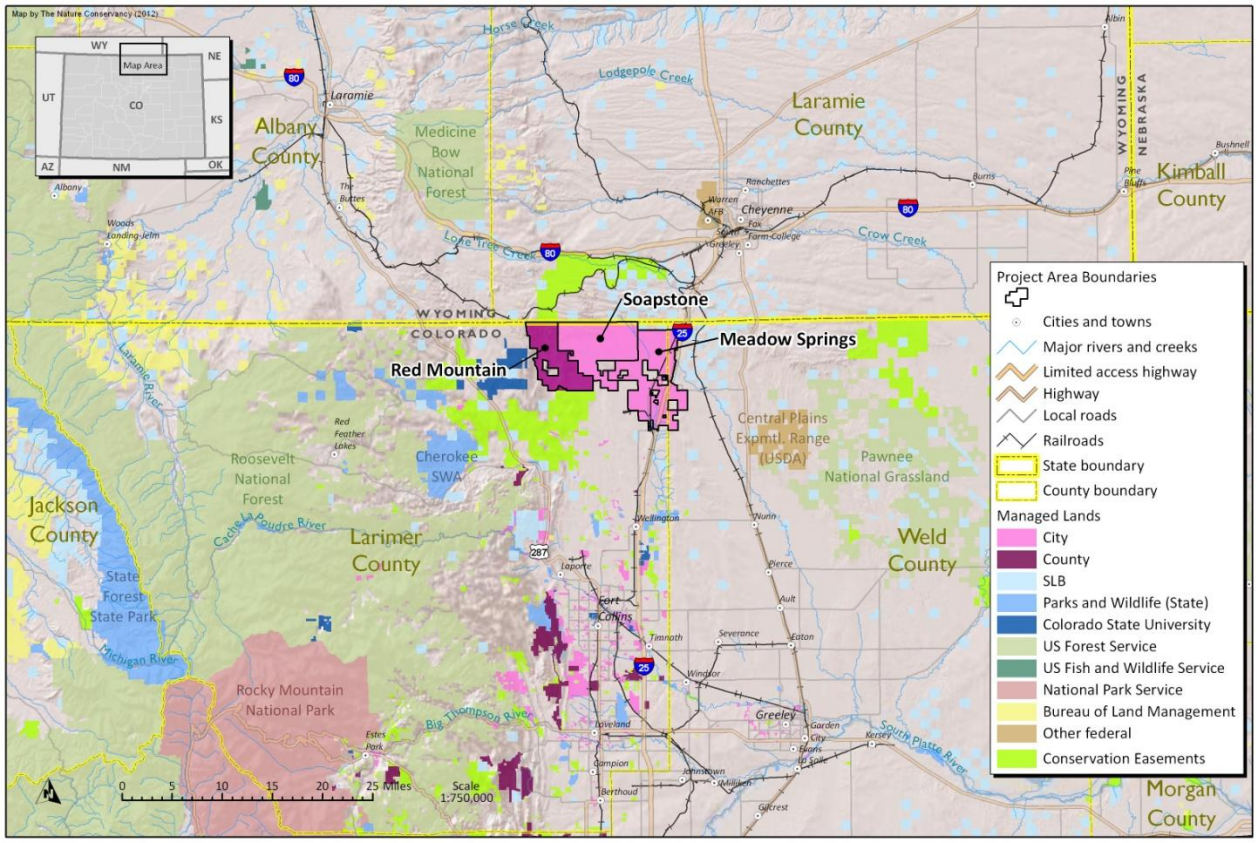
APPENDIX 5. MAPS

The Nature Conservancy created all maps using available data from a wide variety of sources as noted. The State Land Board completed the scenic values analyses with input from the City of Fort Collins and Larimer County. Colorado State University created the cultural resource maps based on past surveys that it completed. The cultural resource maps are included as a separate appendix (Appendix 6) due to the sensitivity of the information.

Map 1. Location of the project area within the broader Mountains to Plains region

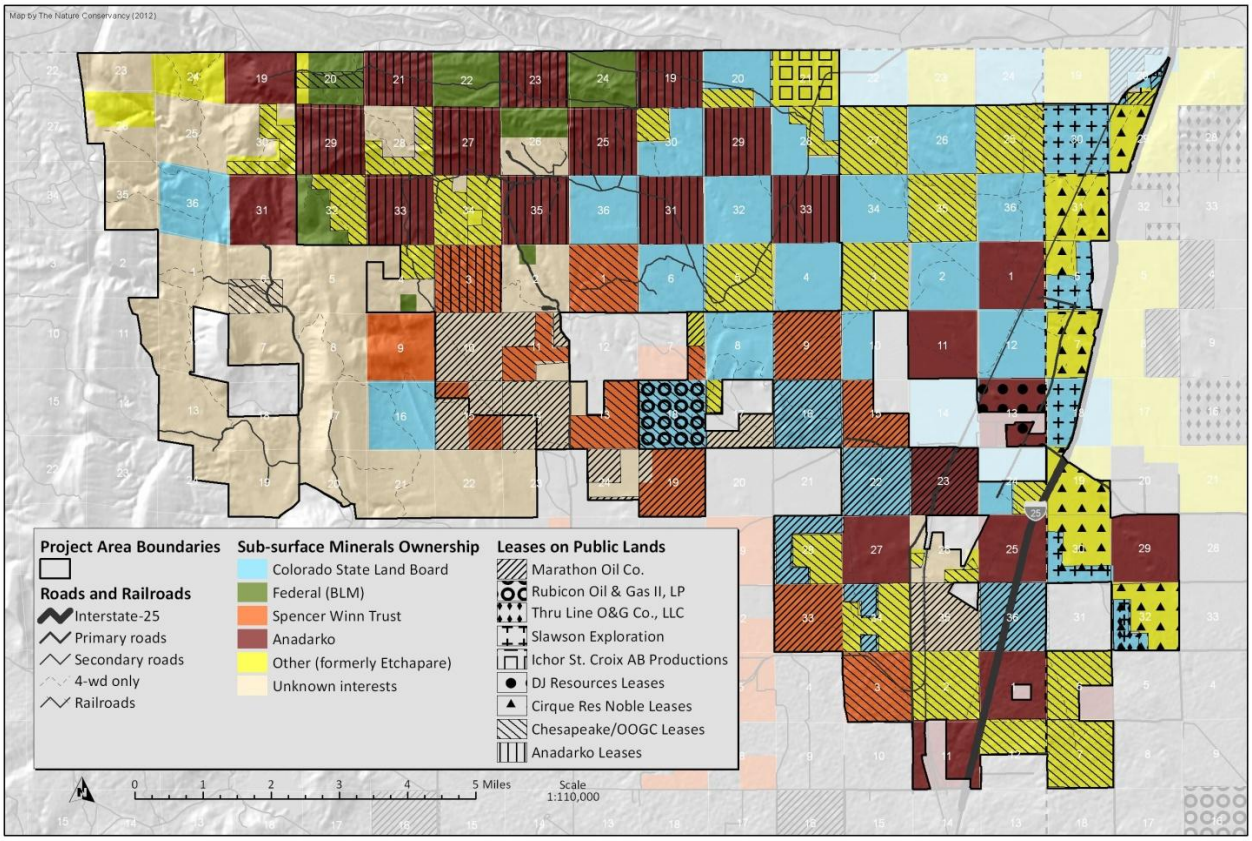
The surface of the project area is owned by the City of Fort Collins and Larimer County and includes Red Mountain Open Space, Soapstone Prairie Natural Area, and Meadow Springs Ranch. The project area is an important component of a network of protected lands in the broader region, from conservation easements to state and federally-owned lands. They are also part of a regional conservation effort called the Laramie Foothills Mountains to Plains Project, through which partners are creating a corridor of protected lands to link the Rocky Mountains with the Great Plains.



Sources: Land ownership/management (Lavender, Fink, Linn, & Theobald, 2011)

Map 2. Subsurface ownership and mineral leases

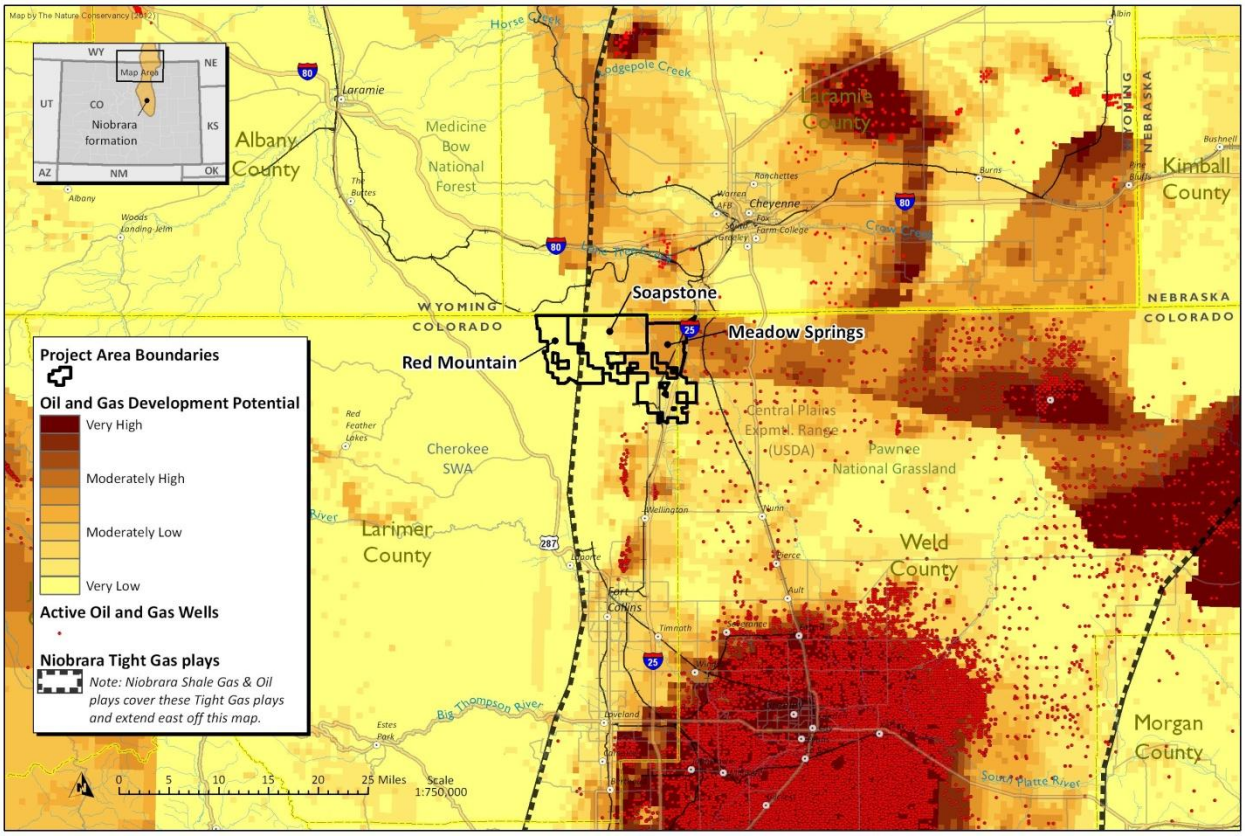
Most of State Land Board's mineral trust lies in the eastern half of the planning area, on Soapstone Prairie and Meadow Springs. Anadarko is another major mineral owner in the project area. Leases change frequently over time. At present, Marathon is a major lease holder, mostly in the southern half of the planning area.



