Spatial Conversions and Alternative Futures: SITLA/ BLM: A Preliminary Analysis

Utah State University

Bioregional Planning Program

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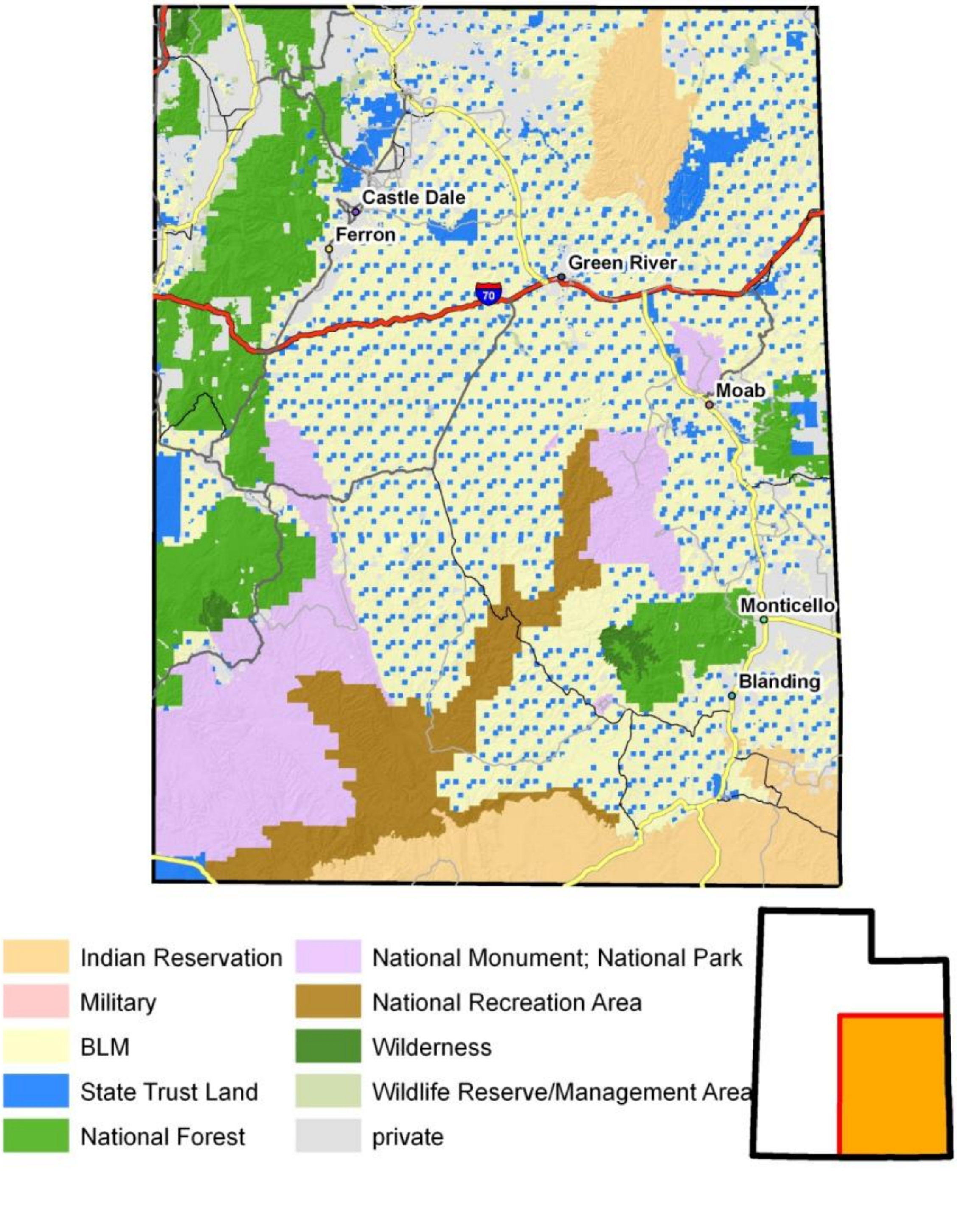
Land Ownership Map



Spatial Conversions; SITLA/BLM
Forward from the Syllabus

"In 1785, prior to passage of the U.S. Constitution, the Continental Congress reserved one square mile out of every thirty-six square mile township 'for the maintenance of public schools.' Beginning in 1850, two square miles were granted to schools; then in 1894 with Utah, Arizona and New Mexico four square miles per township were granted. The lands were granted in trust. In each state constitution, states accepted the responsibilities of trustee, requiring the states to act with undivided loyalty in the best interest of the schools and other institutions that also received lands." "Beginning in the early 1980's, the State Office of Education researched the management of the school trust lands and the investment of the permanent funds. They found misused and neglected lands and raided and poorly invested funds."[1]

In 1981 the State of Utah held a series of public scoping meetings addressing data development and analysis and the examination of alternative exchange proposals between the federal government and the state. A draft paper describing potential criteria for state land selections, which incorporated comments by the Project BOLD Advisory Council, were incorporated into a policy of criteria for State land selection and disposition. That policy was contained in a 1982 publication, "Project BOLD: Alternatives for Utah Land Consolidation and Exchange" (the Project BOLD green book).

