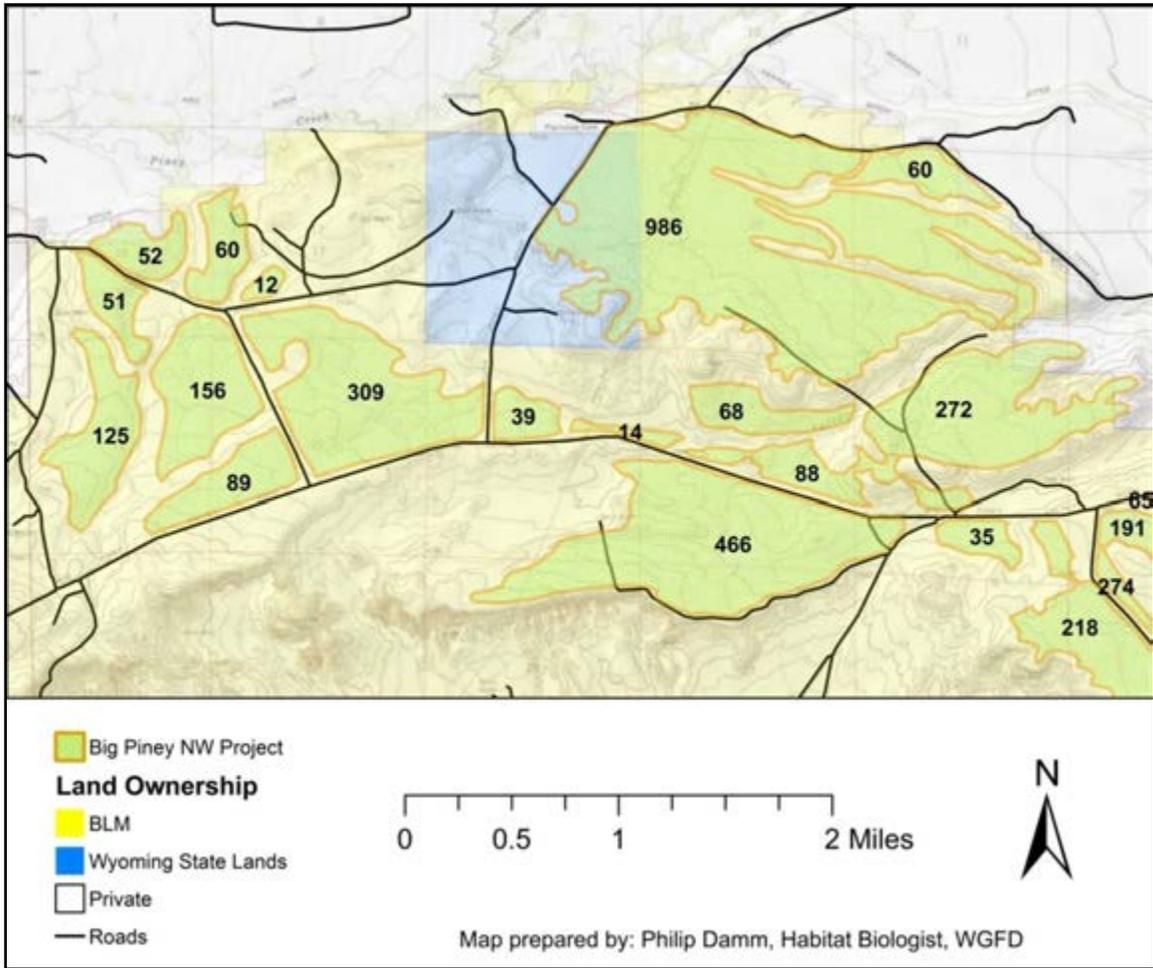


Figure 13. Northwestern portion of the Big Piney Project located within Chimney Butte area of Wyoming Range mule deer crucial winter range near Big Piney in western Wyoming. Number labels indicate acreage for the respective polygon.

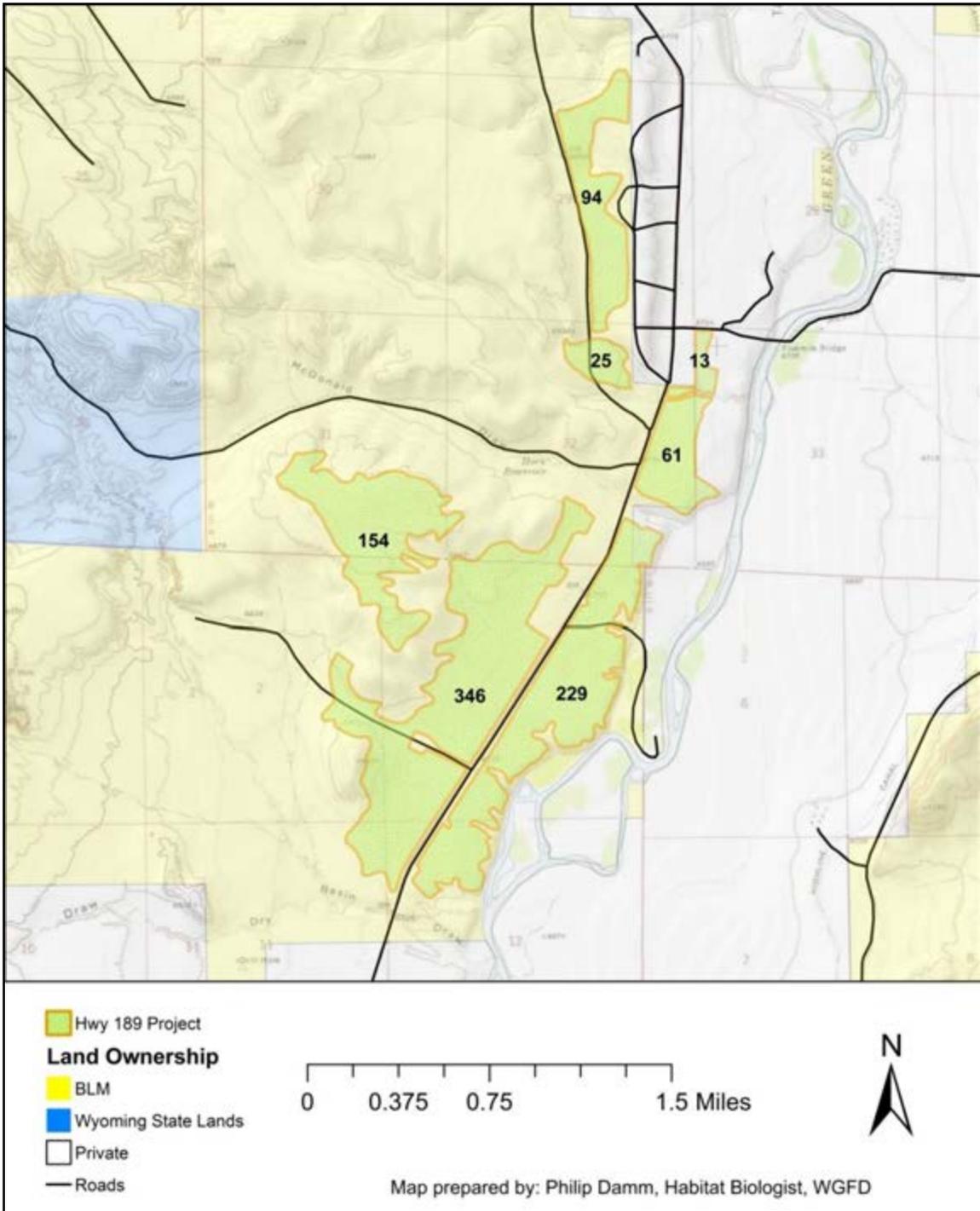


Figure 14. Highway 189 Project located within Chimney Butte area of Wyoming Range mule deer crucial winter range near Big Piney in western Wyoming. Number labels indicate acreage for the respective polygon.

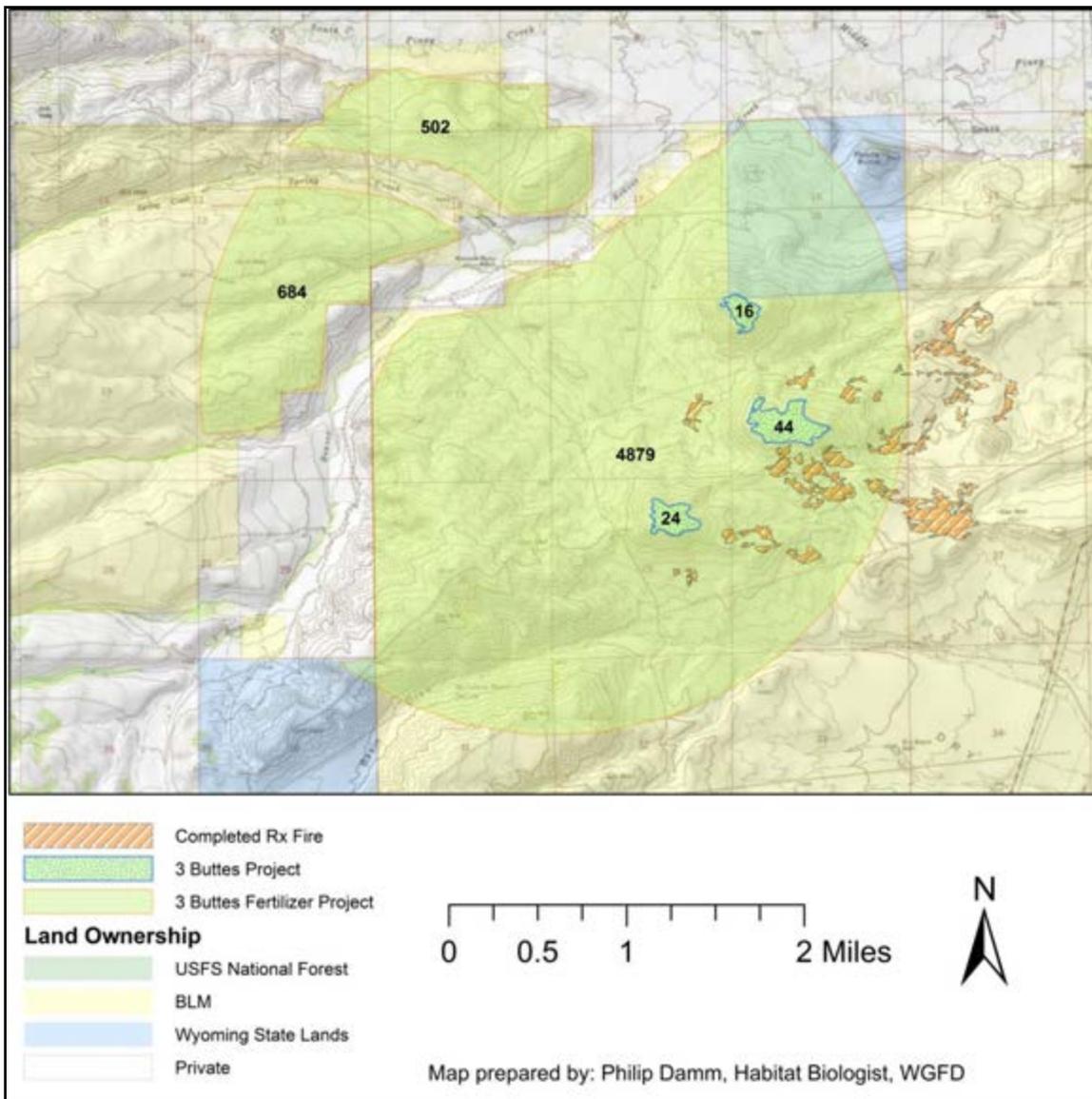


Figure 15. Three Buttes Projects located within Chimney Butte area of Wyoming Range mule deer and elk crucial winter range near Big Piney in western Wyoming. Number labels indicate acreage for the respective polygon.