Sources: Subsurface minerals ownership and leases combined from (Colorado State Land Board, 2012) and (City of Fort Collins, 2012).

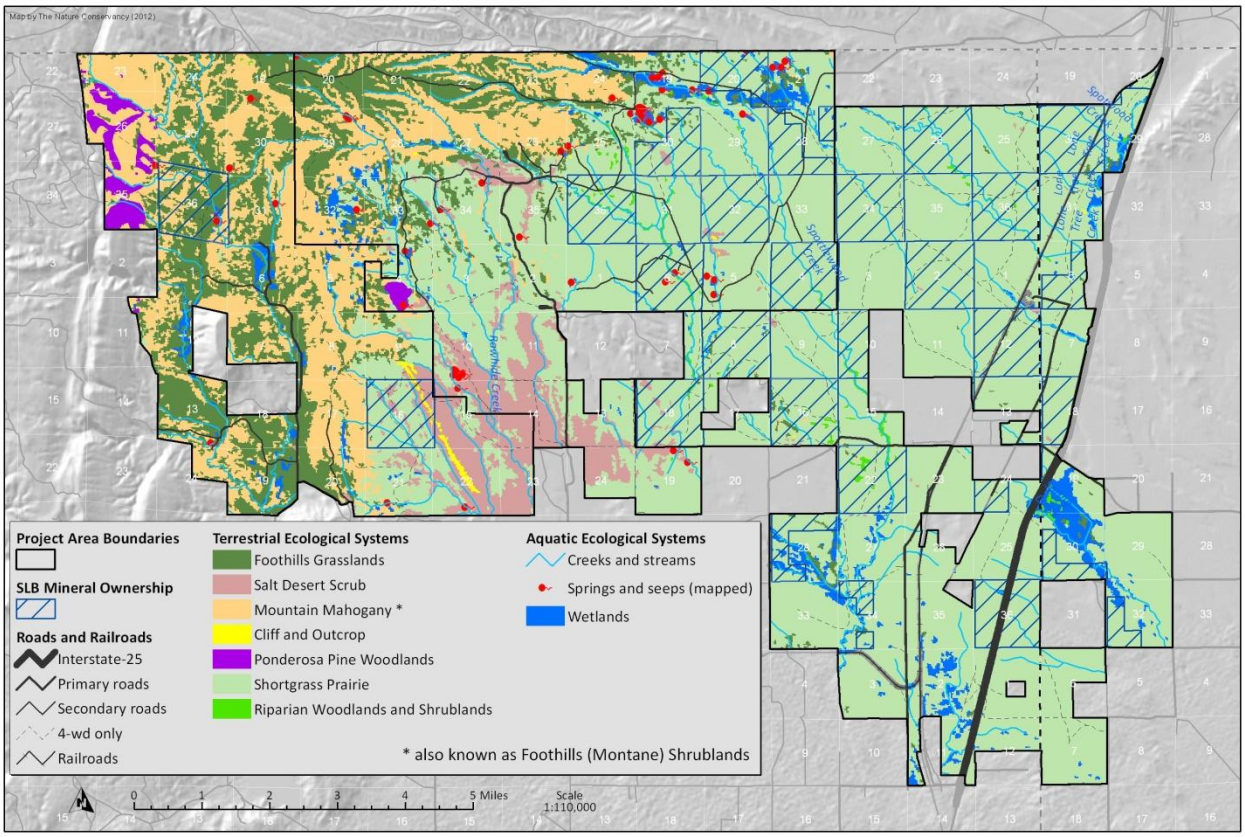
Map 3. Oil and gas development potential in the project area and the surrounding vicinity

The oil and gas development potential of the project area is unproven. The project area lies within the Niobrara formation, which has received significant attention from oil and gas companies in the last few years. The potential within the project area is believed to increase from west to east, with Meadow Springs having the highest potential based on this map in which scientists from The Nature Conservancy, National Audubon Society, and the University of Montana modeled oil and gas development potential across six states, including Colorado.



Sources: Oil and gas development potential: (Copeland, Dougherty, Naugle, Pocewicz , & Kiesecker, 2009). Oil and Gas Wells in Colorado: (Colorado Oil and Gas Conservation Commission, 2012). Oil and gas wells in Wyoming: (Wyoming Oil and Gas Conservation Commission, 2012). Niobrara formation boundary: (Energy Information Administration, 2010).

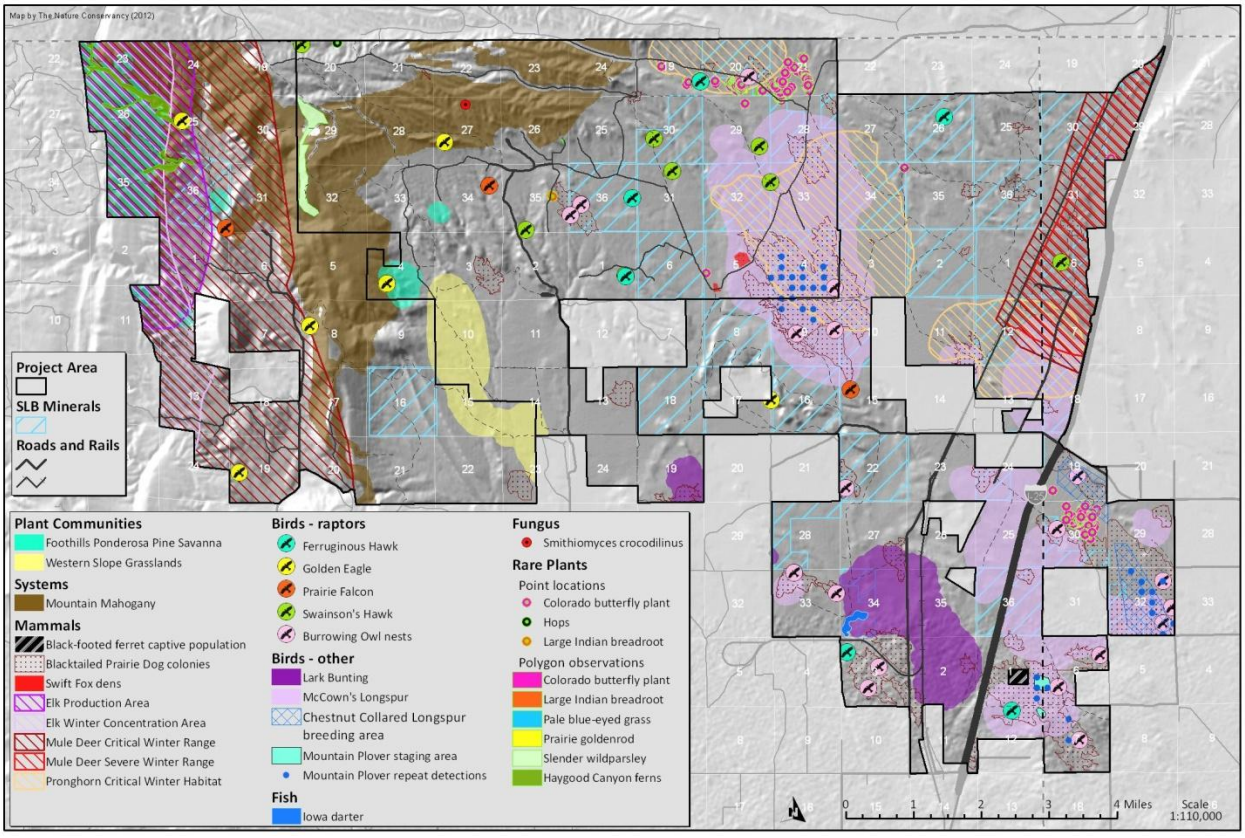
Map 4. Biological values - Ecological system targets



Sources: Aquatic ecological systems: Creeks and streams (U.S. Environmental Protection Agency, 2006); seeps and springs (Larimer County Natural Resources Department, 2011) and (City of Fort Collins Natural Areas Department, 2011) – based on ground-truthed observations from topographic maps; wetlands (U.S. Environmental Protection Agency, 2006) as modified by the City and County. Terrestrial ecological systems: All from (U.S. Geological Survey, 2004) except ponderosa pine, which was from (Larimer County Natural Resources Department, 2007) and (City of Fort Collins Natural Areas Department, 2007).