The criteria were intended to be general guidelines for the selection of lands for exchange. There were four general goals outlined in the1985 Project BOLD report: 1) to improve management of State lands, 2) to select lands previously identified for exchange or selection, 3) to maintain diverse resources and uses on, and regions of, State lands: and 4) to retain certain types of State lands.[2]

By the 1990's education leaders in Utah began to ask:

How can we maximize the impact of this trust for students for the next 100 years?

How can we structure the land management to optimize revenue to our schools?

How can we generate greater returns from our permanent school fund?

How can we build public support for the productive use of school trust lands?[1]

Both School and Institutional Trust Lands Administration (SITLA) and the Bureau of Land Management (BLM) currently auction, sell, and trade various portions of their land holdings. For the most part, these lands are easily recognizable on the Utah State Land Ownership Map as a checkerboard or grid of blue squares designating SITLA lands overlaid on a background of yellow representing BLM lands. This checkerboard or grid pattern generates the following characteristics:

- divides the landscape into two political divisions with each division sometimes having conflicting viewpoints on policy and land use (state vs. federal);
- does not recognize diverse and spatially distinct landscapes;
- does not recognize significant landscape patterns or areas (patches/corridors);[3]
- does not provide the opportunity for enhancing biodiversity and connectivity in the landscape;[4]
- does not recognize areas of high landscape sensitivity (critical lands) as they relate to public health, welfare, and safety;
- does not acknowledge the continuity of landscape services within a region (rivers, wetlands, migration routes, winter habitat, etc.);
- presents vegetation and wildlife patterns in 640 acre segments (square mile), disregarding the biophysical aspects contributing to landscape pattern and form;[6]

From a policy and management perspective, the pattern:

- does not establish any direction or guidance for future land use planning and management.;
- does not designate areas of high development potential (energy extraction, residential development, recreation and tourism, etc.);
- does not reflect any economic, social, ecological services, or benefits;
- does not relate to any built infrastructure of roads, power, or other development services;
- does not offer various decision points, whether positive or negative, for sales, trades or auctions.

To address the issues noted above, this study was proposed to identify the most beneficial patterns and spatial arrangements in the intermountain landscape based upon cultural, ecological, and economic considerations. A portion of the study would identify areas providing critical landscape services with respect to public health, welfare, and safety. The study would also address the cultural and economic history in the region which would help to identify spatial and policy conflicts between future development and management actions for SITLA and BLM. Both agencies were associated with the study as key stakeholders.[5]

The objective of the study was to develop a landscape-level approach for the analysis of public lands within the state of Utah. A contextual template was established in order to limit the spatial scope of the research. The study took into account, but was not limited to, those issues noted above. Broadly, the objectives were:

- Create a GIS database describing various biophysical and socio-demographic characteristics of the study area, including the basic land use infrastructure of the region. This database consists of existing sources of data available from Utah AGRC and other mapping areas;
- Develop objective definitions and criteria by which regionally-significant landscape elements can be identified and evaluated within the study area, and its regional context;
- Assess likely future growth and land-use patterns in relation to landscape and natural resources, and prioritize areas to be considered for management and/or protection;
- Develop strategies to protect regionally-significant critical lands considering features like public health, welfare, and safety and connectivity between local and regional patterns including landscape biodiversity;
- Prepare a final report on the study process and its conclusions for state and federal stakeholders.

The study has the potential for a broader contribution to future planning in the region by providing relevant data, methodologies, and models for conducting evaluations on the impacts and benefits of growth in the study area over the next five to ten years. The study will provide stakeholders and policy makers with a foundation for future development and management policies within the region.

[1]Executive Summary of Utah's Trust Land Story by Margaret Bird, February 8, 2011

[2] Project BOLD: Proposal for Utah Land Consolidation and Exchange, January 1985, Utah Natural Resources

[3] Land Mosaics, 1995, Forman, Richard T. T., Cambridge University Press, NY, NY

[4] Planning for Biodiversity, 1998, Peck, Sheila, Island Press, Washington, DC

[5] Reforming State Trust Land throughout the West by Andy Laurenzi, Nov. 2005, Sonoran Institute

[6] Ecosystem Geography, 1996, Bailey, Robert G., Springer-Verlag New York, Inc.

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Figure 1. Study team at Dead Horse Point From left to right Tyler Allen, Jane Li, Scott Frost, Lexine Long, Kyle Young. Opposite Captiol Reef National Park (Photo: Richard Toth)

Acknowledgements

Many individuals and organizations contributed to this research project. Their contributions throughout the process added greatly to our experience, provided insight, and helped us see our project in new and exciting ways. It was a wonderful experience to be able to work with so many highly qualified individuals during the course of our study.