Big Mesa Focus Area sagebrush projects

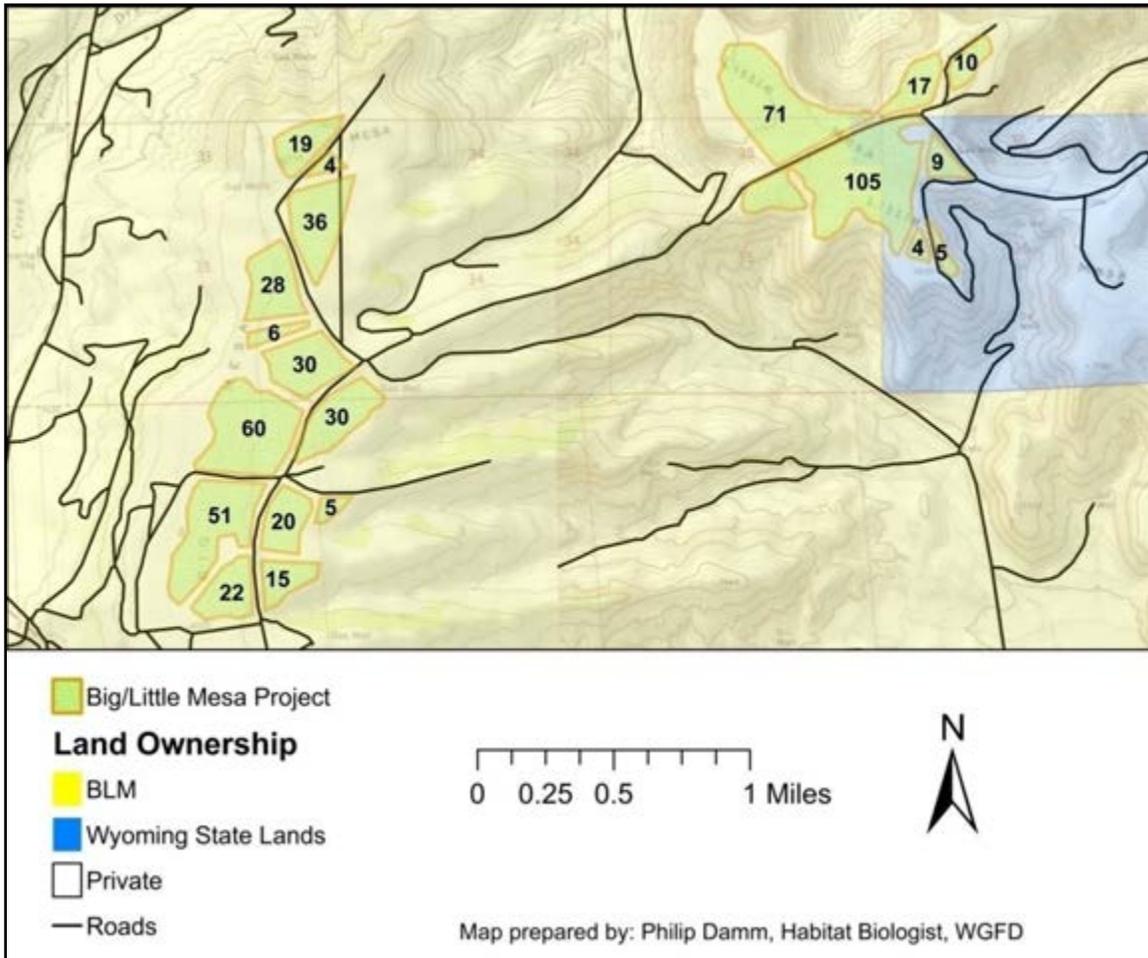


Figure 16. Big and Little Mesa Project located within Big Mesa area of Wyoming Range mule deer crucial winter range near Big Piney in western Wyoming. Number labels indicate acreage for the respective polygon.

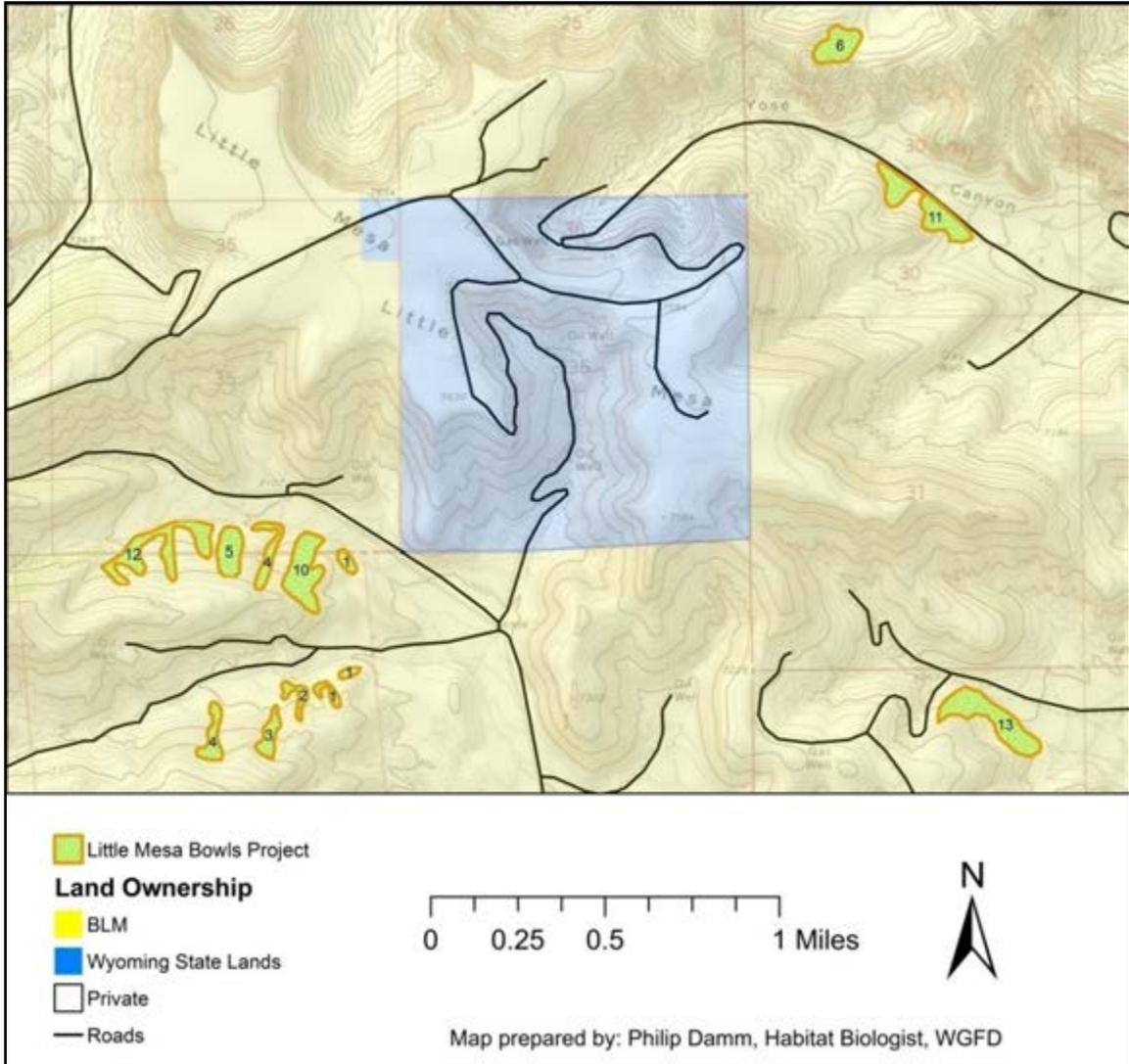


Figure 17. Little Mesa BOWls Project located within Big Mesa area of Wyoming Range mule deer crucial winter range near Big Piney in western Wyoming. Number labels indicate acreage for the respective polygon.

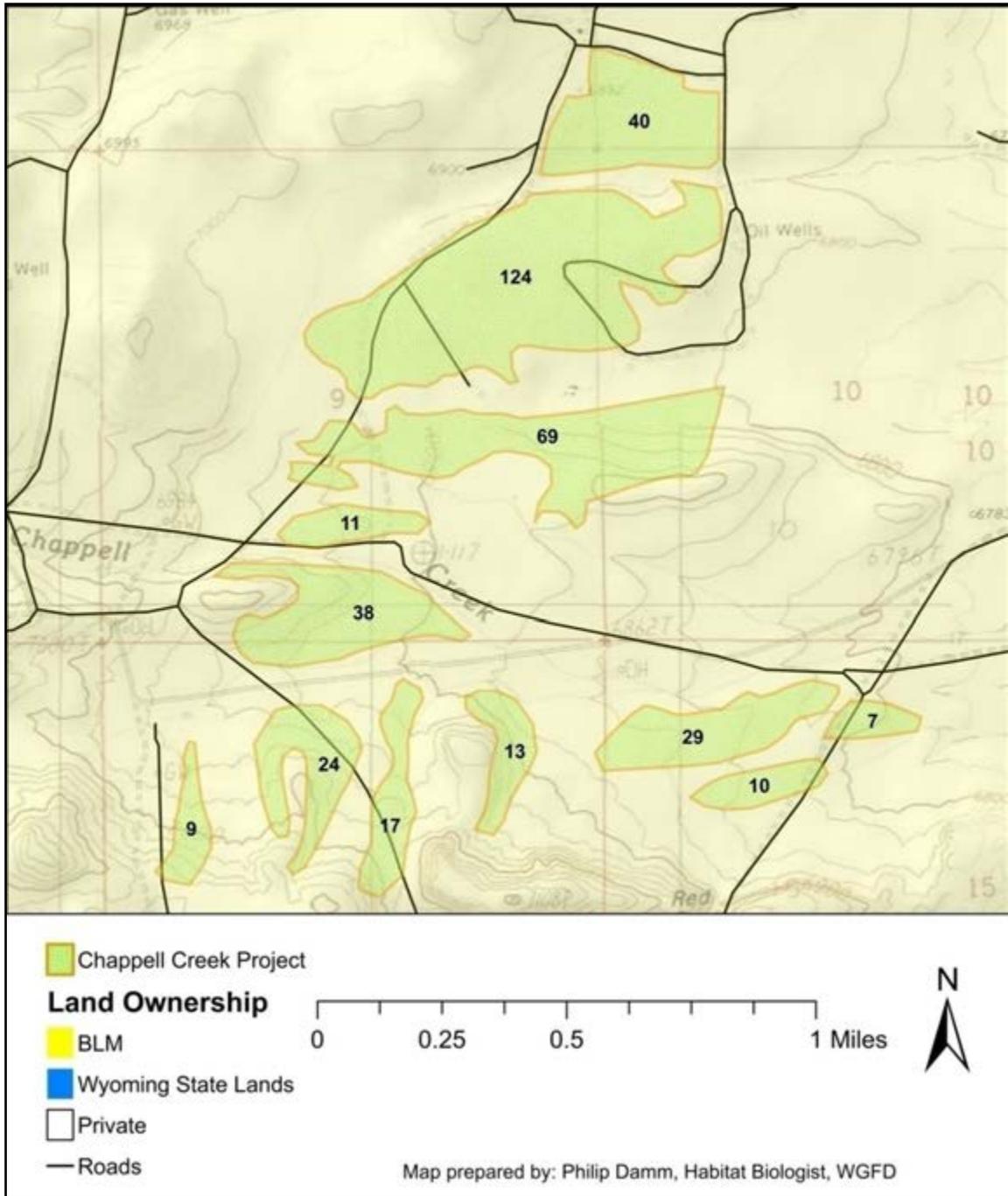


Figure 18. Chappell Creek Project located within Big Mesa area of Wyoming Range mule deer crucial winter range near LaBarge in western Wyoming. Number labels indicate acreage for the respective polygon.

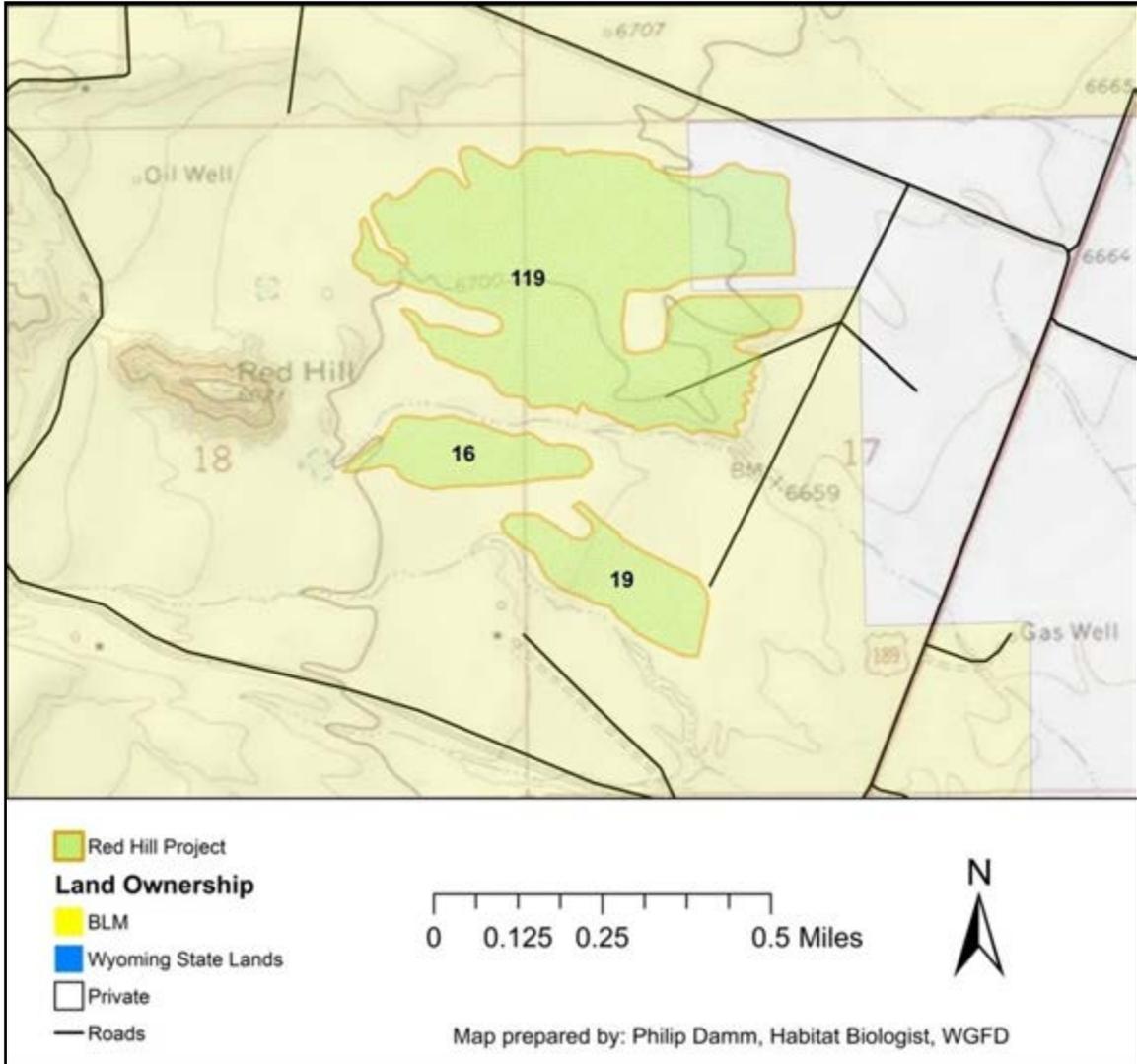


Figure 19. Red Hill Project located within Big Mesa area of Wyoming Range mule deer crucial winter range near LaBarge in western Wyoming. Number labels indicate acreage for the respective polygon.