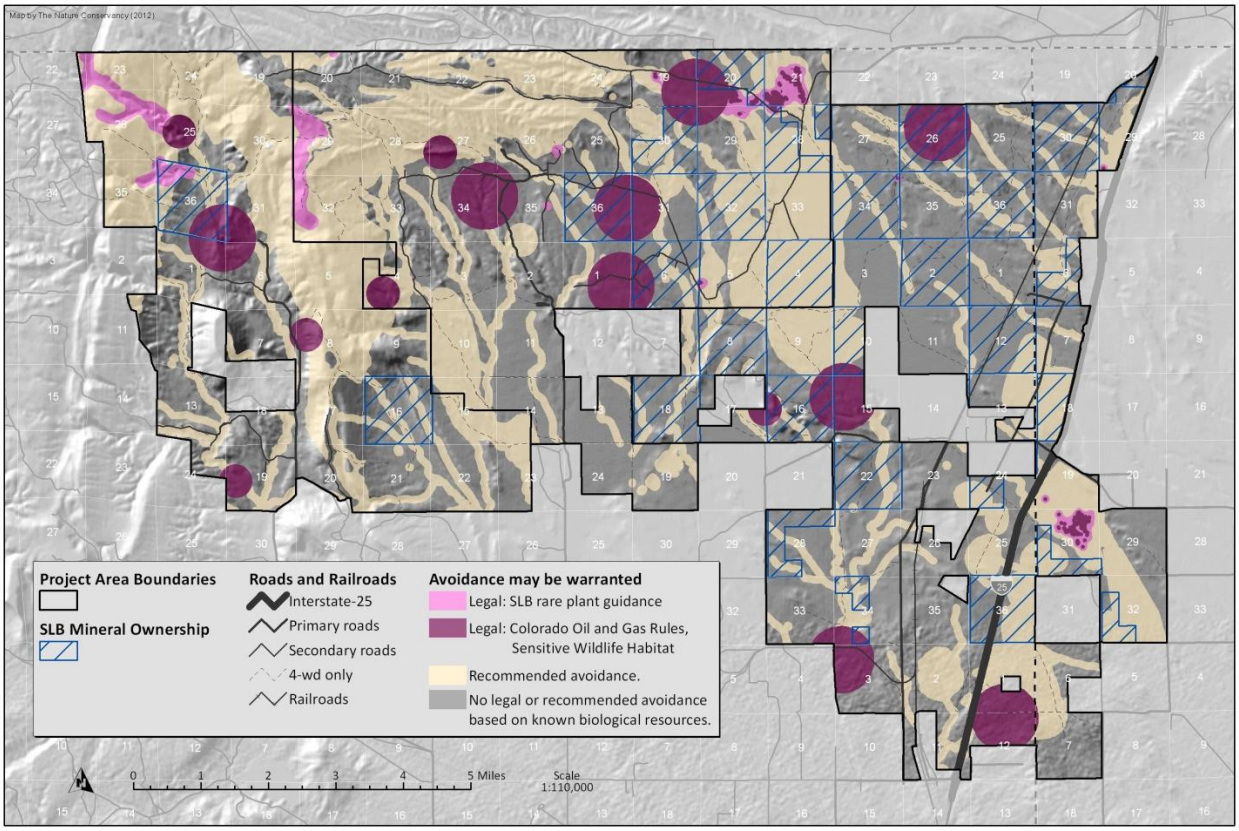
Map 5. Biological values – Species and plant community targets

This map shows all species and plant communities for which mapped data was available. No maps were available for the following targets: aquatic insects, northern leopard frog, bald eagle nests and winter roosts, owls and other nesting raptor nests, and plants including *Agrimonia striata* and purple spikerush. Mountain plover nests are represented as repeat detection areas, within which the nests themselves are found.



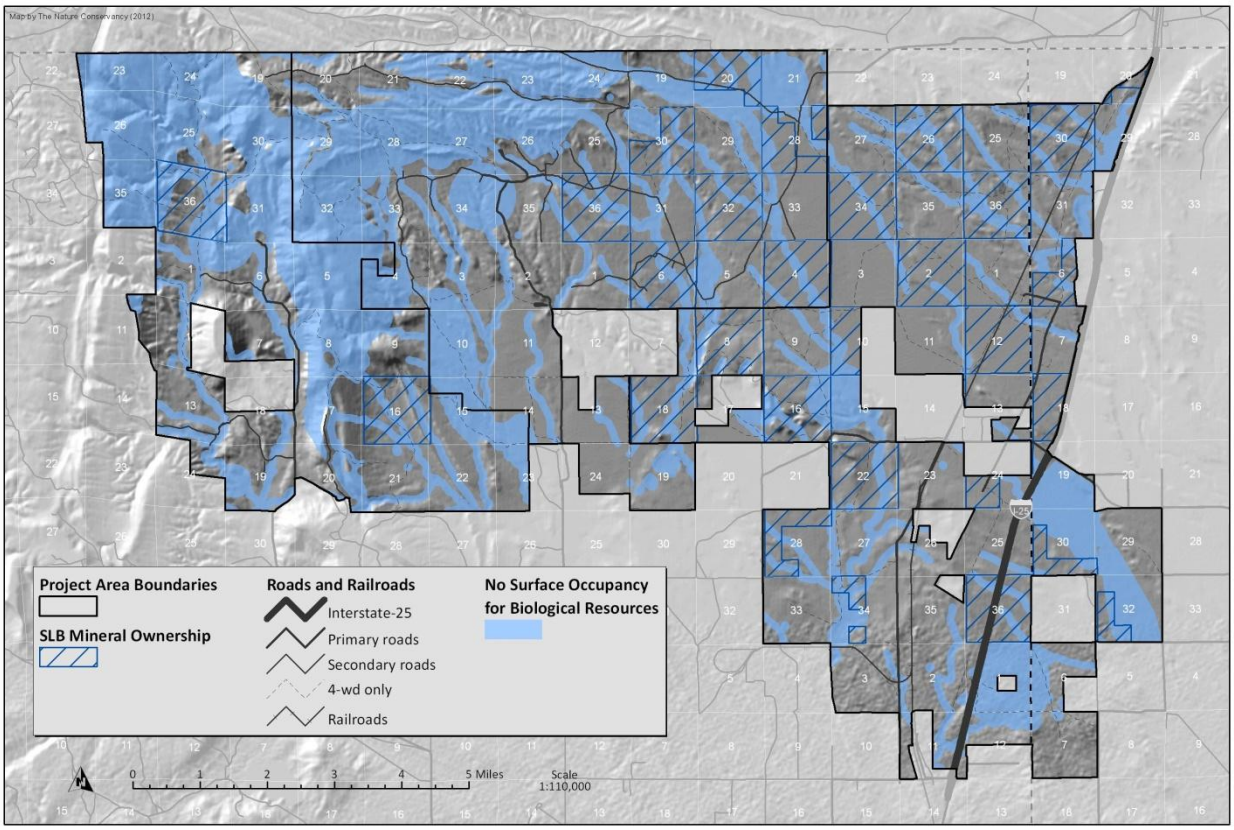
Sources: Plant communities: (Colorado Natural Heritage Program, 2012). Mammals: Black footed ferret captive population (The Nature Conservancy, 2012); black-tailed prairie dogs (City of Fort Collins Natural Areas Department, 2007) and (Larimer County Natural Resources Department, 2007) - the City used its 2007 maximum extent layer before plague reduced acreage, the City has data through 2012 and the colonies are nearly back to the 2007 acreage; swift fox dens (City of Fort Collins Natural Areas Department, 2007-2012) (Colorado Natural Heritage Program, 2012); elk production area and elk winter concentration area (Colorado Parks & Wildlife , 2011); mule deer critical winter range and mule deer severe winter range (Colorado Parks & Wildlife , 2011); pronghorn critical winter range - updated by the City from (Colorado Parks & Wildlife , 2011); birds-raptors – combined data from (City of Fort Collins Natural Areas Department, 2007-2012) (Larimer County Natural Resources Department, 2011) (Colorado Natural Heritage Program, 2012) (Rocky Mountain Bird Observatory, 2012); birds-other - (Rocky Mountain Bird Observatory, 2012); fish - Iowa darter (City of Fort Collins Natural Areas Department, 2008, 2010); rare plants – all combined from (City of Fort Collins Natural Areas Department, 2007-2011) and (Colorado Natural Heritage Program, 2012); Fungus (Colorado Natural Heritage Program, 2012); Colorado blue butterfly (City of Fort Collins Natural Areas Department, 2007) – City conducted surveys in 2004 and 2007, but the Colorado blue were found only in 2007.

Map 6. Biological values – Legal and additional recommended areas warranting year-round avoidance (input to No Surface Occupancy and Restricted Surface Occupancy maps for biological values)

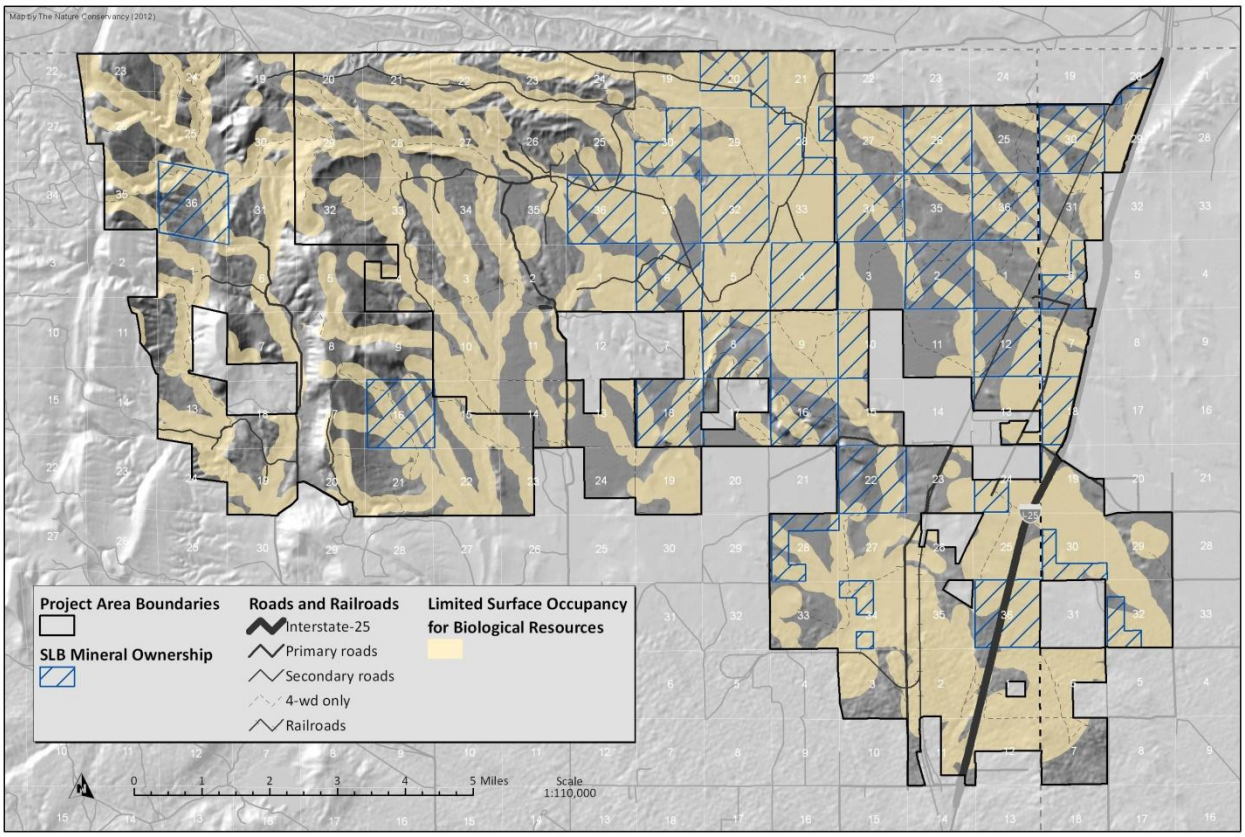


Source: "Legal" areas are Restricted Surface Occupancy areas from the COGCC rules (Colorado Oil and Gas Conservation Commission, 2008). "Recommended" areas are from the Mountains to Plains Energy by Design Technical Team.