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List of Figures

Figure 2. Study team at BLM Offices for Stakeholder Meeting (Photo: Ricichard Toth)

Overview of Study Area:

The study region lies within the Southeastern portion of the state of Utah. The study area is within the Colorado Plateau ecoregion, an area that is an uplifted tableland (Bureau of Land Management (BLM) 2011). The area is generally arid and largely dominated by pinyon-juniper woodlands. The region has a unique geology and, because of this, it is a big attraction for tourism as well as natural resource extraction. Parts of the study area, largely around Moab, have become major recreation destinations.

The project will look at parcels owned in the region by both BLM and the State and Institutional Trust Lands Administration (SITLA). Lands owned by SITLA are currently in a checkerboard pattern across the landscape, with very few areas of clustering. The project will examine how to take the competing goals of the two different agencies, SITLA and BLM, and propose ways of managing and aggregating land in a more cohesive and ecological manner across the landscape.

Figure 3. Physical Map of Study Area

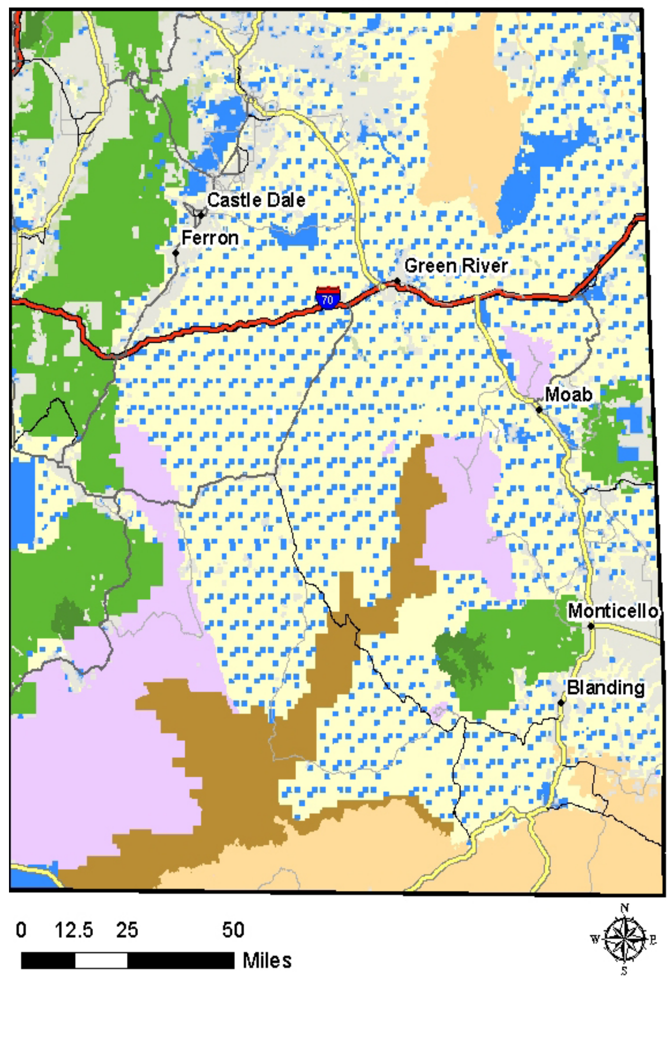

Figure 4. Current Land Ownership Map

Land uses

Major land uses in the area are varied and not always compatible with each other. Land uses include tourism and recreation in many of the areas owned by the state or federal government, oil, mining and natural gas production on private and SITLA owned land and grazing on both private and public land and private residential land.

Stakeholders

The Bureau of Land Management's mission is to sustain the health, diversity, and productivity of public lands for the use and enjoyment of present and future generations (BLM.gov). In order to achieve this goal, the BLM has been working toward creating a more landscape-level approach to the management of the landscape. This project is an exploration of possible futures which the BLM may pursue for more holistic and integrated land management. The goals which the BLM outlined for the project were to have a landscape which is less managerially fragmented than it is currently and to create a management landscape which aids the BLM in accomplishing its stated mission.

The School and Institutional Trust Lands Administration's mission is to administer the trust lands prudently and profitably for Utah's schoolchildren and other Trust beneficiaries (trustlands.utah.gov). The goal which SITLA had in this project was to explore futures which would increase the capacity of SITLA to accomplish its stated mission and to generate the most revenue for the state on its trust lands. The greatest revenue for SITLA in the past has been through mineral extraction and land sales.

Methods and Process

The methodology for regional planning consists of a combination of identifying issues, assembling data, analyzing and assessing the data based upon defined criteria, and finally using information to develop future plans (Toth, 1974). A detailed process is essential in understanding project objectives for establishing priorities of issues to address, and in developing future scenarios. (Toth et al., 2006; Toth, Covington, Curtis, & Luce, 2007)

The flow chart (Figure 5) illustrates a logical progression in the development of future scenarios for the study area. The process for the study consists of seven general phases, which help guide the planning process.

The process begins with pre-analysis, including background research and data collection. At this point, a regional inventory is outlined for the study area, which helps refine the questions. Additionally, a database of relevant information is collected.

The second phase is a characterization of the geographic region, including biophysical and human systems and interactions. This stage serves to clarify the characteristics of the landscape, the context of the study area, to determine drivers, and to identify data needs (Odum, 1971).