South LaBarge Focus Area sagebrush projects

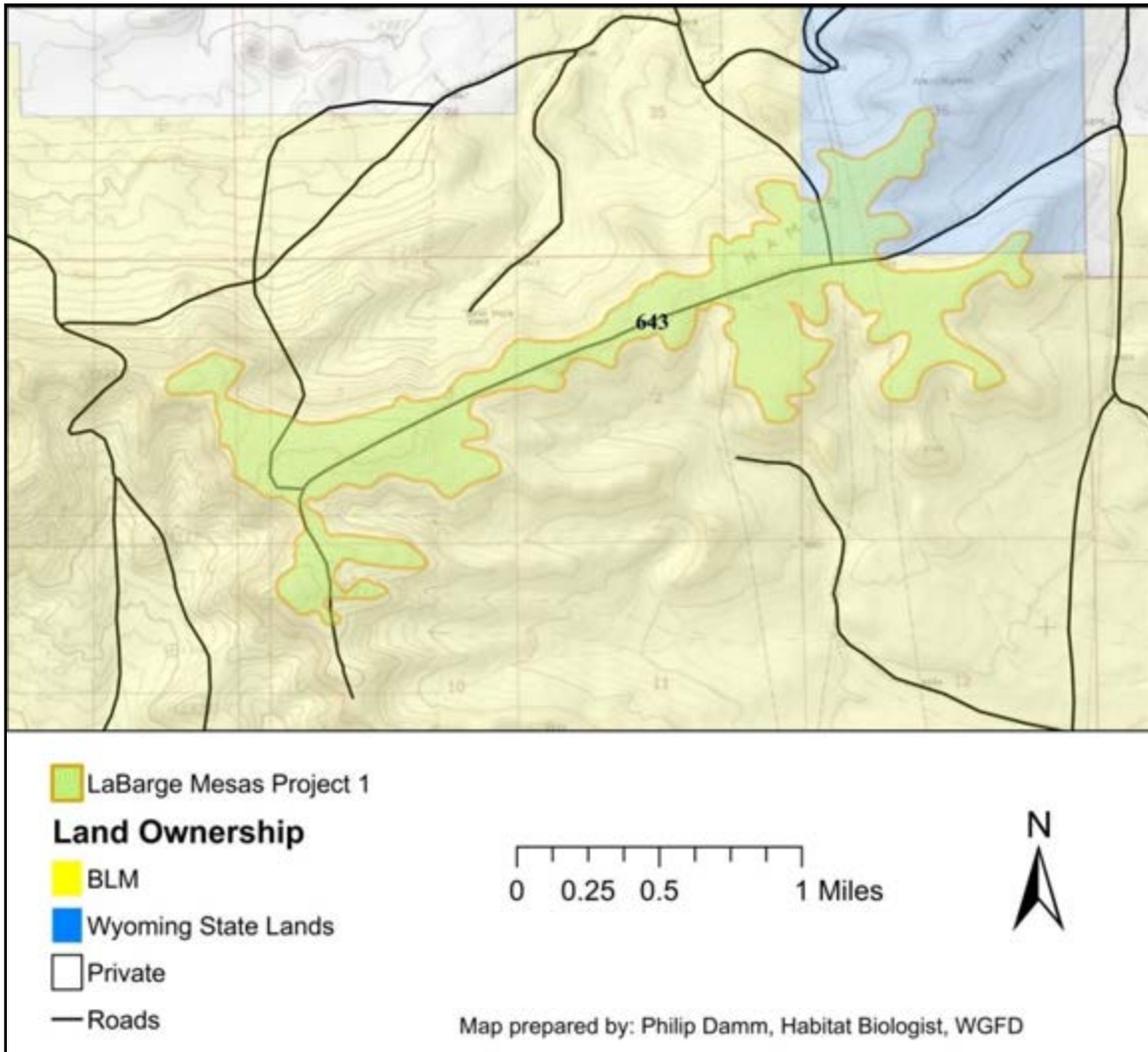


Figure 20. LaBarge Mesas Project 1 located within South LaBarge area of Wyoming Range mule deer crucial winter range near LaBarge in western Wyoming. Number labels indicate acreage for the respective polygon.

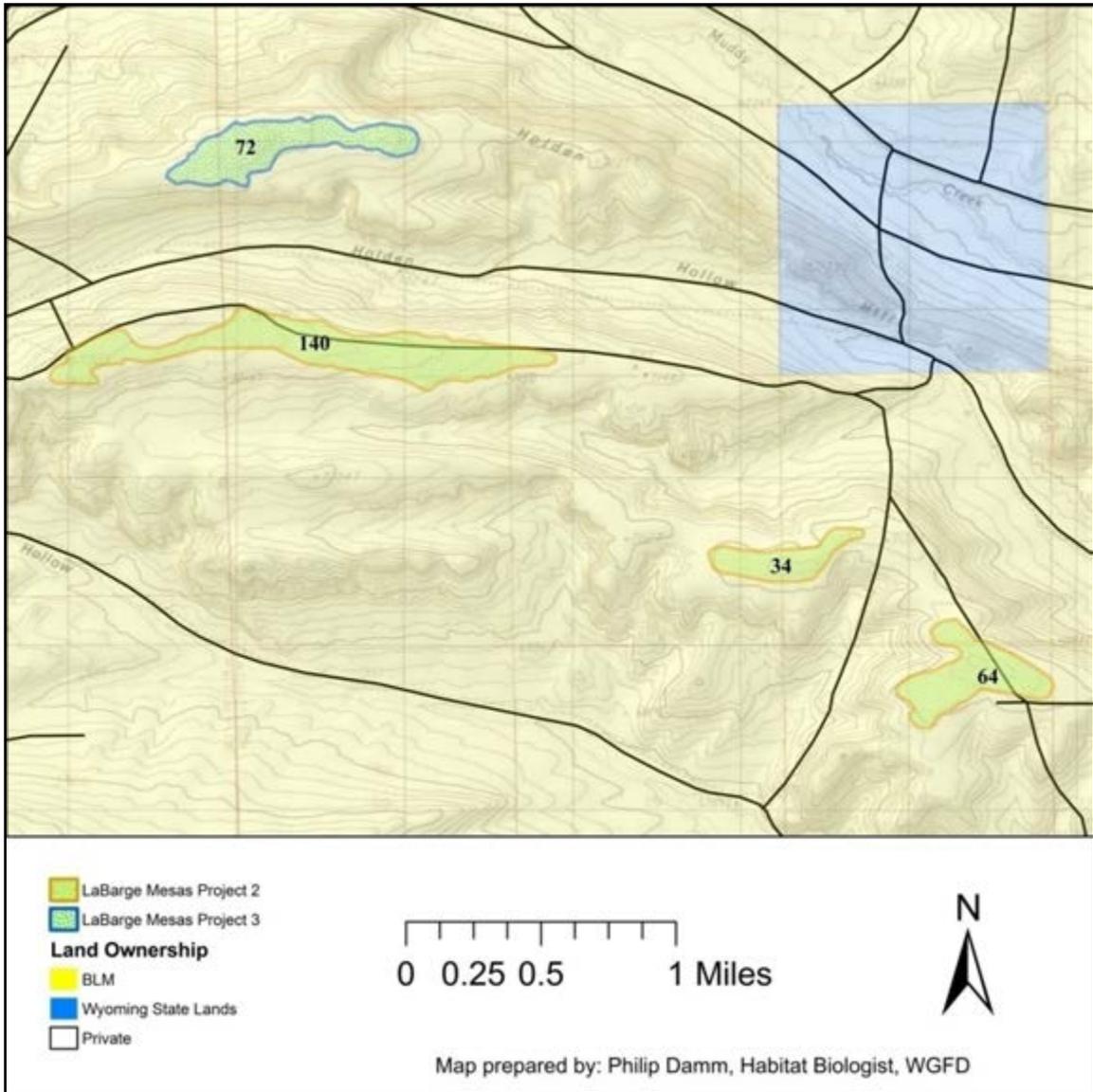


Figure 21. LaBarge Mesas Project 2 and 3 located within South LaBarge area of Wyoming Range mule deer crucial winter range near LaBarge in western Wyoming. Number labels indicate acreage for the respective polygon.

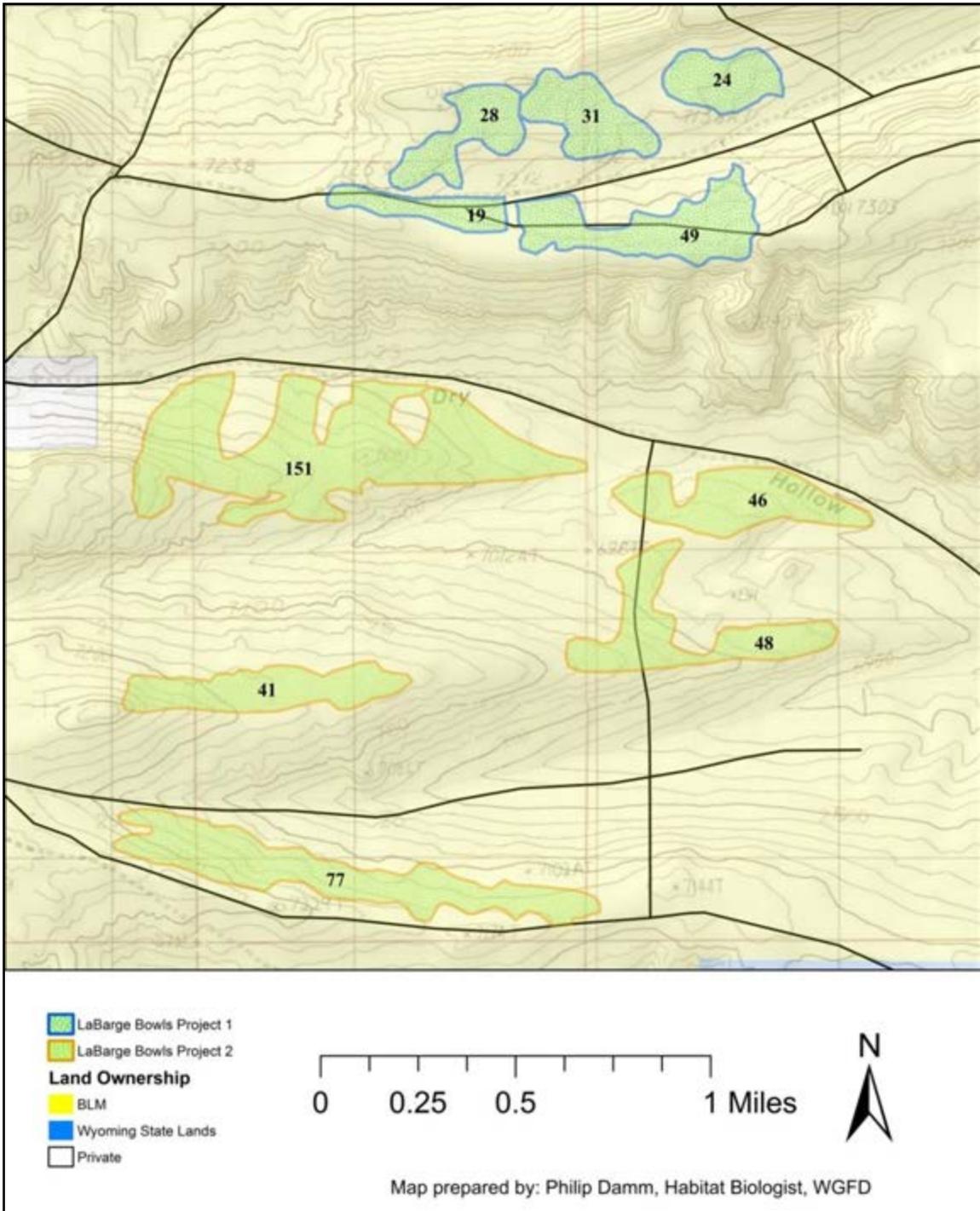


Figure 22. LaBarge Bows Project located within South LaBarge area of Wyoming Range mule deer crucial winter range near LaBarge in western Wyoming. Number labels indicate acreage for the respective polygon.