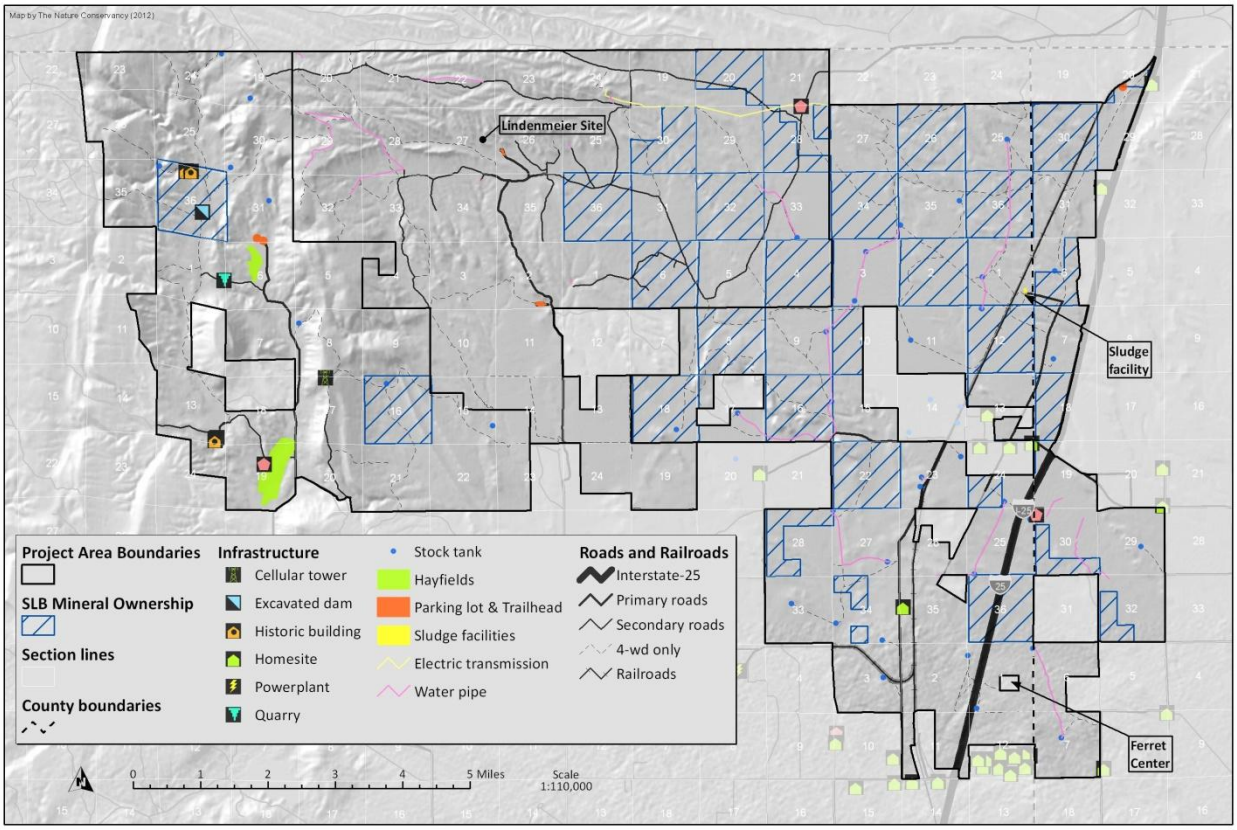
Map 7. Biological values – No Surface Occupancy (input to final biological map)



Map 8. Biological values – Limited Surface Occupancy (input to final biological map)



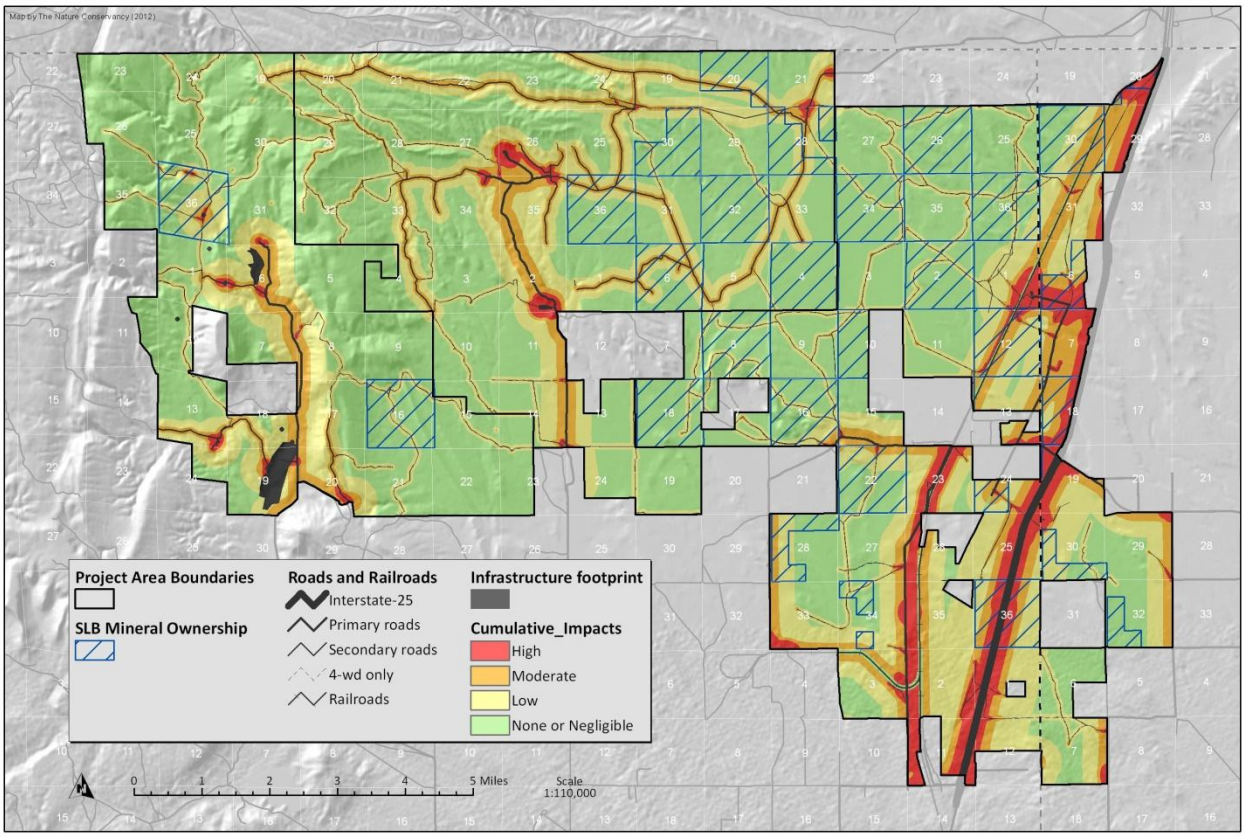
Map 9. Biological values - Existing infrastructure impacting biological values (input to Preferred Surface Occupancy map for biological values)



Sources: Roads - outside of the Project Area boundary (U.S. Census Bureau, 2006); within the Project Area boundary (U.S. Census Bureau, 2006) (City of Fort Collins Natural Areas Department, 2012) (Larimer County Natural Resources Department, 2011). Infrastructure – cellular tower, evacuated dam, historic buildings, home sites, powerplant, and quarry (The Nature Conservancy, 2012) (City of Fort Collins Natural Areas Department, 2012) (Larimer County Natural Resources Department, 2011); hayfields (Larimer County Natural Resources Department, 2007).