The third and fourth phases involve the creation of assessment models and then combining those assessment models to create more robust tools for use in the next phase of the project. Assessment models are created to spatially depict what is on the landscape. Each of the assessment models can be combined to find patterns on the landscape, aiding in the creation of alternative futures.

The fifth phase is the development of alternative futures. This is a process where alternatives futures are selected to present trajectories of different land uses, management and policy decisions. Alternative futures are designed to create projections of the future given certain management or policy decisions. A spatial representation of the consequences of these decisions allows managers to see likely outcomes prior to implementation of policies. The process of creating these futures involves the use of a number of the assessment models to create a variety of options for future trades. It is important to have a number of alternatives for each stakeholder to choose from to create well-informed decision makers.

The sixth phase is an evaluation of likely effects and impacts of the potential alternative futures. Implementation strategies and recommendations are suggested in the last stage.

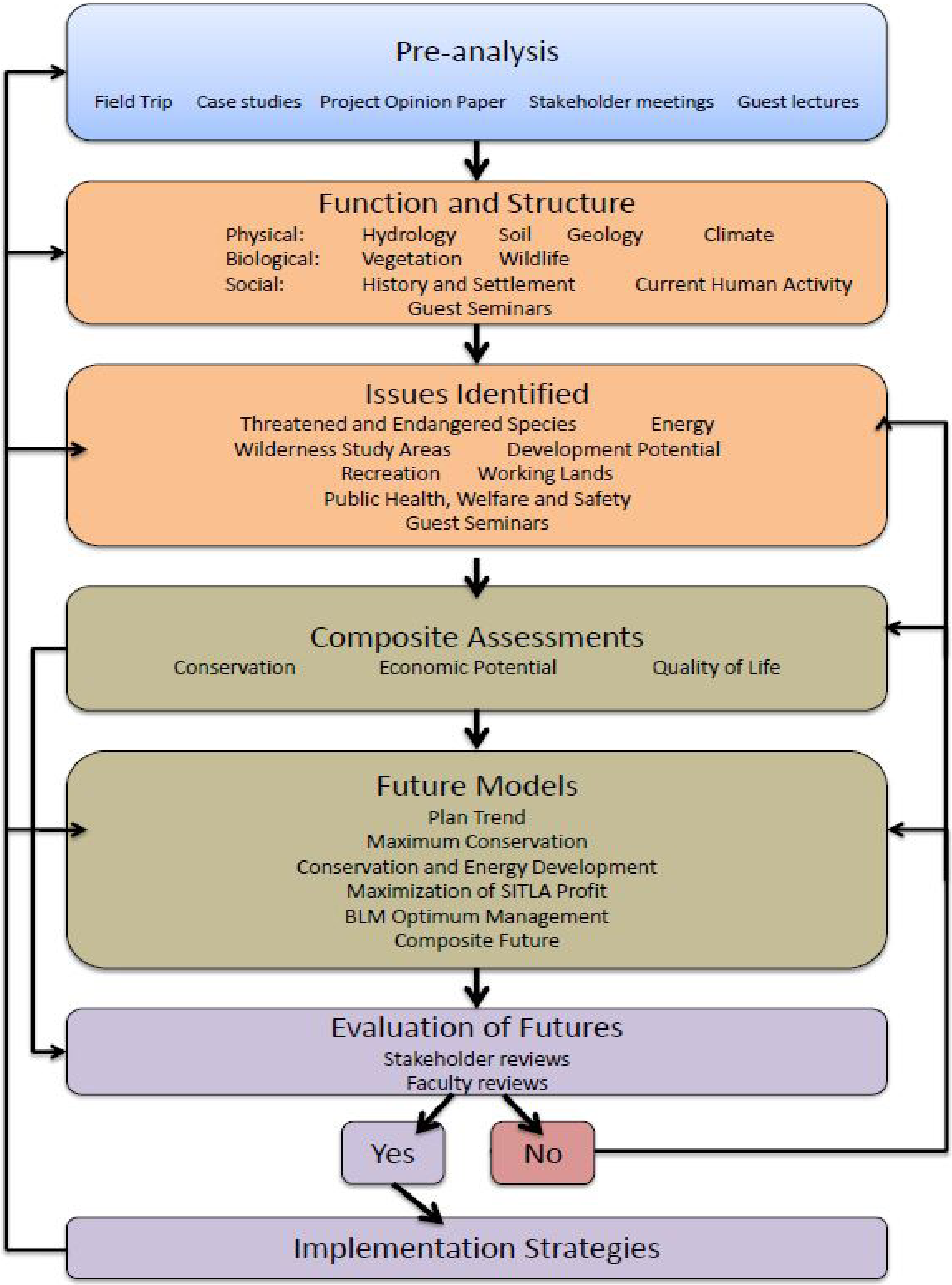

Figure 5. Process diagram of program of study for project

Pre-Analysis

Site Visits

During the pre-analysis phase of the project, we went on a site visit through the study area. This included stops in Arches National Park, Dead Horse Point State Park, the Manti-La Sal National Forest, Natural Bridges National Monument, Glen Canyon National Recreation Area, and Capitol Reef National Park. We were also able to visit several communities in the study area, including Moab, Monticello, and Torrey, among others. The site visits allowed us to understand the complexity of working in such a large landscape and the variety of habitat types, land uses, and relevant issues that exists throughout the study area. This gave the study group a better appreciation of the study area and an experiential reference to use when later analyzing data from the region.