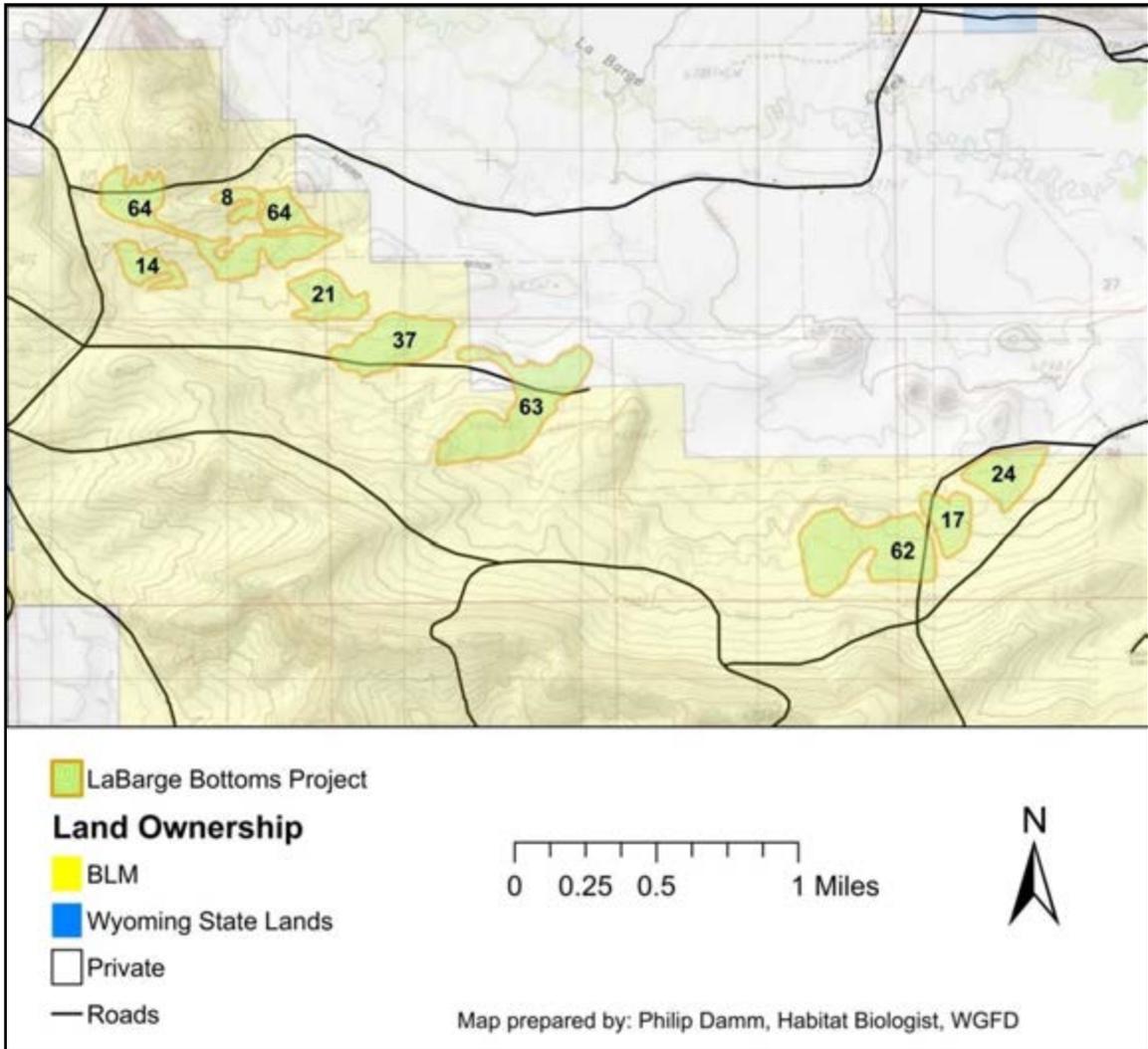


Figure 23. LaBarge Bottoms Project located within South LaBarge area of Wyoming Range mule deer crucial winter range near LaBarge in western Wyoming. Number labels indicate acreage for the respective polygon.

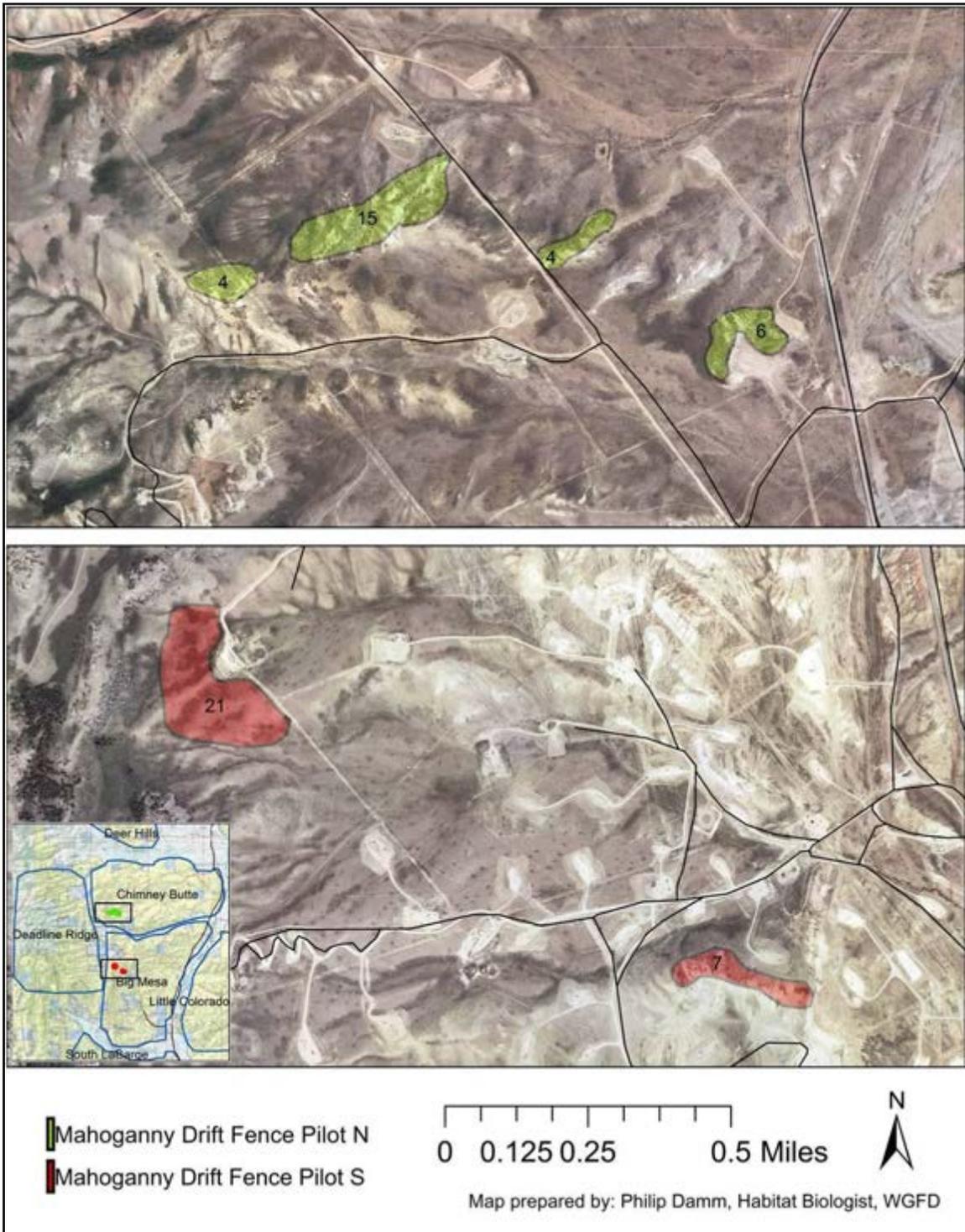


Figure 24. Mahogany Drift Fence Pilot Project located within Big Mesa and Chimney Butte areas of Wyoming Range mule deer crucial winter range near Big Piney and LaBarge in western Wyoming. Number labels indicate acreage for the respective polygon.

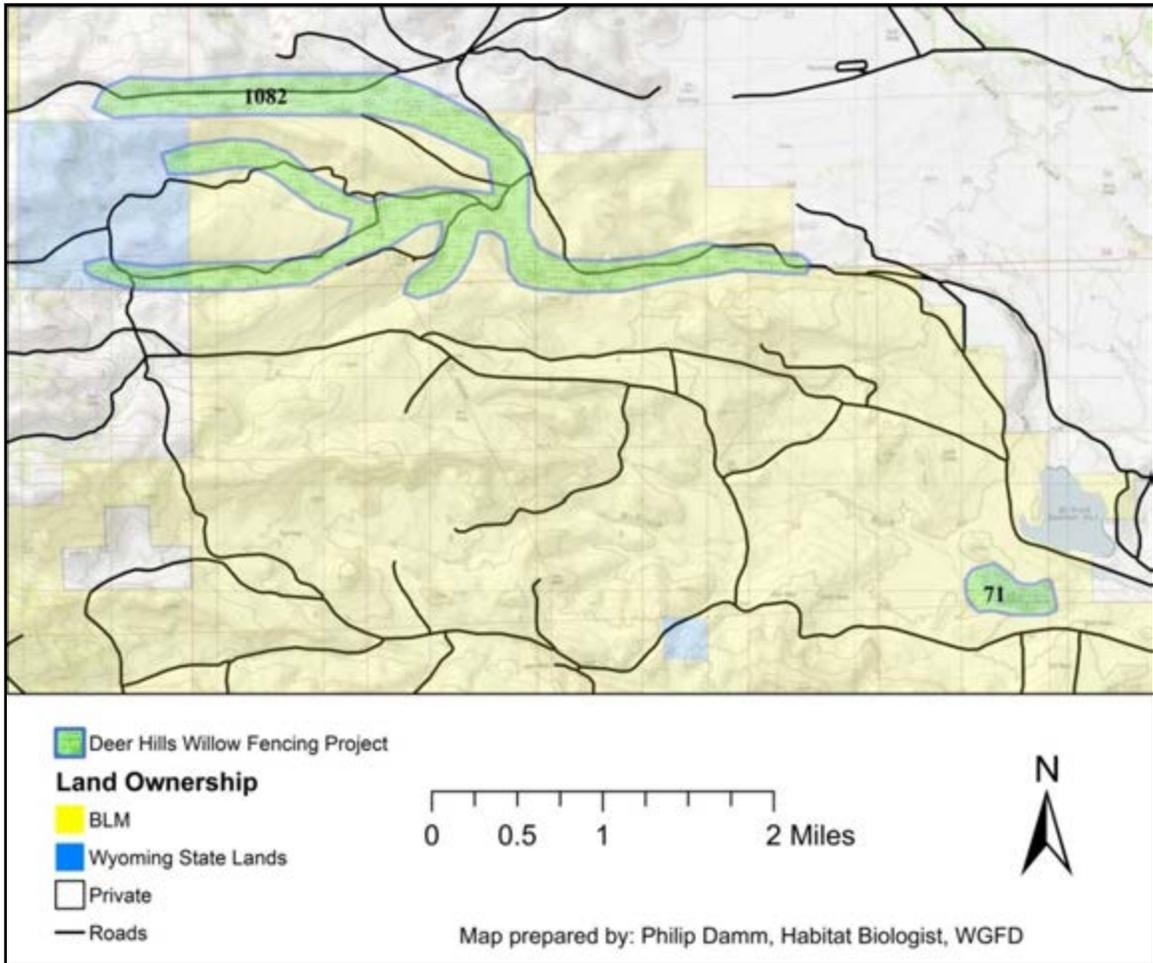


Figure 25. Deer Hills Willow Fencing Project located within Deer Hills area of Wyoming Range mule deer crucial winter range near Big Piney in western Wyoming. Number labels indicate acreage for the respective polygon.

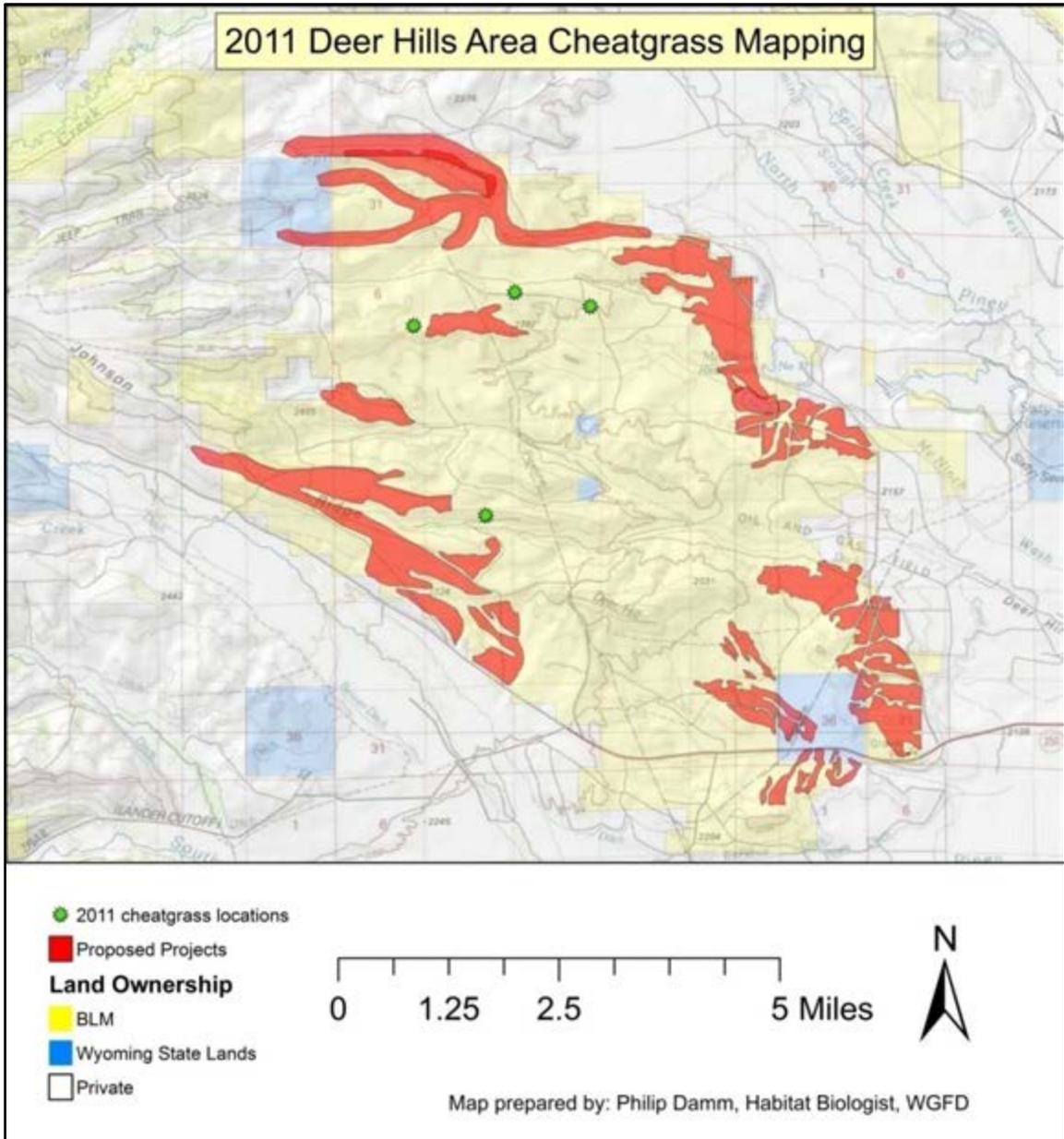


Figure 26. Deer Hills focus area cheatgrass (*Bromus tectorum*) patches located during summer 2011 near Big Piney in western Wyoming.