Map 10. Biological values – Cumulative impacts (input to Preferred Surface Occupancy map for biological values)

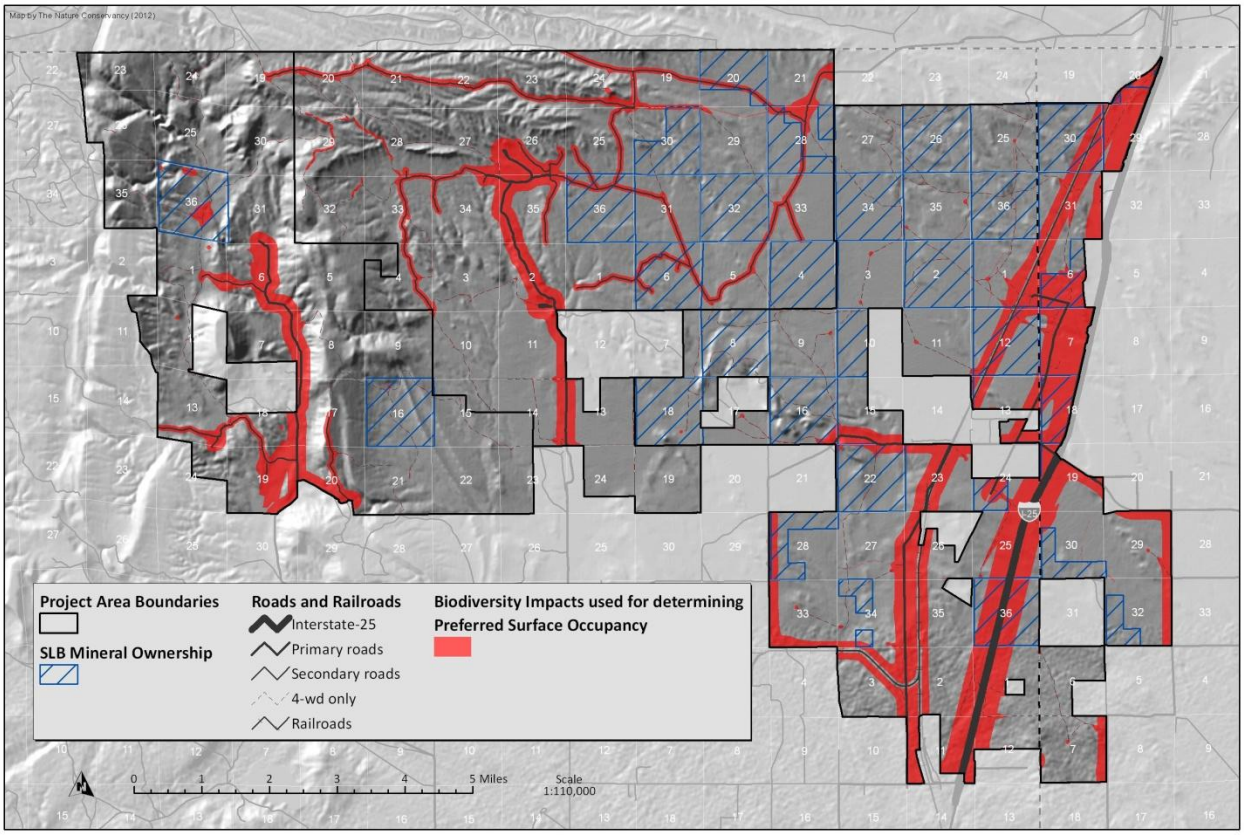
This map shows the cumulative impacts of existing infrastructure to biological values.



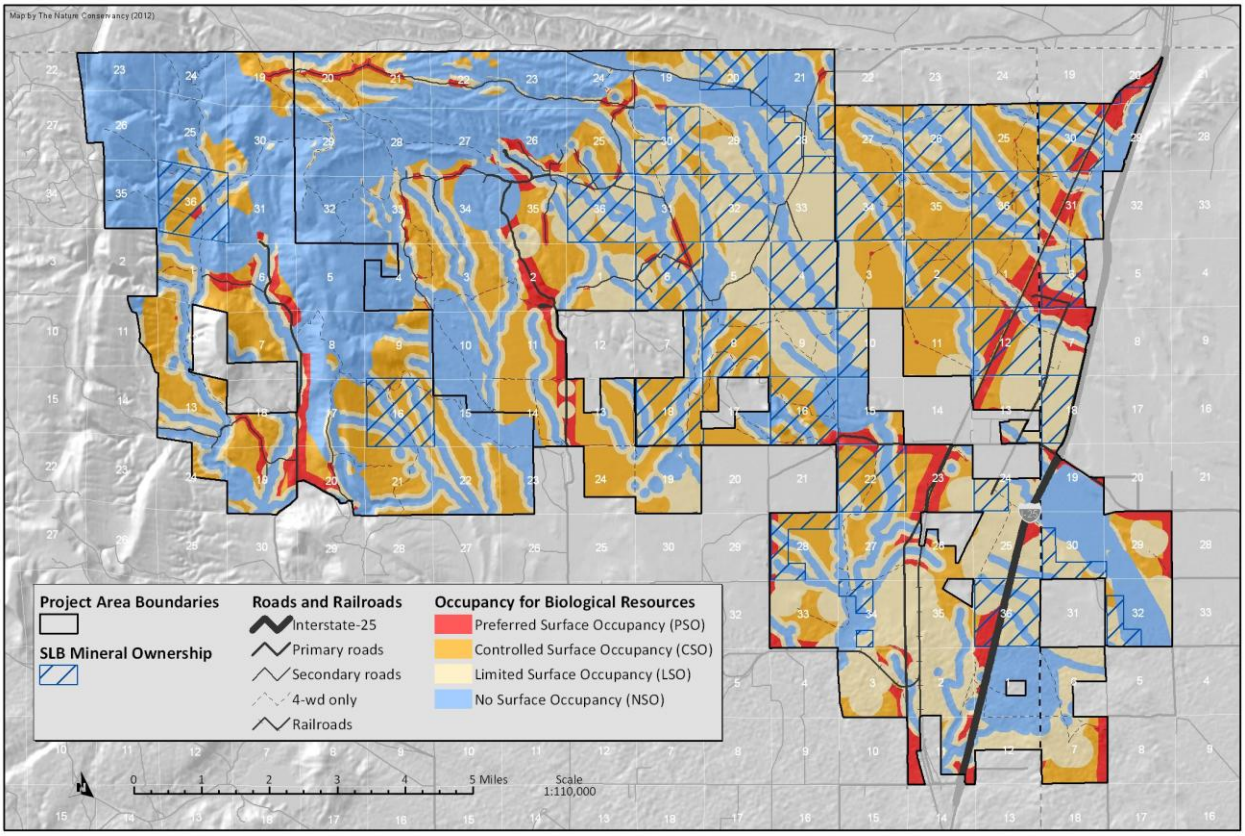
Source: The Nature Conservancy based on methods from the Central Shortgrass Prairie Ecoregional Plan (Neely, et al., 2006).

Map 11. Biological values - Preferred Surface Occupancy (input to final biological map)

This map combined the moderate and high cumulate impacts from the previous map to create the final potential Preferred Surface Occupancy Areas. "Potential" is used because these areas could be "trumped" by No Surface Occupancy and Limited Surface Occupancy areas once combined.

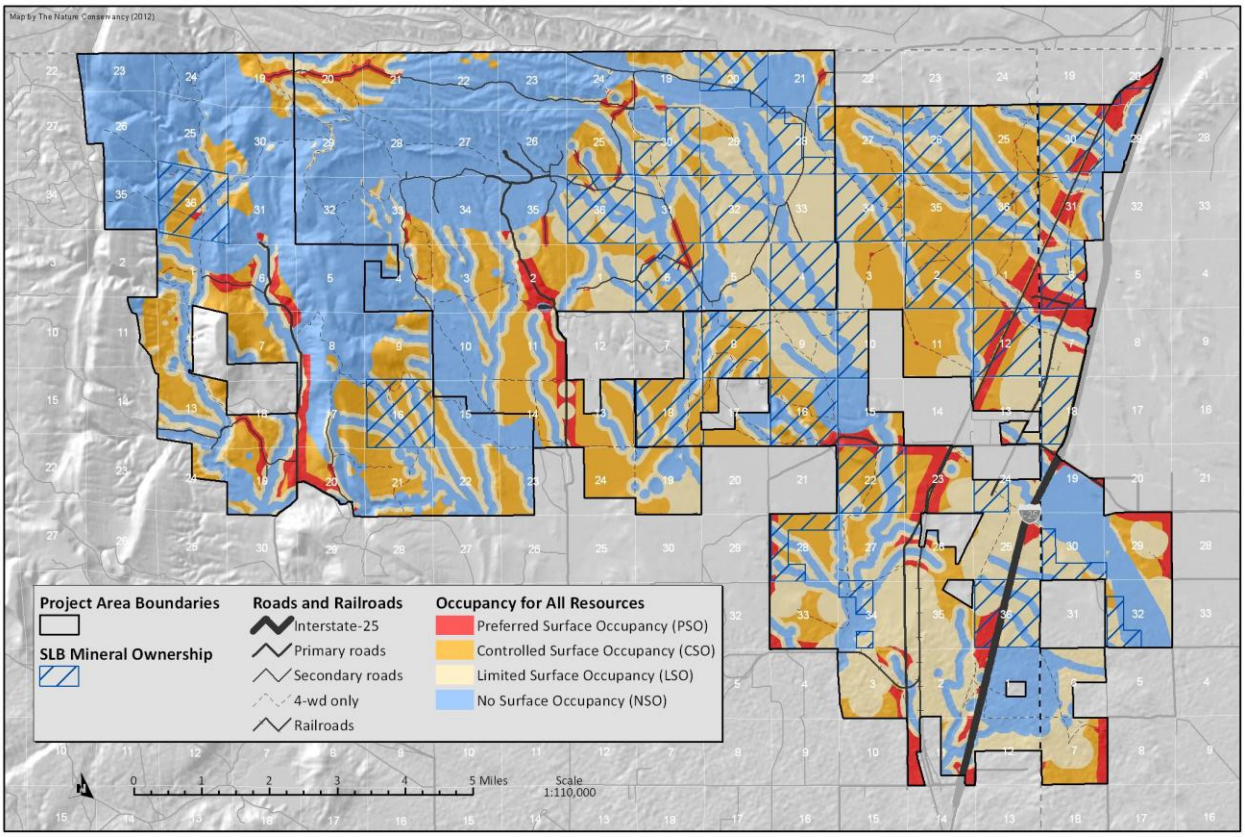


Map 12. Biological values - Final surface occupancy recommendations for biological values ONLY



Map 13. FINAL MAP OF SURFACE OCCUPANCY RECOMMENDATIONS FOR BIOLOGICAL AND CULTURAL VALUES

See next page for definitions and standards of each type of surface occupancy.



Definitions and Standards for Surface Occupancy Categories

Requirements for all categories

- All surface occupancy shall be consistent with existing regulations, lease terms and stipulations (including but not limited to Best Management Practices), and surface use agreements.
- The surface occupancy area map is a starting point. On-the-ground surveys prior to oil and gas development will be used to verify or identify the presence/absence of biological and cultural targets, and associated surface occupancy requirements. The map reflects biological and cultural priorities only; it does not include scenic and recreational priorities, which may affect the design of oil and gas infrastructure.
- Based on surveys, the operator may petition the surface owner and the SLB to change the designation of any surface occupancy category at a given locale to another category. Any changes require advanced written approval of the Board, the Lessee, and the Surface Owner. For example, an NSO for a rare plant may shift to LSO, CSO or even PSO if inventories demonstrate that the plant no longer exists in that area and habitat is no longer suitable for the plant. Similarly, a CSO could shift to LSO if lark bunting habitat moves from one location to another.