Figure 6. Wind turbines along Hwy. 89 (Photo: Lexine Long)

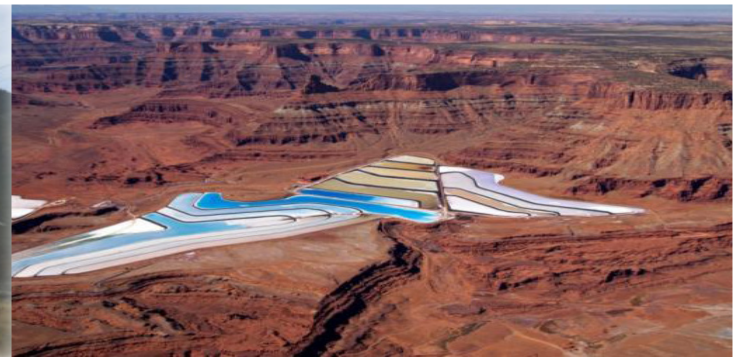

Figure 7. Potash mine seen from Dead Horse State Park (Photo: Ecoflights.org)

Case Studies

In order to gain an understanding of bioregional planning and alternative future studies as a whole, and how it relates our task in particular, we reviewed several relevant case studies, including the Upper Colorado Ecosystem-Alternative Futures Study (Phase 1), Project Bold, Honey Hill, and Alternatie Futures for the Telluride Region, Colorado. The intention of using case studies was to give each member of the team a common background of knowledge and language when approaching the project as a group. The case studies we found to be most relevant to this project were:

Upper Colorado River Ecosystem – Alternative Futures Study (Phase 1)

In the summer of 2004, Utah State University's Bioregional Planning Program was asked by the U.S. Fish and Wildlife Service (FWS), Region 6, to identify the necessary data to conduct a wildlife habitat analysis and landscape-level management study. The study would rely heavily upon Geographic Information Systems (GIS) application to ecosystem-level planning. In October of 2004, the results of the study were presented to FWS Region 6 staff. The work consisted of six elements: 1) Develop criteria for choosing which data is needed for analysis; 2) Initiate a data search to find out which data are available; 3) Collect data and assemble data files; 4) Process, Merge, and Clip data to projected boundary; 5) Produce descriptive maps; 6) Define and display sample models using various criteria (Toth et. al, 2006). This study therefore helped to define a methodology with which this project was conducted allowing for work on a large landscape.

Project Bold

Project Bold was a project in the 1980's which focused on removing the fragmented land ownership across the public lands of Utah and aggregating the land ownership in other areas. This project was optimistic in its scope as it was attempting to aggregate the lands across the entire state of Utah. This project showed that this has been a problem in Utah for a long time and has had the attention and effort put into it to solve the issues related to fragmented land ownership. Some of the findings we came to in this study correlated with Project Bold's recommendations, however more recent data and modeling techniques allowed for a more accurate representation of what is on the landscape than what was available in the 1980's.

Function and Structure

Function and Structure refers to the analysis of elements on the landscape to better understand the interactions and cause and effect relationships. It is important to gain an understanding of current conditions in the study area and the interplay which each element of the landscape has with each other. As a first step in this process we selected several features based upon the case studies in the pre-analysis phase, which would help best define this landscape.

Hydrology

Hydrology is the study of the movement, distribution, and quality of water. It includes the hydrologic cycle, water resources, and environmental watershed sustainability. Few issues, if any, are as rife with contention as water issues are in the western United States. Mark Twain put it succinctly when he said, “Whiskey is for drinkin’; water is for fightin.’” The scarcity of water in southeastern Utah and the intermountain west is a difficult reality to mitigate between the states and other interests. Predicted climate change will likely exacerbate water scarcity issues in southeastern Utah. Pressure on water resources, especially the Colorado River, mounts in the face of increasing population and drought. Andrew Liveris, CEO of Dow Chemical said, “Water is the oil of the 21st century.” In the southeast region of Utah, water is arguably the most precious resource available.

Figure 8. The Colorado River Basin (Arizona Department of Water Resources)

Hydrology of the Colorado Plateau

The primary hydrologic features of southeastern Utah within the Colorado Plateau are the Colorado, Green, and San Juan Rivers. Very few natural lakes exist in southeastern Utah; almost all are impoundments created by the construction of dams. The largest of these is Lake Powell, which contains a maximum of 27,000,000 million acre feet (Bureau of Reclamation, 2009), but currently holds about 16.60 maf (68% of capacity), as of October, 2011 (Bureau of Reclamation, 2011). The Green River, which is the largest tributary of the Colorado, flows initially from headwaters in the Wind River Range in Wyoming. The San Juan River, the second largest tributary of the Colorado, has headwaters in the Rocky Mountains of southern Colorado. The Colorado River drains the western slopes of northern and central Colorado. It is often referred to as, “one of the most important water systems in the western United States” (McPherson, p. 109, 1994).