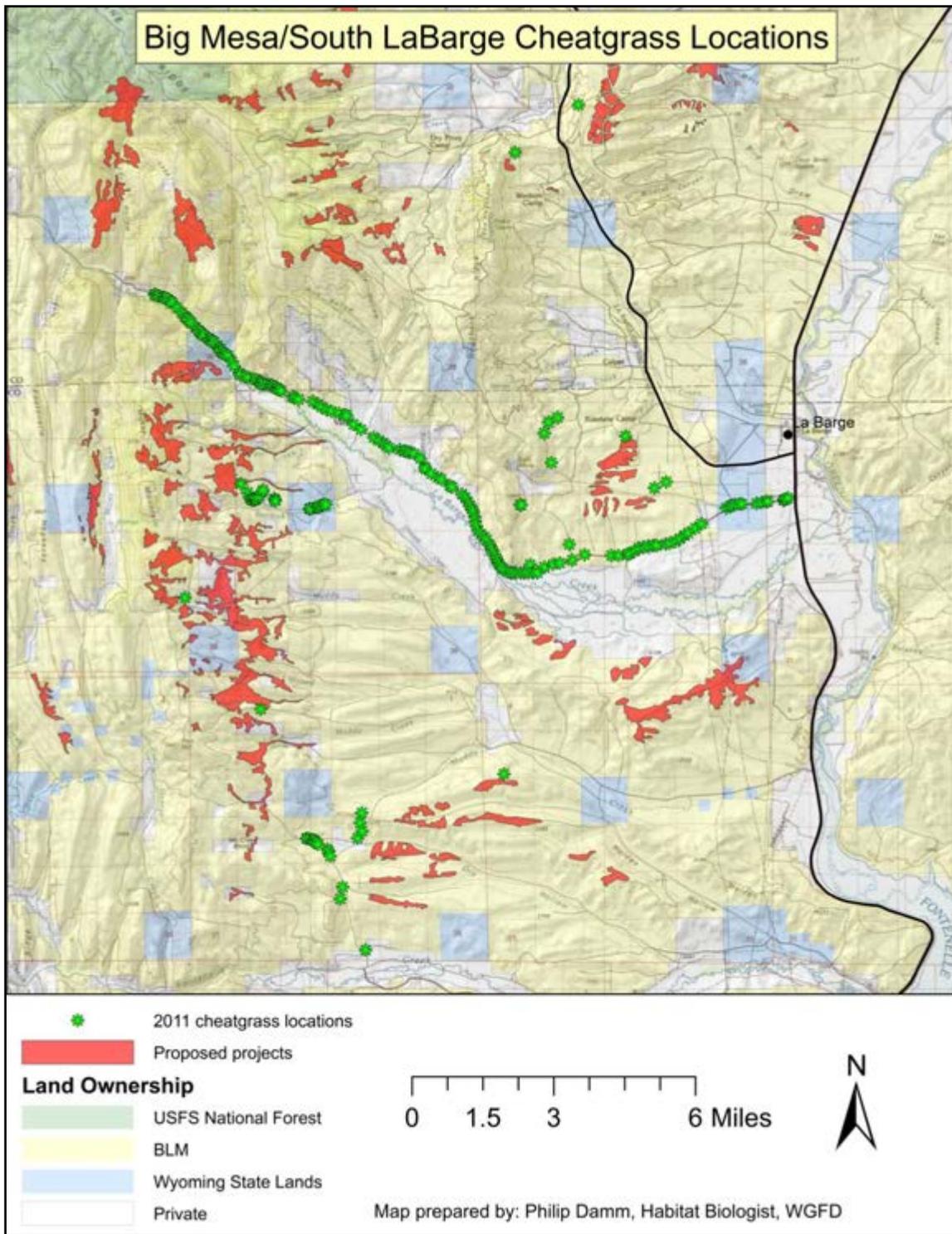


Figure 27. Big Mesa and South LaBarge focus areas cheatgrass (*Bromus tectorum*) patches located during summer 2011 near LaBarge in western Wyoming. Most locations lie along ~20 mile portion of LaBarge Creek Road.

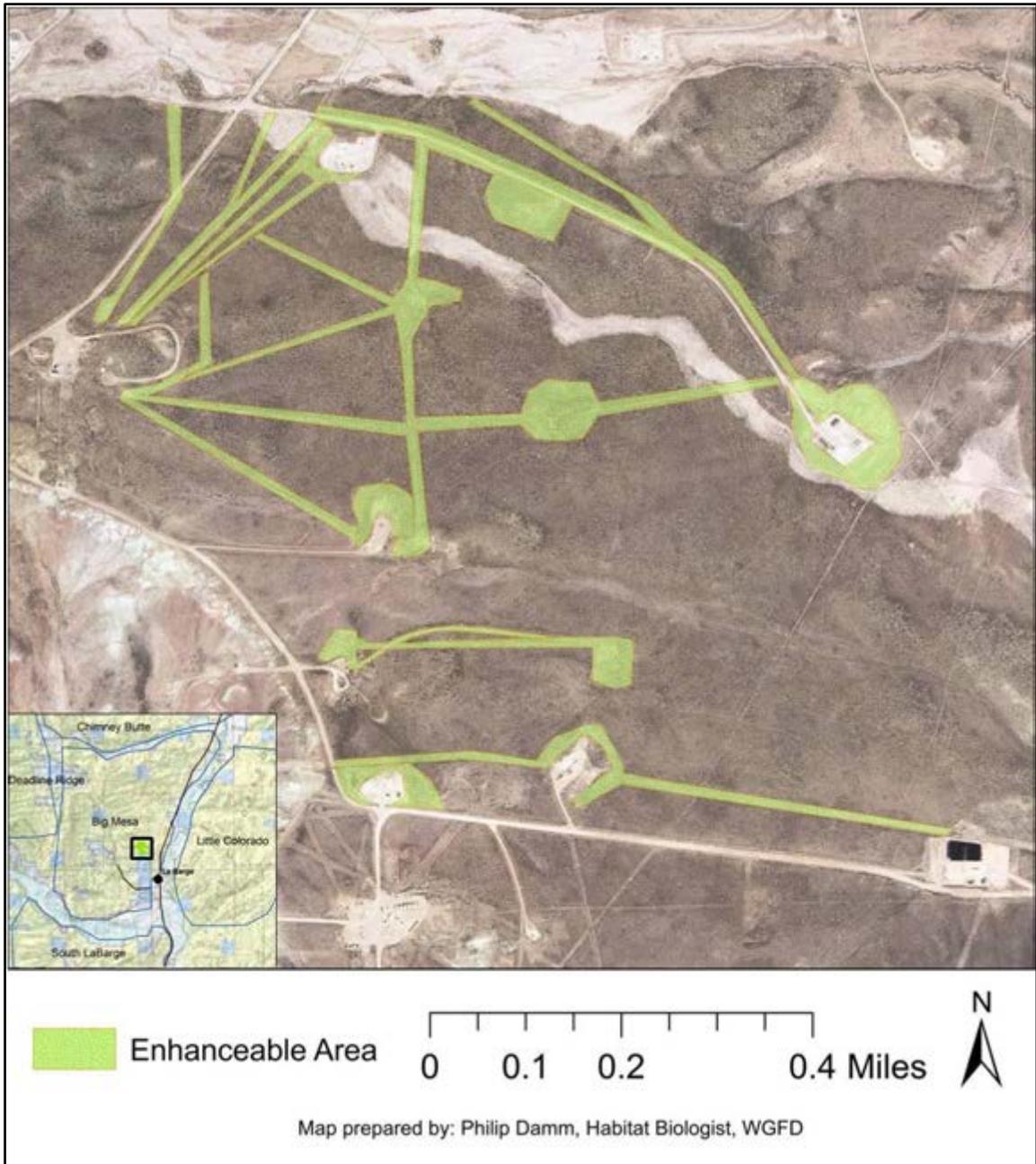


Figure 28. Natural gas development enhanced reclamation project example located within Big Mesa area of Wyoming Range mule deer crucial winter range near LaBarge in western Wyoming.

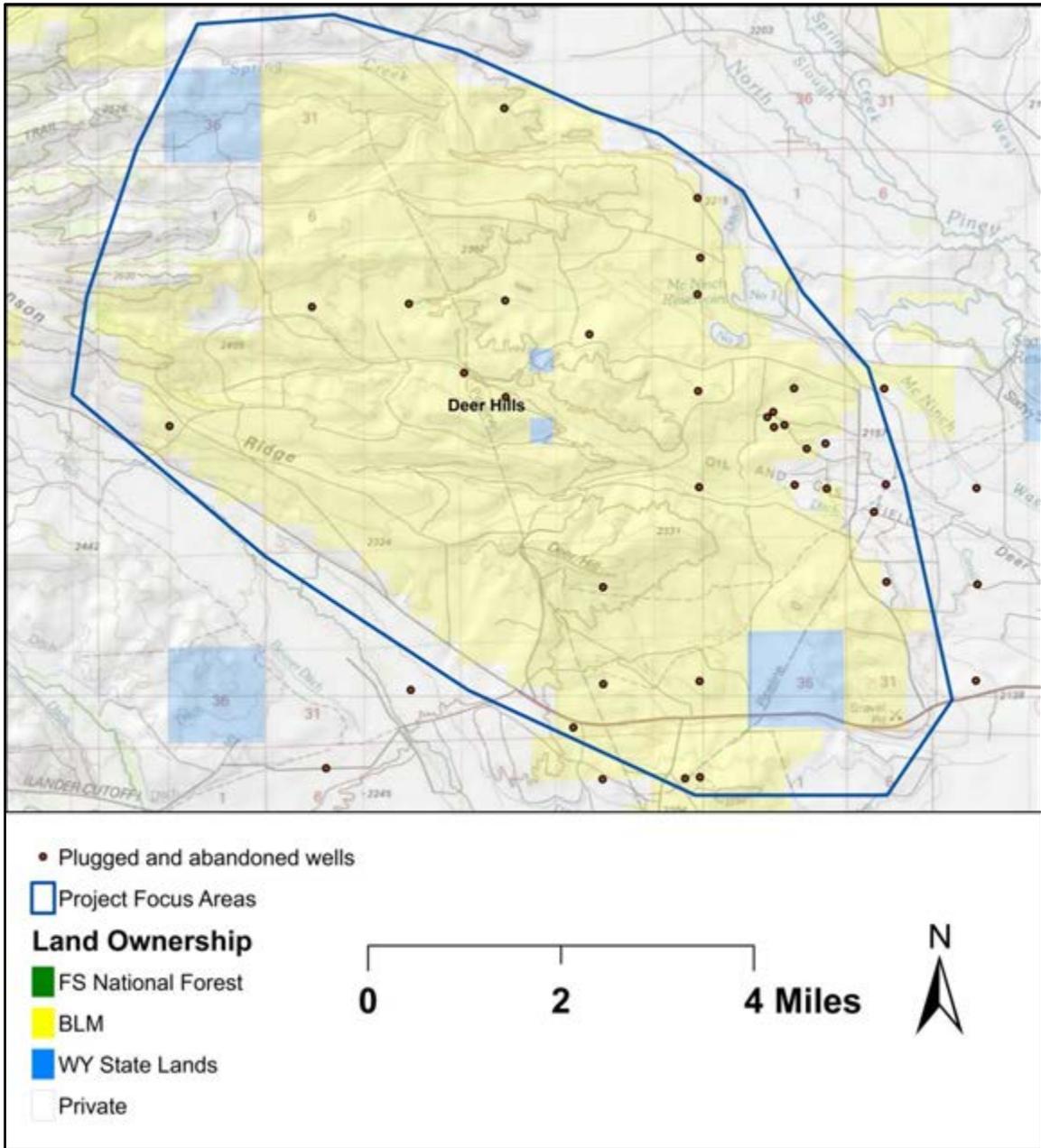


Figure 29. Plugged and abandoned natural gas wells potentially suitable for enhanced reclamation projects located within Deer Hills area of Wyoming Range mule deer crucial winter range near Big Piney in western Wyoming.