- No permanent facilities.
- All lands impacted by oil and gas development will be reclaimed.
- Biological targets subject to long-term impacts from oil and gas development will require compensatory mitigation.
- Timing limitations related to construction activity and/or human disturbance may cover portions of any of these surface occupancy areas.

No Surface Occupancy

- **Definition:** Mandated no surface occupancy except for temporary low impact uses such as geophysical studies, due to the unprecedented biological or cultural values in these areas, that are either irreplaceable or would take decades or centuries to restore. Species and ecological systems impacted here may not recover.
  - Cultural values: The Lindenmeier site plus a one-mile buffer around it, and all surveyed, very high and high priority sites plus a 50 meter buffer around each. The Technical Team included the one-mile buffer around Lindenmeier because only a small part of the area has been surveyed. The full extent of the resources in this area is unknown.
  - Biological values: Targets and surrounding buffers (as needed) that warrant *permanent, year-round protection* from new surface disturbance because impacts to them *cannot successfully be mitigated* through restoration or land protection. Examples include wetlands plus a 300 ft. buffer, golden eagle nests plus a ¼ mile buffer, and rare plants plus a 300 ft. buffer.
- **Standards:**
  - No permanent O&G operations or facilities conducted or installed.
  - Minimum intrusion may be permitted in connection with seismic exploration operations, temporary access, emergency response access and other limited purposes for effective ongoing surface owners' management of the surface resources. The surface owner, in consultation with the SLB and others entities as appropriate, may deny such access (i.e., surface owner has final decision).
  - Existing roads may provide access through NSOs depending on the amount of construction that is needed to upgrade the road, the amount of traffic, and the impact associated with viable alternatives. New roads will not be allowed, unless to avoid perverse outcomes.
  - Should accidents occur during oil and gas exploration and development that destroy or damage NSO areas, extensive and immediate reclamation will be required along with payment of the highest fees for compensatory mitigation.

Limited Surface Occupancy

- **Definition:** Areas that are subject to stringent restrictions on surface use due to the presence and sensitivity of the biological and/or cultural values.
  - Cultural values**:** Unsurveyed areas that have known sites whose values are undetermined.
  - Biological values**:** Targets and surrounding buffers (as needed) that warrant year-round protection, but not necessarily *permanent* protection from new surface disturbance because they can be mitigated elsewhere through restoration or land protection. Examples include lark bunting core areas plus a 450 ft. buffer and mountain plover nests plus a ¼ mile buffer.
- **Standards**:

- Limited oil and gas operations are permitted on these lands after consultation with the surface owner and the SLB, and approval of specific strategies and physical plans that will minimize (or eliminate) any permanent surface impact.
- No new roads are allowed unless the Lessee demonstrates that there is no technologically or economically feasible alternative.
- Requires higher fees for compensatory mitigation than Controlled Surface Occupancy and Preferred Surface Occupancy as it is more difficult to restore and/or mitigate the biological values in LSO areas.

Controlled Surface Occupancy

- **Definition:** Areas which are generally suitable for O&G development. While biological and cultural resources are present throughout the CSO areas, they are less sensitive than in Limited Surface Occupancy areas:
  - Cultural values: Unsurveyed areas and surveyed areas/sites identified as having lower value.
  - Biological values: Values that do not need year-round protection from new surface disturbance because they are less sensitive than those in LSO and NSO areas. Examples include swift fox dens and important winter habitat for elk, mule deer, and pronghorn.

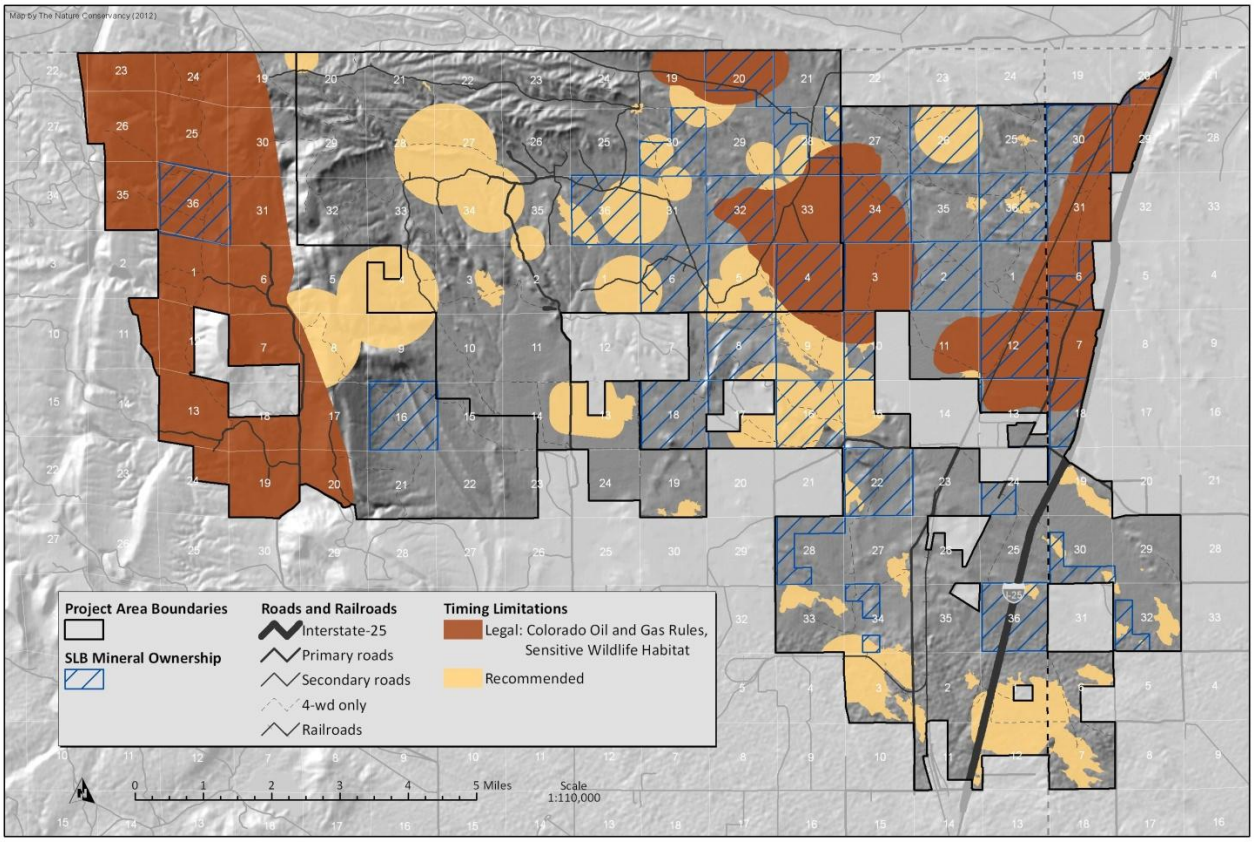
- **Standards:**
  - Oil and gas operations are permitted on these lands after consultation with the surface owner and the SLB, and approval of specific strategies and physical plans that will minimize (or eliminate) any permanent surface impact.
  - Undeveloped lands may become subject to additional limitations imposed to address wildlife habitat, nesting or fawning grounds based on on-site surveys completed prior to oil and gas development.
  - Require lower fees for compensatory mitigation than Limited Surface Occupancy areas, but higher fees than Preferred Surface Occupancy.

Preferred Surface Occupancy

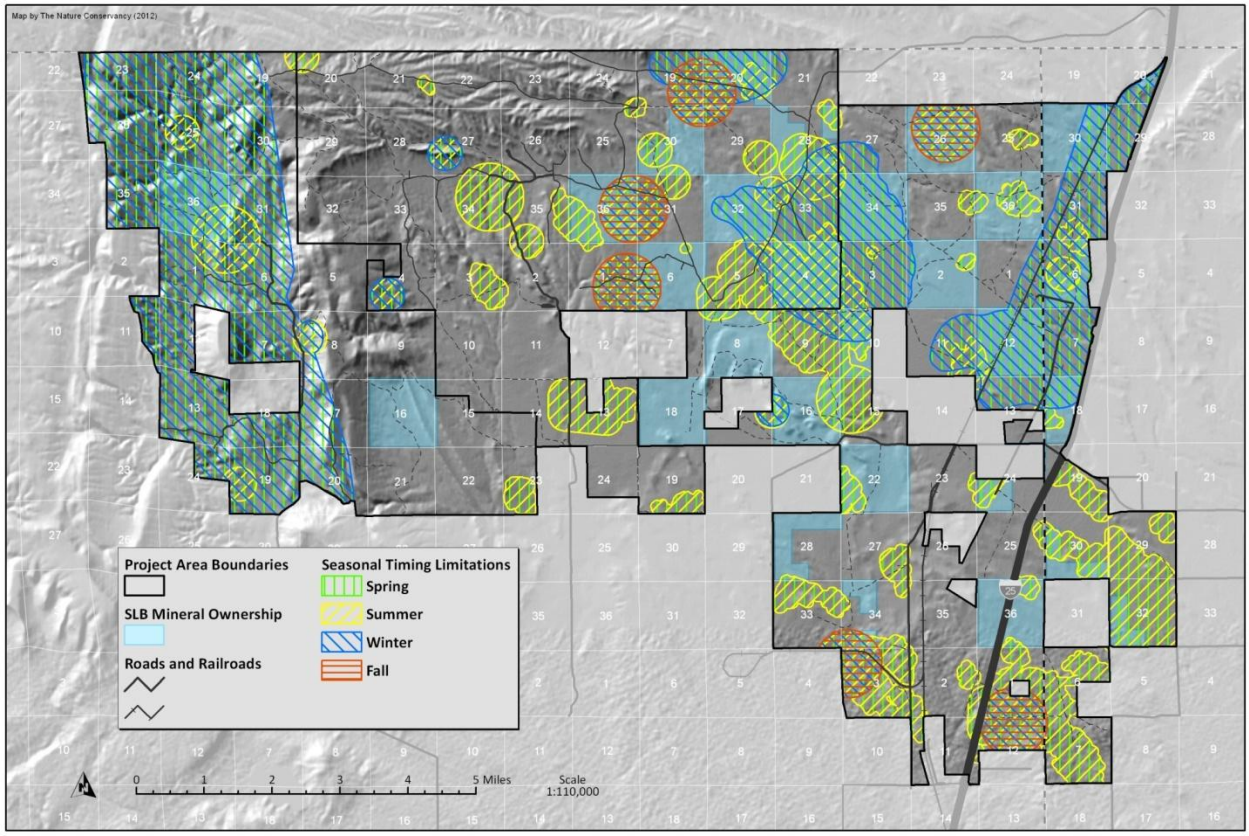
- **Definition:** Areas where surface occupancy is preferred from a biological perspective due to previous and existing disturbances such as along roads, buildings, and transmission lines.
  - Cultural values: none – the Technical Team identified the entire project site as NSO, LSO, or CSO for cultural resources because cultural resources are unknown in most locales.
  - Biological values: This area includes the combined footprints and indirect impacts to biological values from existing infrastructure (e.g., roads, historic agricultural areas and transmission lines) that have a negative impact on biological values. The extent of the indirect impacts varies based on the type of infrastructure; for example, the impacts from I-25 are much greater in intensity than those of the many 4WD roads in the planning area.
- **Standards:**
  - Oil and gas operations are permitted on these lands after consultation with the surface owner and the SLB, and approval of specific strategies and physical plans that will minimize any permanent surface impact.
  - Requires lowest (i.e., baseline) fees for compensatory mitigation compared to the other surface occupancy areas and as defined by the Technical Team.