Surface Flow

The Colorado Plateau region is an area within the Upper Colorado Basin watershed (see Figure 8). The northern part of this area extends from southern Wyoming in the north to the western slopes of the Rocky Mountains of Colorado in the east, and comprises the Colorado Plateau portion of Utah. The lower basin consists of southeastern Nevada, nearly all of Arizona, southern California, and western New Mexico. Nearly all of the water supply to the rivers in the region is generated by runoff from winter snowpack in the mountain areas. Precipitation in the form of rain can be incredibly fickle but usually arrives in the region in summer and fall monsoons. Due to the general lack of vegetation in the canyon country, much of the precipitation strikes directly on bare rock or soil. This causes significant erosion and can potentially result in flashfloods strong enough to move large boulders and trees.

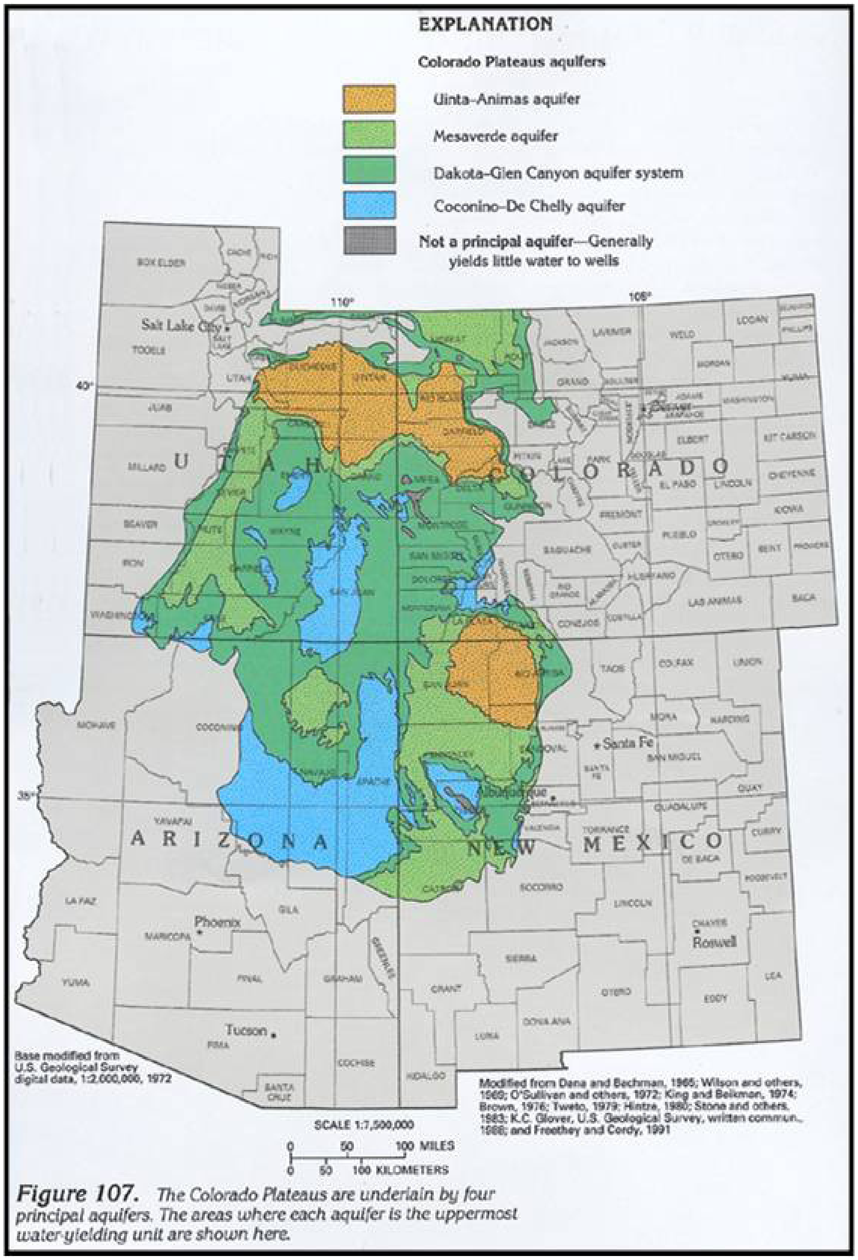

Figure 107. *The Colorado Plateaus are underlain by four principal aquifers. The areas where each aquifer is the uppermost water-yielding unit are shown here.*

Figure 9. The Aquifers of the Colorado River Basin (United States Geological Survey)

Ground Water

Figure 9 indicates the aquifers in the Colorado River Basin. Aquifers are highly correlated to the geologic structure and precipitation of an area. Recharge areas are generally at the base of mountain slopes and in adjacent valleys. Many of the communities and residents within the study area depend on ground water for culinary and agricultural uses. Much of the ground water is highly mineralized, especially by halite, either due directly to the substrata or seepage from unplugged oil wells (Robinson & Banta, 1995). Future land-use planning should carefully consider ground water quality and seek, when possible, conservation of aquifer recharge areas.