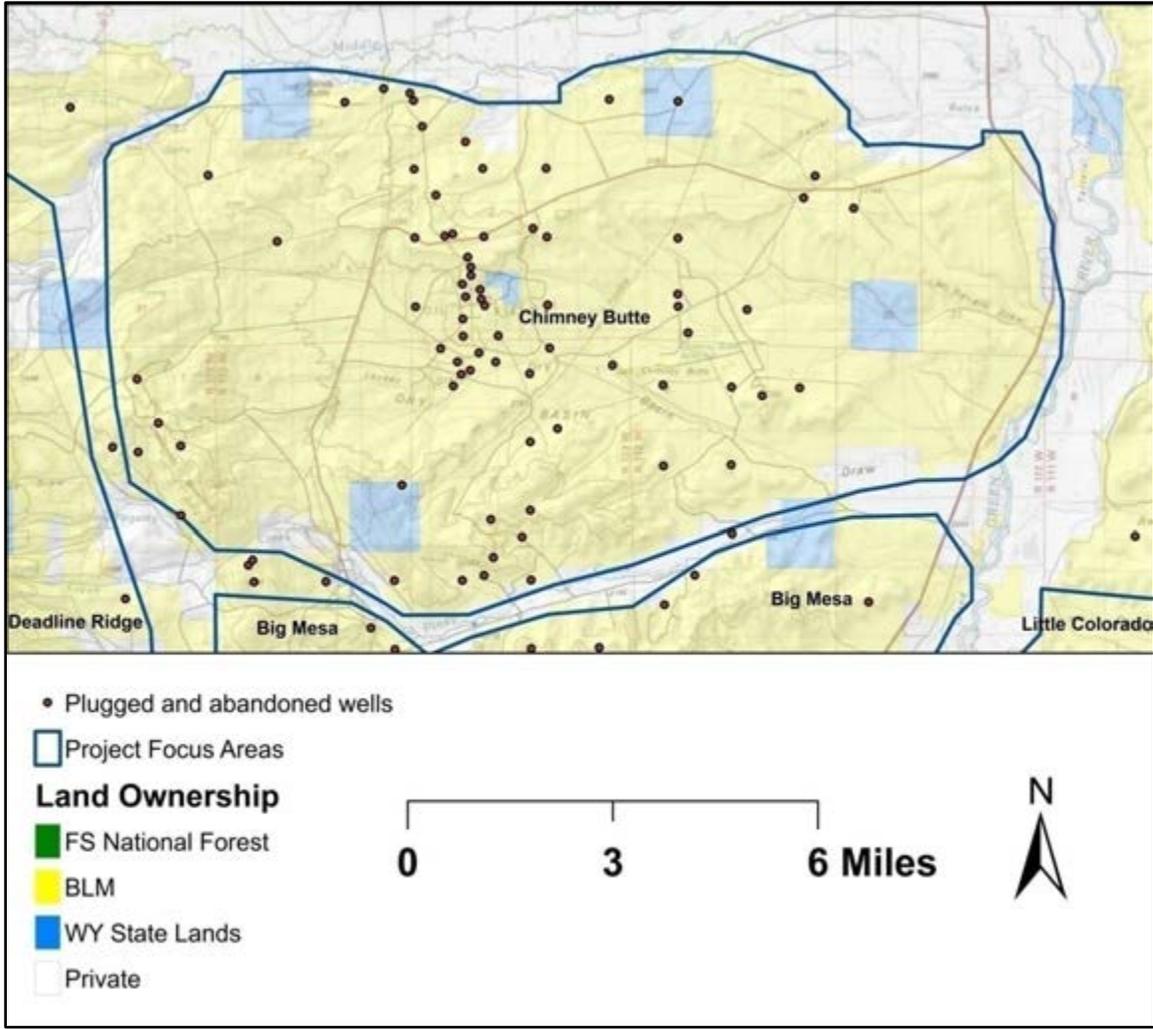


Figure 30. Plugged and abandoned natural gas wells potentially suitable for enhanced reclamation projects located within Chimney Butte area of Wyoming Range mule deer crucial winter range near Big Piney in western Wyoming.

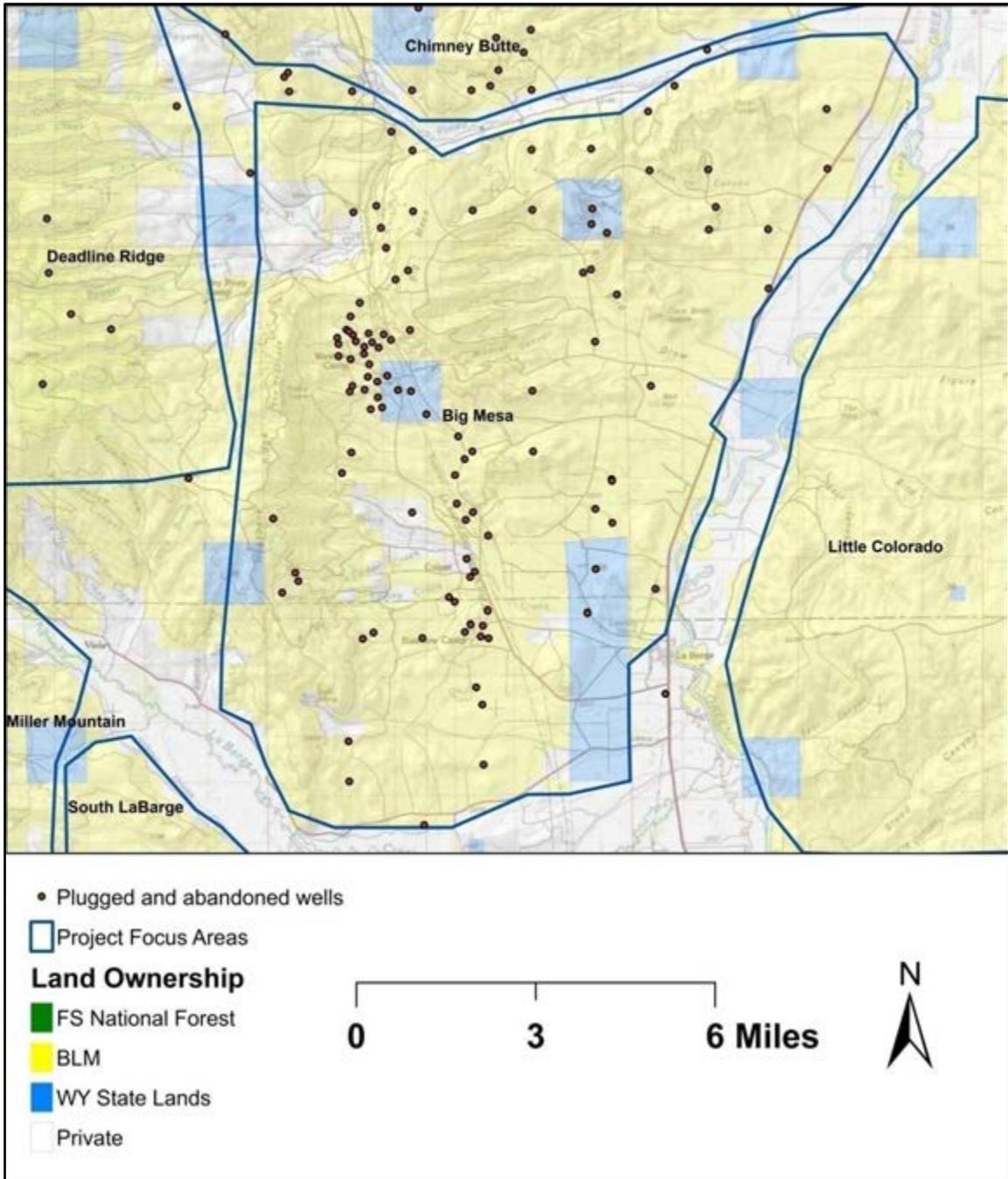


Figure 31. Plugged and abandoned natural gas wells potentially suitable for enhanced reclamation projects located within Big Mesa area of Wyoming Range mule deer crucial winter range near LaBarge in western Wyoming.

Little Colorado Focus Area

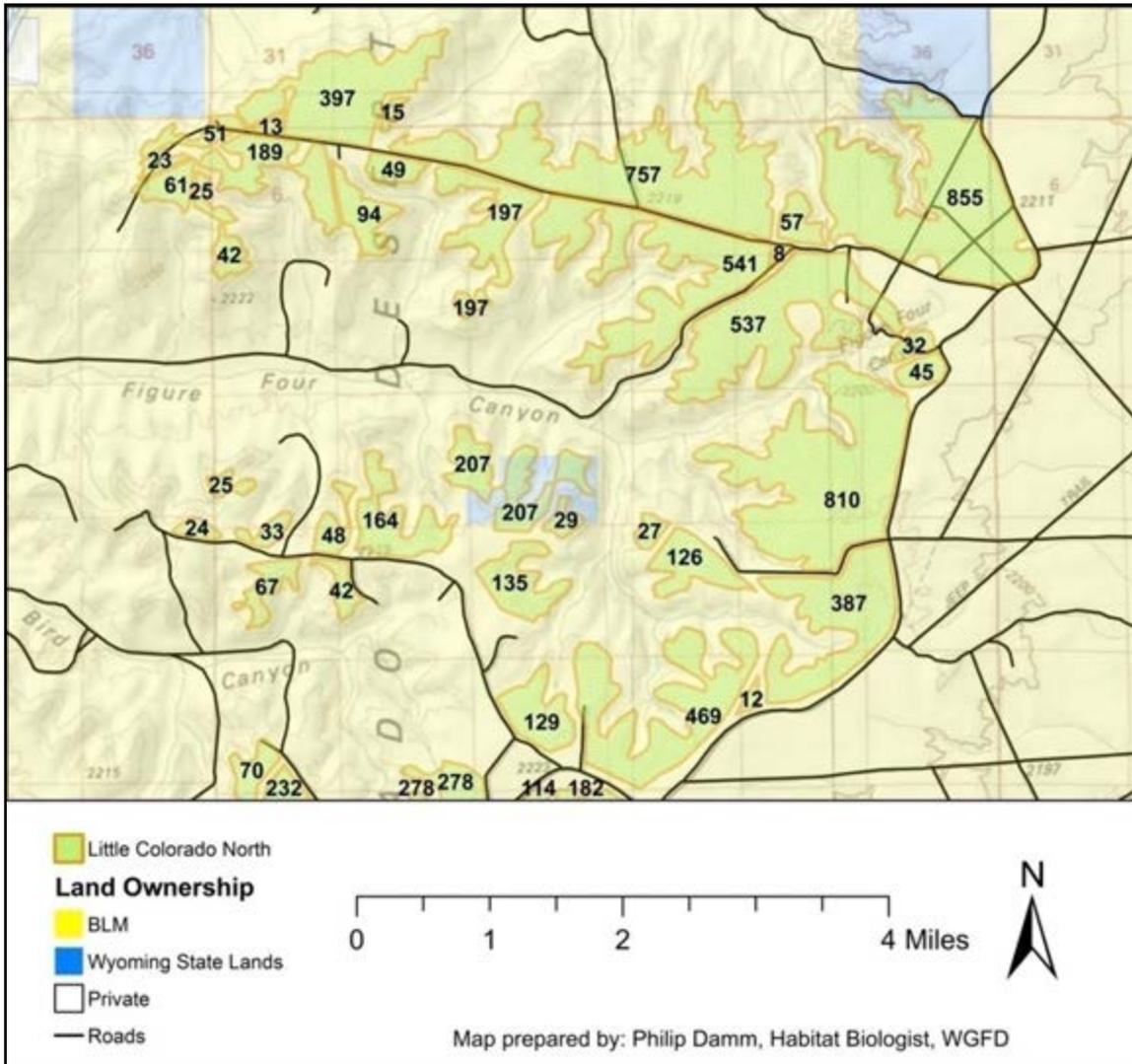


Figure 32. Northern portion of the Little Colorado Project located within Little Colorado area of Wyoming Range mule deer crucial winter range near Big Piney and LaBarge in western Wyoming. Number labels indicate acreage for the respective polygon.