Map 14. Timing limitations – Legal and additional recommended timing limitations affecting surface occupancy

This map includes legal timing limitations from Colorado's oil and gas rules (Colorado Oil and Gas Conservation Commission, 2008), plus additional timing limitations that the Technical Team recommended based on the biological needs of the targets according to available Best Management Practices, scientific publications, and expert opinion. These timing limitations are applied **seasonally** to specific targets; for example, the timing limitation for ferruginous hawk is no human encroachment within ½ mile of nests from February 1-July 15. See Map 15 for the seasonality of the timing limitations.

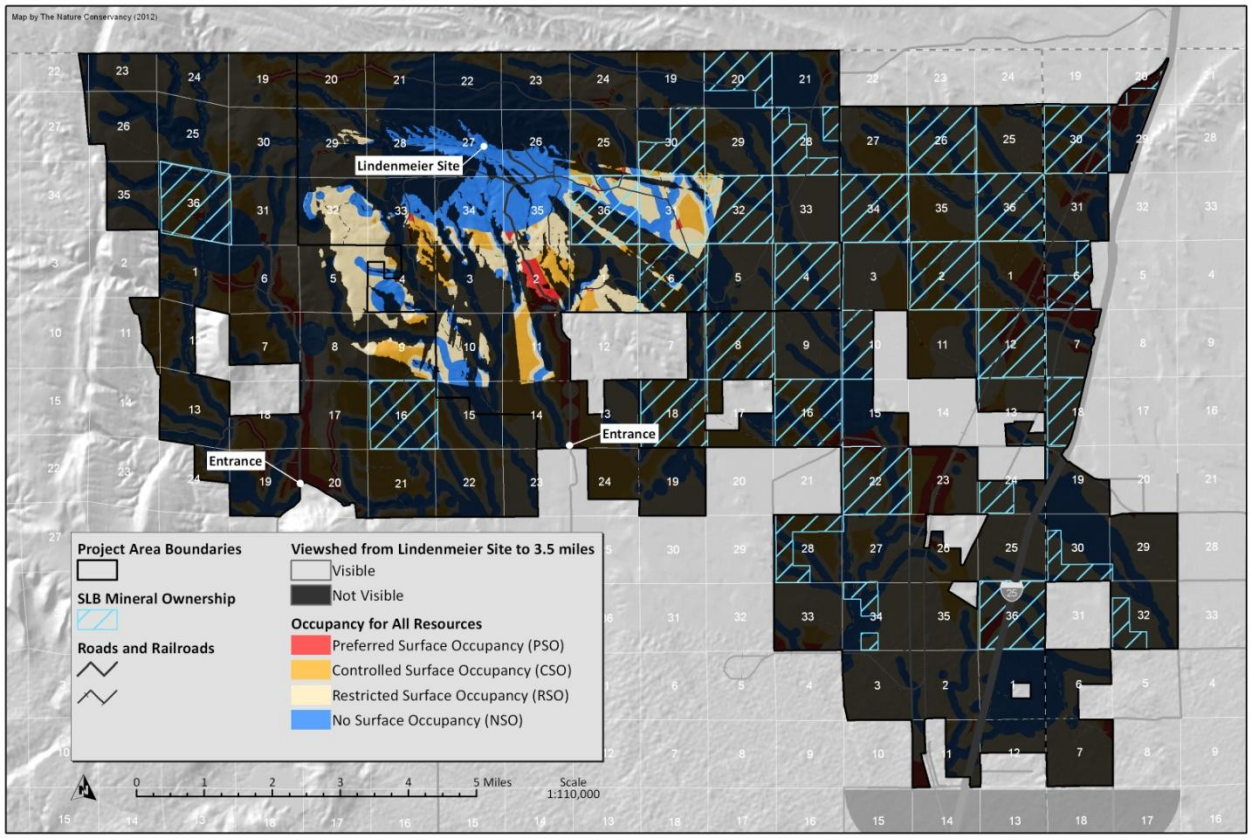


Map 15. Timing limitations - Seasonality of timing limitations affecting surface occupancy



Map 16. Scenic values – Surface occupancy areas that are visible from the Lindenmeier Archaeological Site.

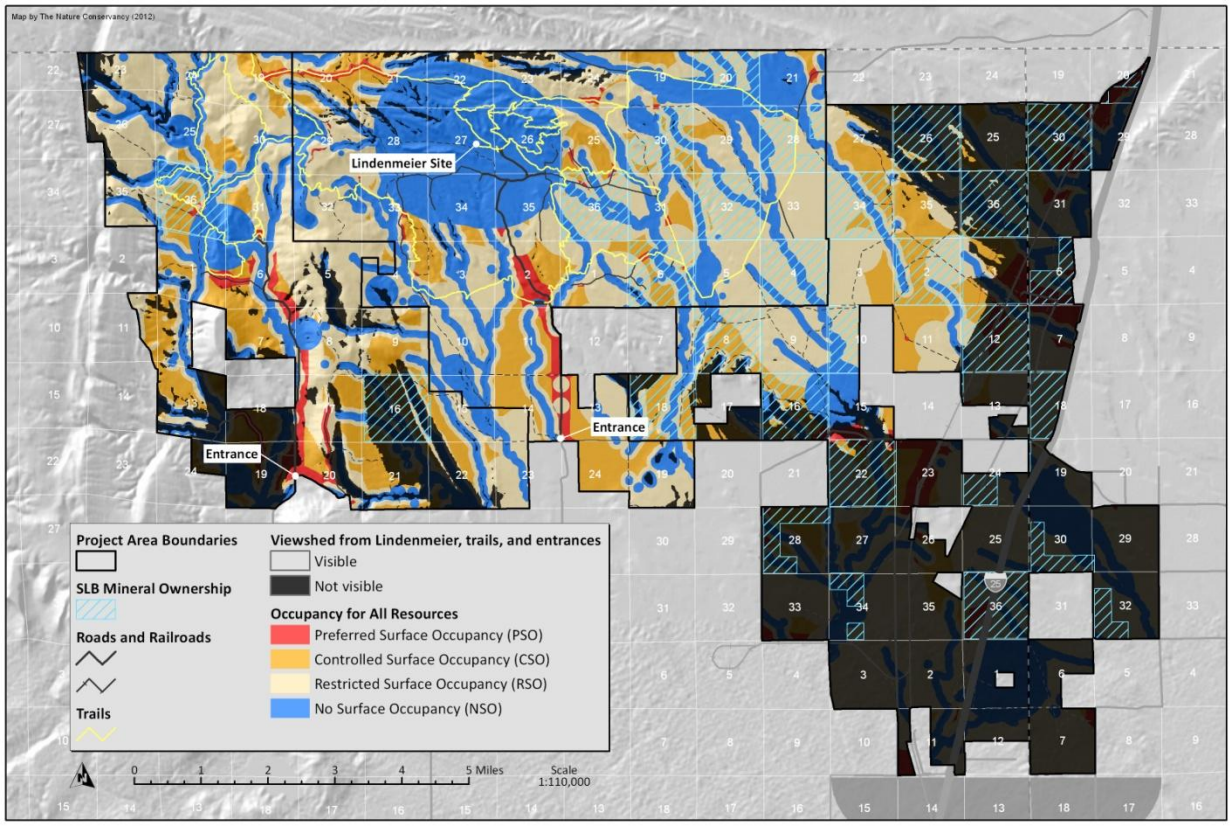
This map shows the surface occupancy areas that are visible from the Lindenmeier site, assuming a sight distance of 3.5 miles.