Water Resources in the Colorado Plateau

Water resources in southeastern Utah originate primarily from snowpack and groundwater. Dams impound spring runoff and store the water in reservoirs. Nearly every community in the region has local reservoirs to support agricultural and municipal uses. Crop farming in the southeast part of Utah relies heavily upon irrigation for water. Additionally, the Green, Colorado, and San Juan Rivers are major water resources for irrigation. These rivers also provide the setting for myriad recreational activities, which bring money to local economies.

Water Policy

Anne J. Castle (1999) explains “The essence of the doctrine of prior appropriation is that, while no one may own the water in a stream, all persons, corporations, and municipalities have the right to use the water for beneficial purposes. The allocation of water rests upon the fundamental maxim ‘first in time, first in right.’ The first person to use water (called a “senior appropriator”) acquires the right (called a “priority”) to its future uses against later users (called “junior appropriators”).” This doctrine, first adopted in Colorado, eventually extended to the rest of the western states.

The most well-known water policy in southeastern Utah is called the Colorado River Compact. In 1922, fearing federal injunction, the seven states in the Colorado River Basin organized to negotiate how water rights’ on the Colorado River would be split between them. The upper basin states feared that water projects in the lower basin would deprive them of water in the future under the doctrine of prior appropriation (Bureau of Recreation, 2008). When the states could not agree to a water allocation compromise, Secretary of Commerce Herbert Hoover suggested that the basin be split into an upper and lower half. Each half would have the right to 7.5 maf annually (Bureau of Reclamation, 2008).

Appropriation of water since the signing has been extremely difficult. At the time of the signing, little was understood of the climate regimes and drought cycles of the southwest. Upper basin states often feel they are getting the “short end the stick” when required to send 7.5 maf downstream despite years when total water supply is much less than 15 maf. In 1948, the upper basin states negotiated how their 7.5 maf would be split between them. Most often, 7.5 maf was not available; thus, each state agreed to receive a percentage of the water. The percentage breakdown between states is as follows: Colorado (51.75 percent), New Mexico (11.25 percent), Utah (23 percent), and Wyoming (14 percent); the portion of Arizona that lies within the Upper Colorado Basin was also apportioned 50,000 acre-feet annually (Bureau of Reclamation, 2008).

Vegetation

Vegetation in the larger Colorado Plateau ecoregion consists of subalpine forests, mixed coniferous forests, pinyon-juniper shrublands, grasslands, and sagebrush communities. Southeastern Utah is mostly composed of pinyon-juniper shrublands and sagebrush shrublands. Vegetation composition and structure in Southeastern Utah is heavily affected by the soil composition, climate, and history of human activities (Schwinning, 2008). Climate plays a big factor in determining what vegetation is present, and plants have different ways of adapting to the dry climate, such as smaller leaves to minimize the amount of water lost, waxy or hairy leaves to increase water retention, and either deep taproots, or shallow, extensive root systems (Williams, 2000). Functions that vegetation perform in the region include controlling erosion and providing wildlife habitat, among other functions (Miller, 2005).

Ecoregions in the Colorado Plateau include the alpine zone, arid canyonlands, dry forests and shrublands, sagebrush basins and slopes, subalpine forests, high plateaus, mountain valleys, and semi arid foothills. For a complete list, see Figure 10.

In general, there are three types of pinyon-juniper woodlands: pinyon-juniper grass savannas, pinyon-juniper shrublands, and pinyon-juniper forests. The range of pinyon-juniper woodlands has recently been expanding, and the expansion in range could be potentially attributable to factors such as overgrazing and suppression of fire. Tree canopy cover composed by pinyon-juniper trees is increasing, resulting in a decrease in shrub cover in the region. The decrease in a shrub understory can result in increased erosion and a decrease in the amount of food available for grazing animals (Harris et al., 2003). However, much of the Colorado Plateau woodlands are relatively unstudied as compared to woodlands of the nearby Great Basin region. There are relatively few pure grasslands in the study area. Historic overgrazing and a decrease in fire frequency have resulted in a decrease of grassland cover and an increase in shrub cover. Sagebrush shrublands are another important vegetative community in the region. Sage grouse as well as several other important wildlife species depend heavily on sagebrush for their survival (Harper et al., 1994).