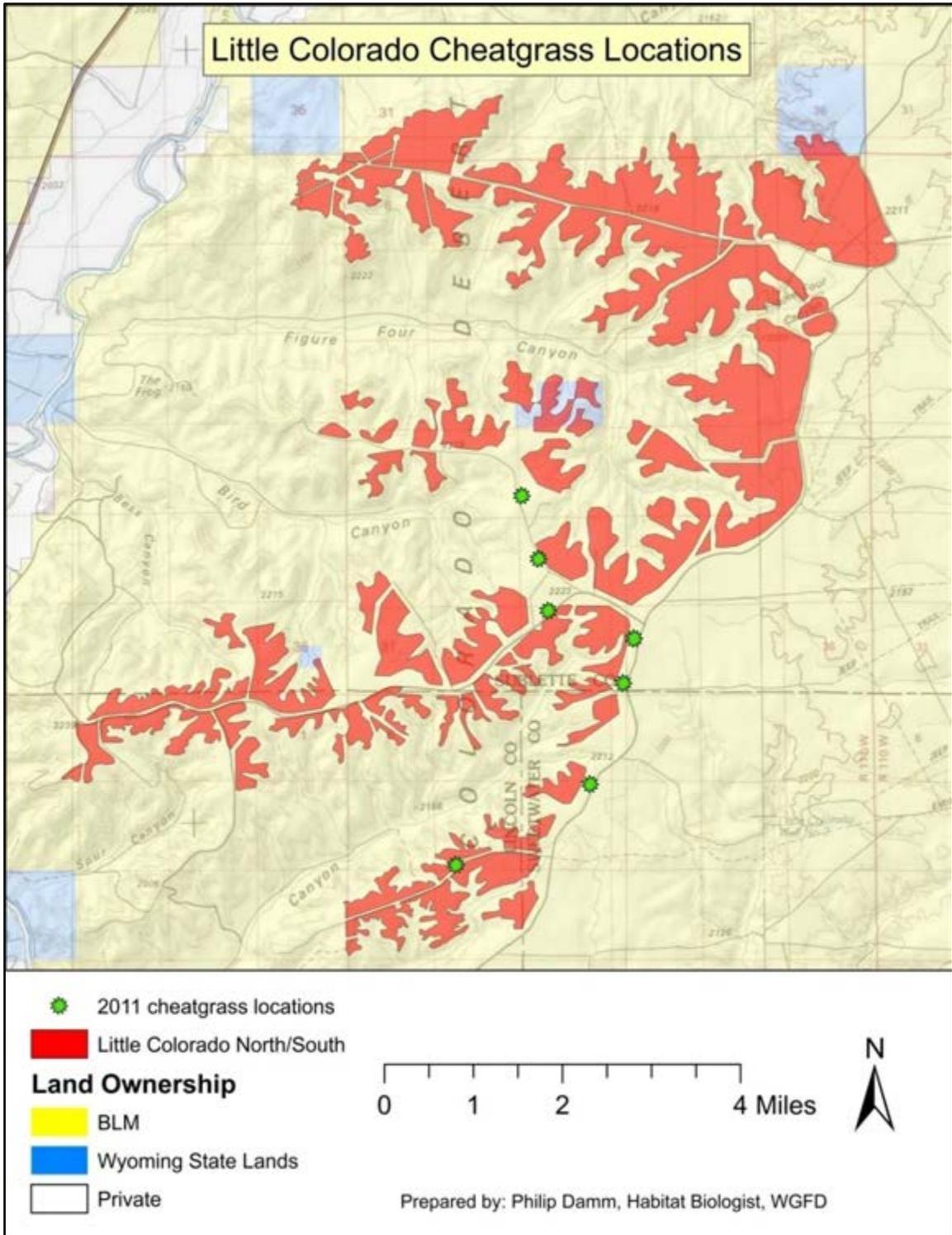


Figure 34. Little Colorado focus area cheatgrass (*Bromus tectorum*) patches located during summer 2011 near Big Piney and LaBarge in western Wyoming.

APPENDIX C-BLM and FS grazing allotment maps

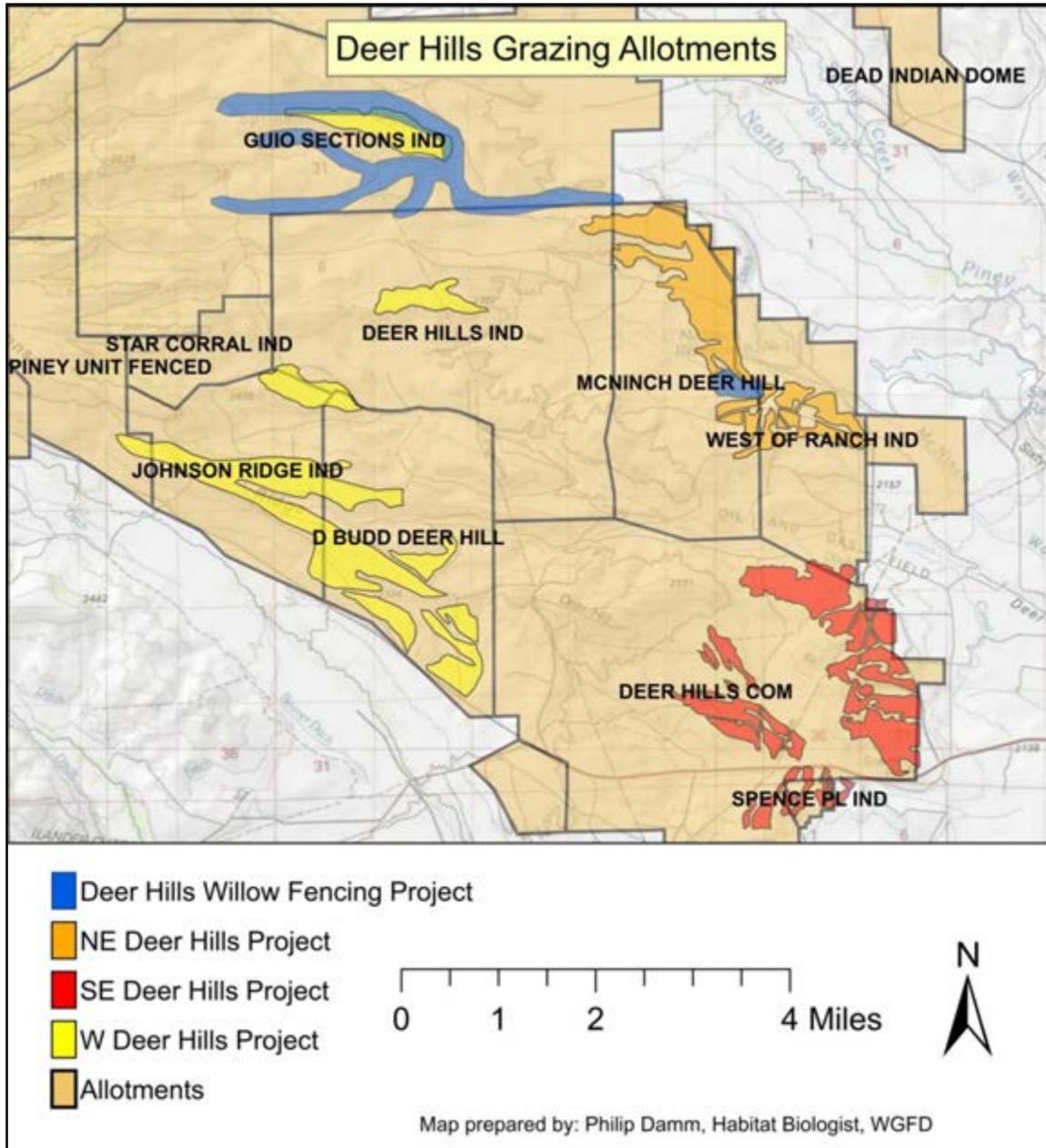


Figure 35. BLM grazing allotments for Deer Hills focus area including proposed projects for Wyoming Range mule deer crucial winter range near Big Piney in western Wyoming.

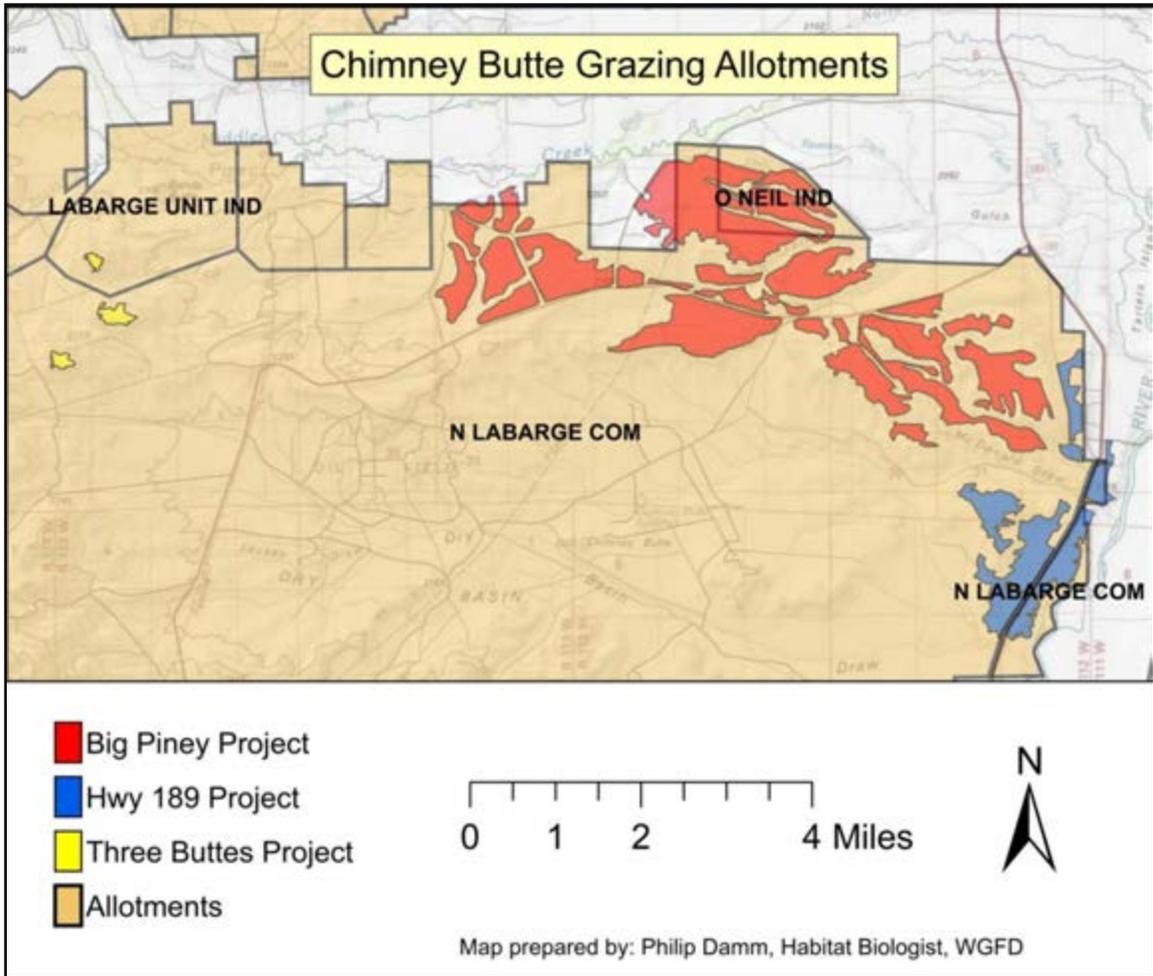


Figure 36. BLM grazing allotments for Chimney Butte focus area including proposed projects for Wyoming Range mule deer crucial winter range near Big Piney in western Wyoming.

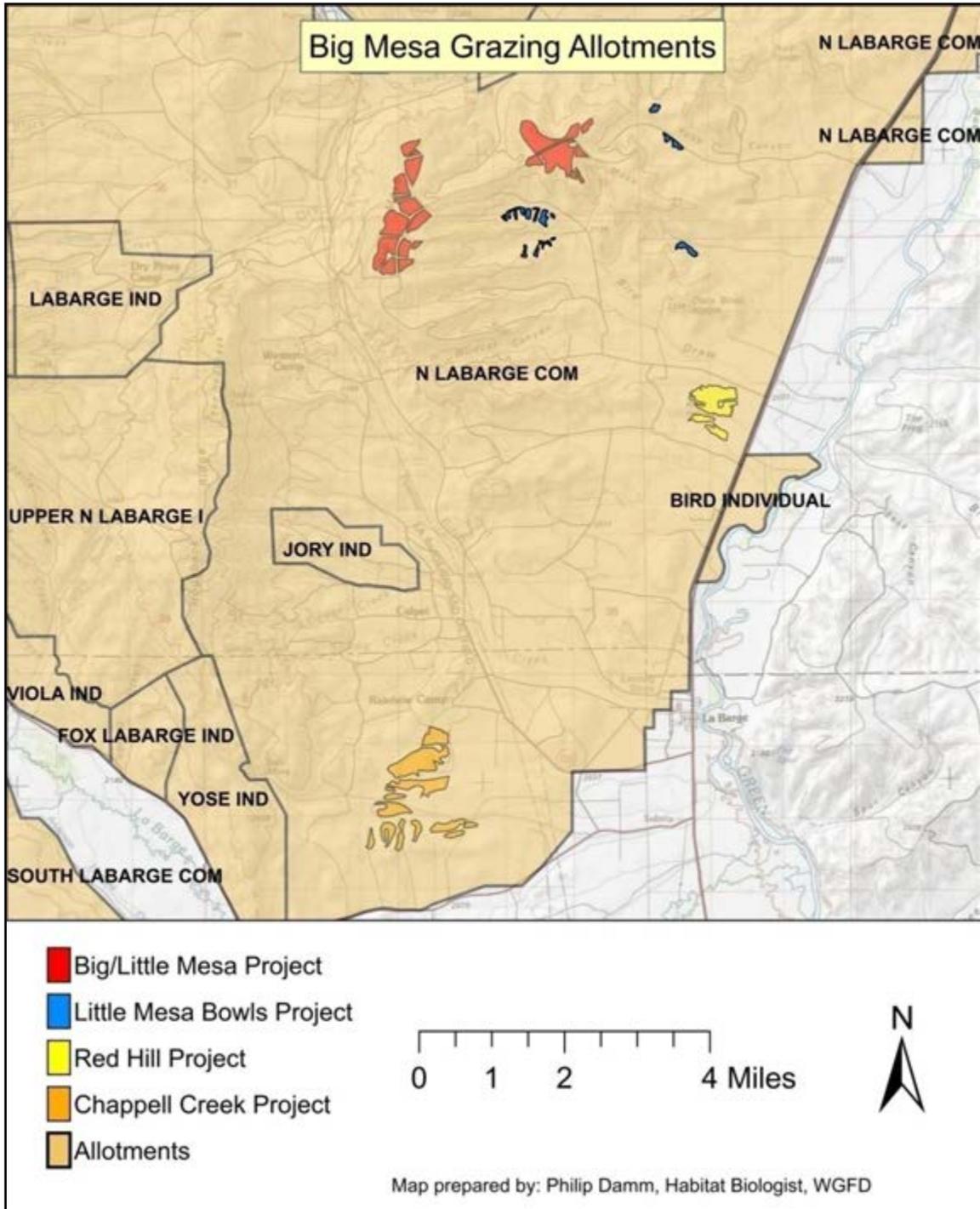


Figure 37. BLM grazing allotments for Big Mesa focus area including proposed projects for Wyoming Range mule deer crucial winter range near Big Piney and LaBarge in western Wyoming.