Source: (Gaertner, Robertson, & Scharton, 2012)

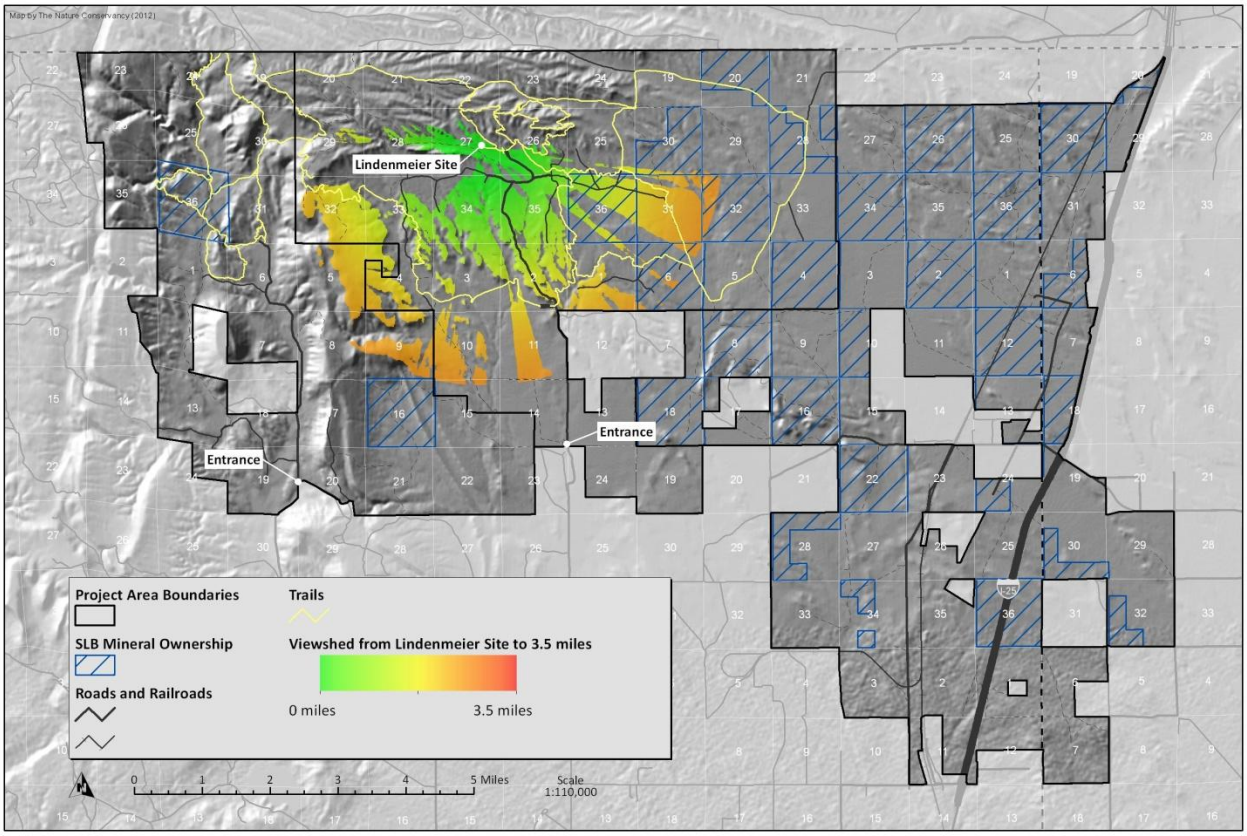
Map 17. Scenic values – Surface occupancy areas that are visible from public trails in the Project Area.

This map shows the surface occupancy areas for biological and cultural resources that are visible from the public trail system in the Project Area, assuming a sight distance of 3.5 miles.



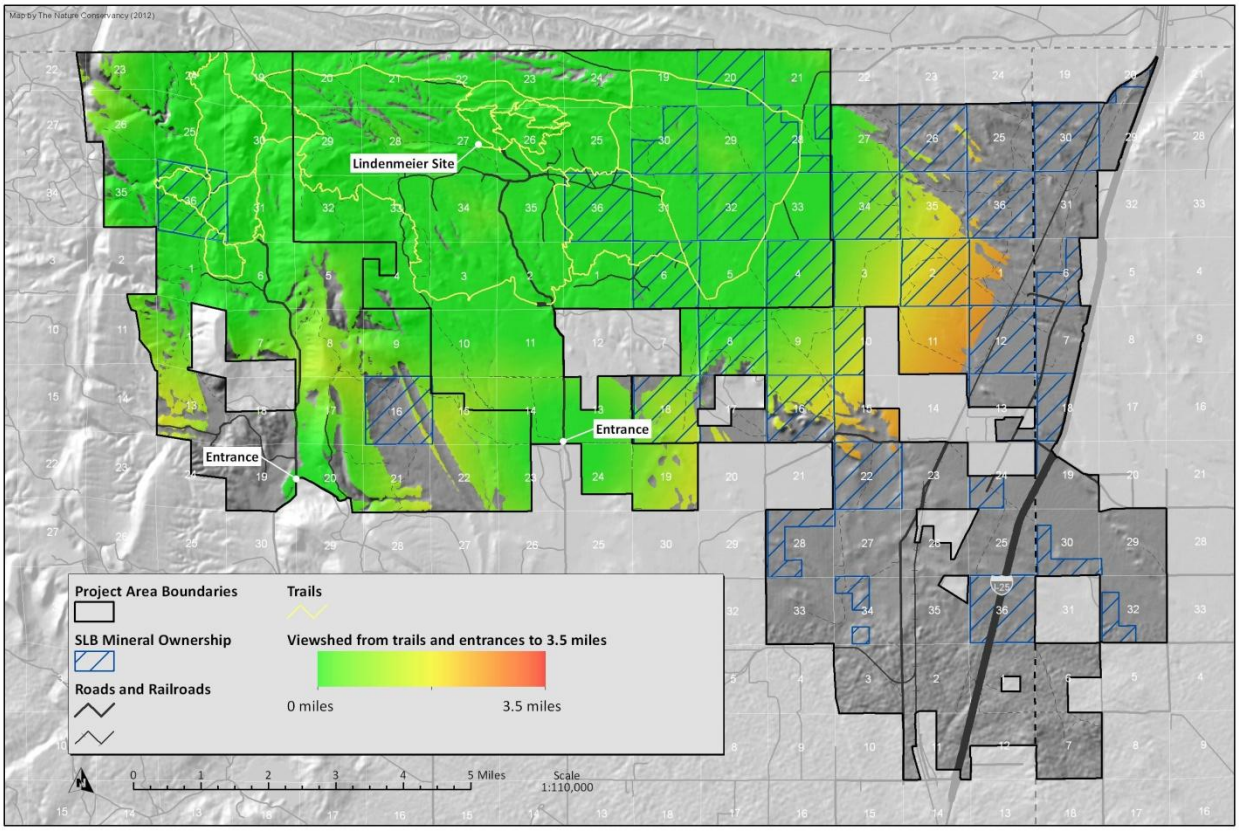
Source: (Gaertner, Robertson, & Scharton, 2012)

Map 18. Scenic values – Decline in visibility analysis from the Lindenmeier Archaeological Site



Source: (Gaertner, Robertson, & Scharton, 2012)

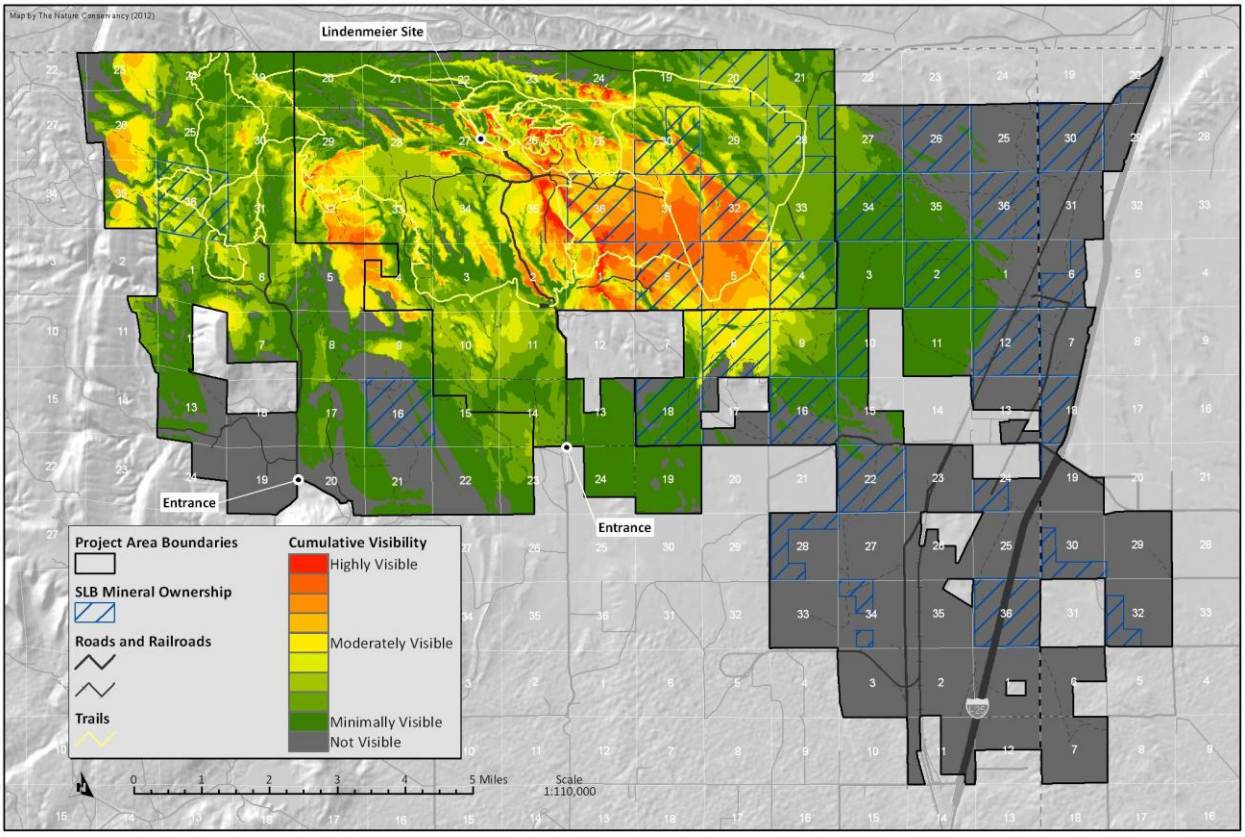
Map 19. Scenic values – Decline in visibility analysis from all public trails in the Project Area



Source: (Gaertner, Robertson, & Scharton, 2012)

Map 20. Scenic values – Cumulative viewshed analysis from the public trails in the Project Area

This map shows the scenic priorities of the Project Area based on the decline in visibility from the trail network (to a distance of 3.5 miles away) combined with the frequency with which any one location within the Project Area can be seen from each step along the trails.



Source: (Gaertner, Robertson, & Scharton, 2012)