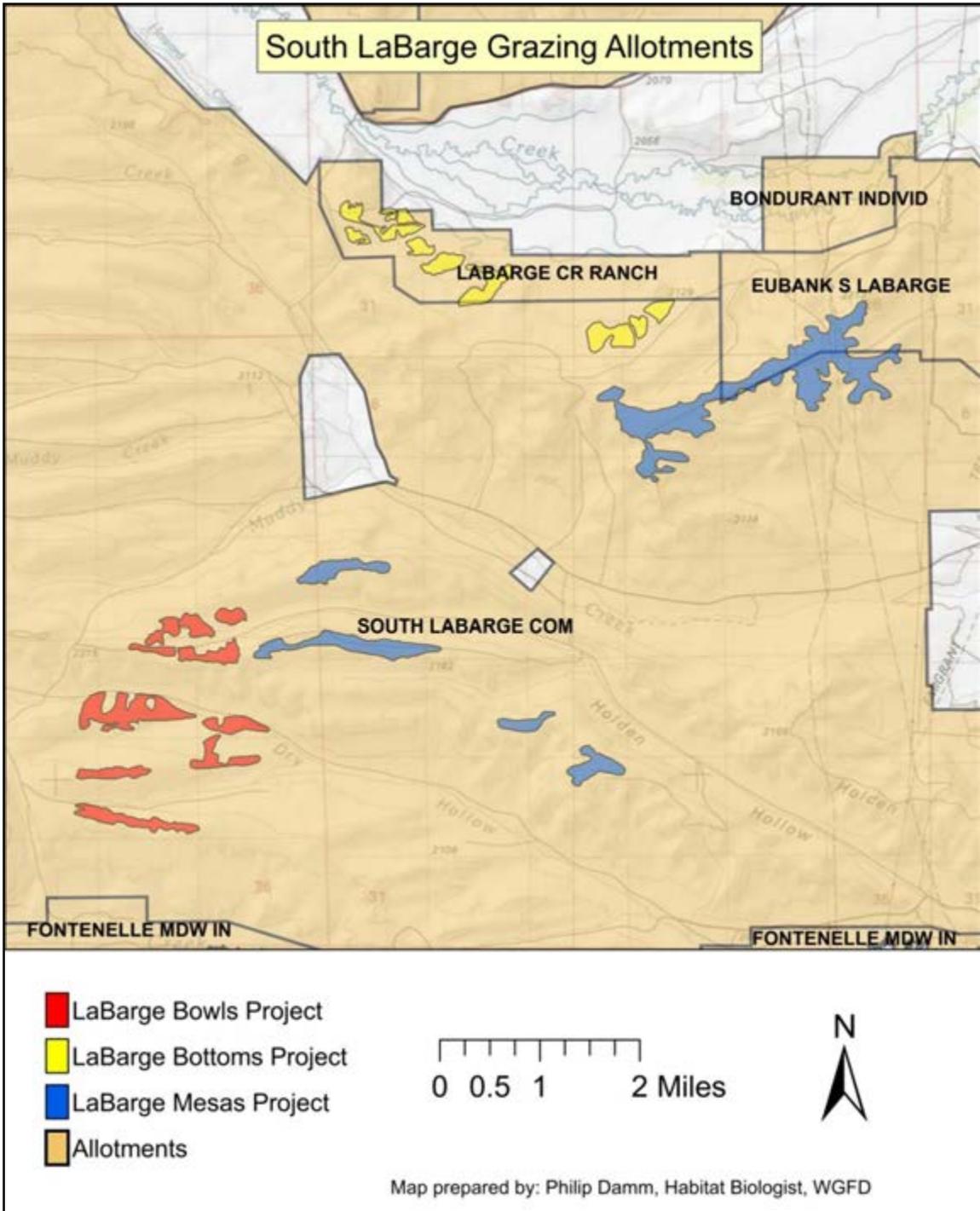


Figure 38. BLM grazing allotments for South LaBarge focus area including proposed projects for Wyoming Range mule deer crucial winter range near LaBarge in western Wyoming.

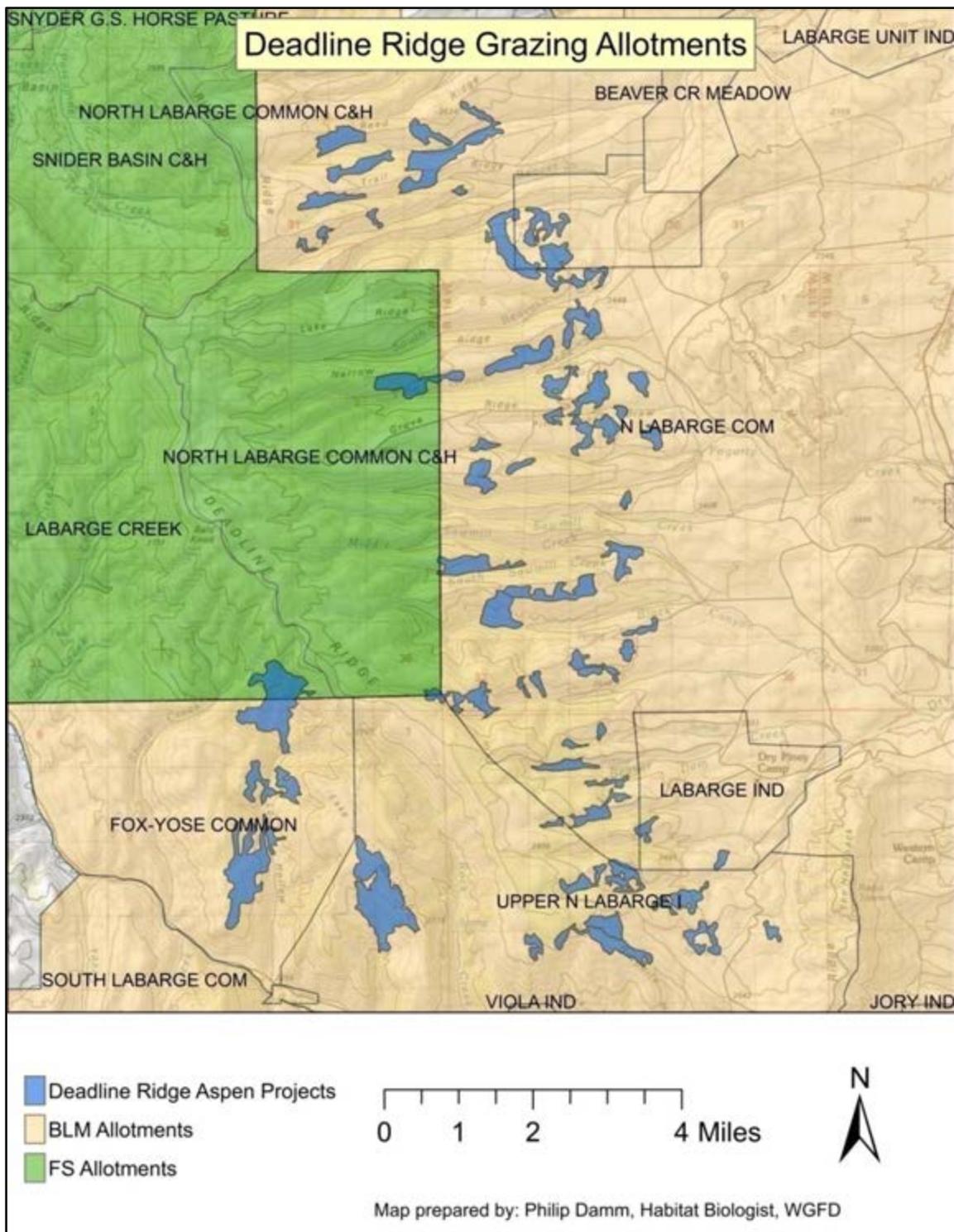


Figure 39. BLM and FS grazing allotments for Deadline Ridge focus area including proposed projects for Wyoming Range moose crucial winter range and mule deer spring, summer, and fall range near Big Piney and LaBarge in western Wyoming.



APPENDIX D-Natural gas well density map

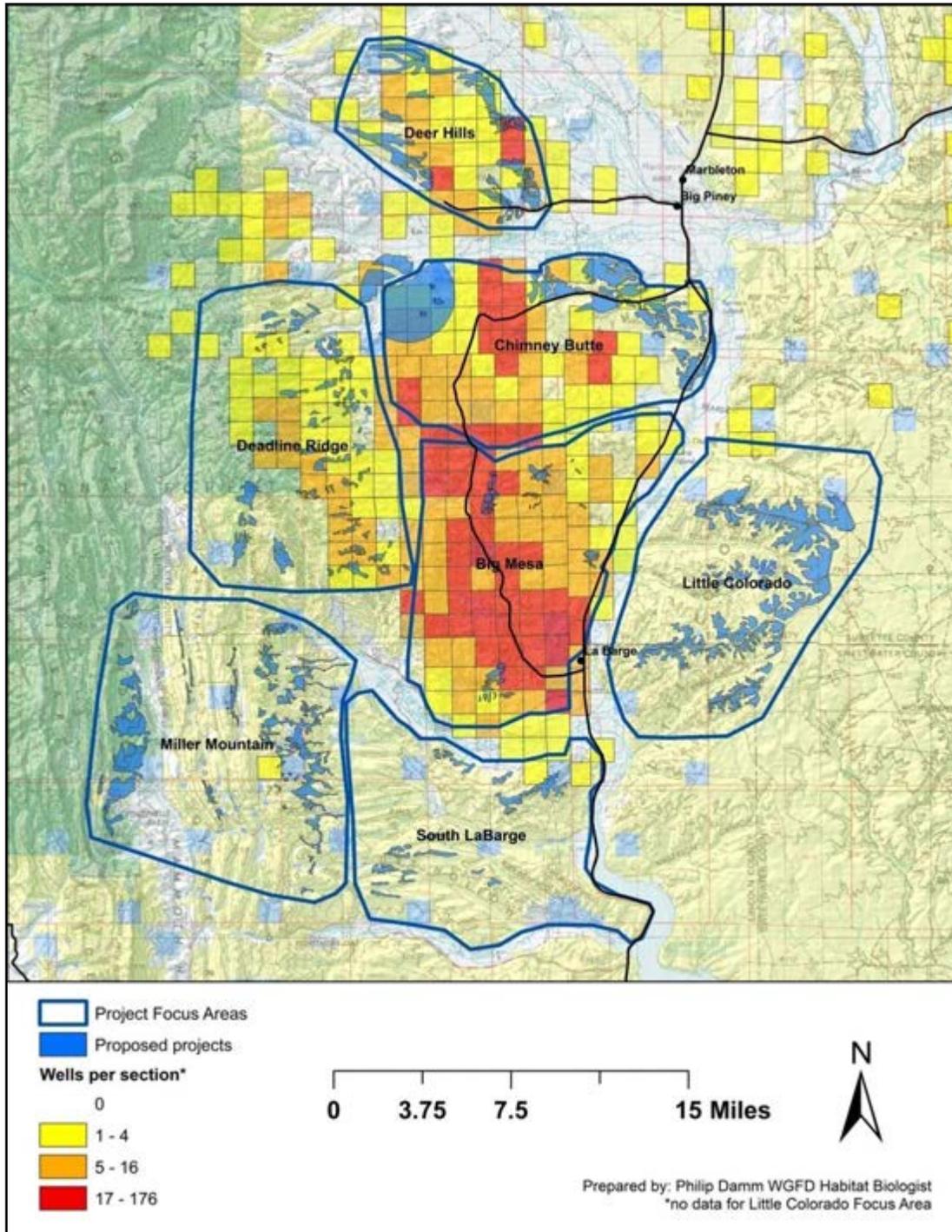


Figure 41. Natural gas and oil well densities including proposed projects for Wyoming Range moose and mule deer crucial winter range near Big Piney and LaBarge in western Wyoming. The three density groupings resulted from WGFD (2009) and Smith and Younkin (2010a).

## APPENDIX E.-Literature Cited

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