<u>Rare plants</u>

The diverse geologic and soil conditions in Utah, especially southeastern Utah, have created unique micosites and habitat conditions that have resulted in a high presence of rare plants. Most rare plants in Utah are edaphic specialists, meaning they grow only certain usually rare soils (Utah Native Plant Society). Unlike endangered animal species under the

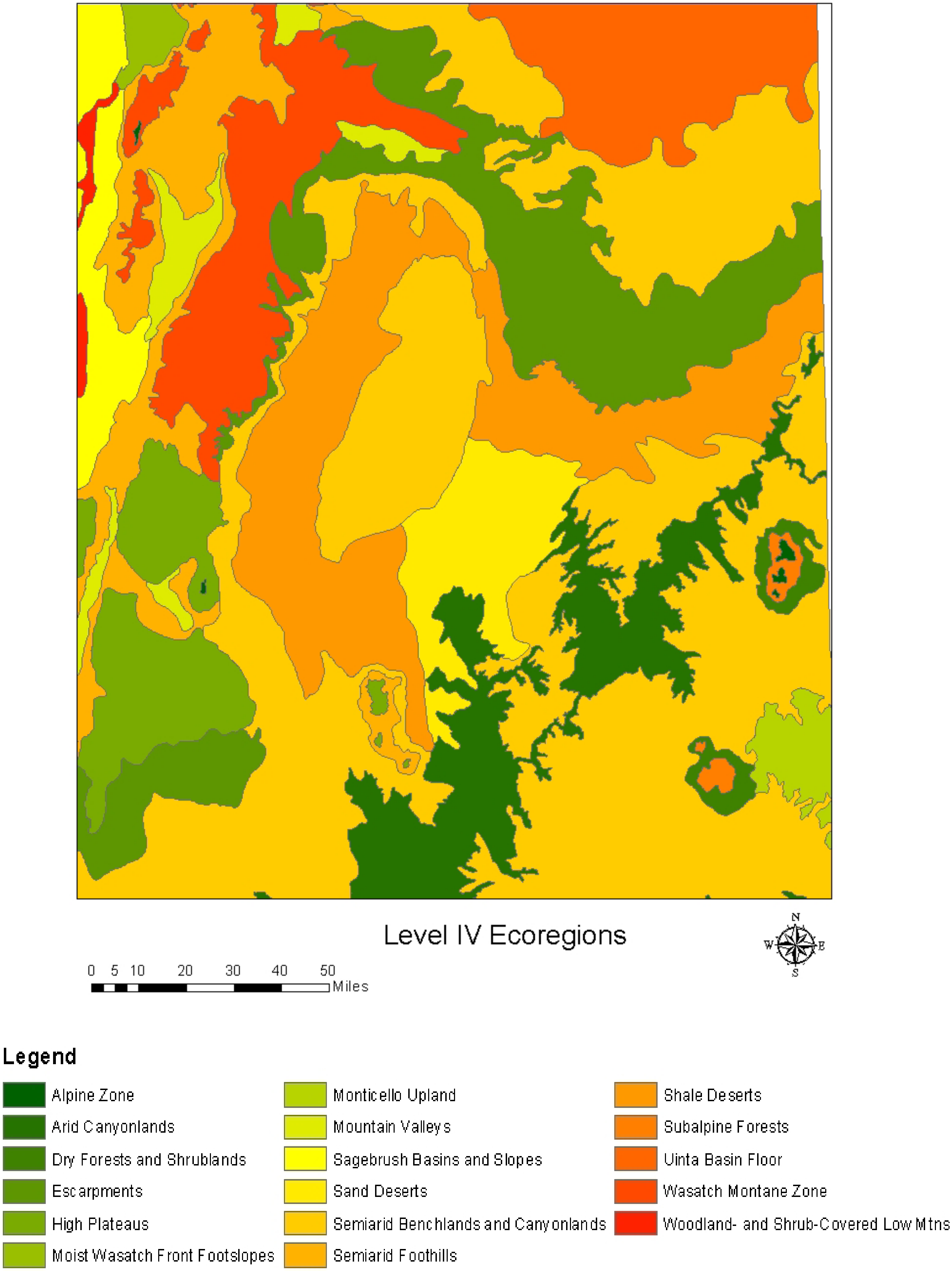

Figure 10: Bailey's level IV Ecoregions

Federal Endangered Species Act, which are protected on land no matter who the owner, endangered plant species are only protected when they occur on federal land. Rare plants are not protected on state lands, so areas with important populations of rare plants occurring on state lands could be candidates for being moved onto federal land to ensure their protection. Some different issues that are of particular threat to rare plants include habitat loss due to development, or in the case of our study area, resource extraction activities, grazing, and impacts from non-native invasive species.

Invasive species

Invasive species are non-native species that are particularly aggressive in their introduced range, and have negative impacts on native ecosystems. Invasive species can alter fire regimes, nutrient cycling, and community composition, among other things. (Vilaa and Ibanez, 2011). Some common invasive species in the study region include: tamarisk (*Tamarix spp*.), cheatgrass (*Bromus tectorum*), and Russian olive (*Elaeagnus angustifolia).*

Effect of grazing on vegetative communities

Like a lot of the intermountain west, grazing on both public and private land is a major influence in the study region. Intensive grazing has been shown to alter vegetation communities, as well as small mammal communities (Rosenstock 1996).

Wetlands and riparian areas

While most of the study region is arid, wetlands and riparian areas are an important part of the ecosystem function in the areas. Riparian areas, wetlands on the edges of riverbanks, support a wide range of plant and wildlife species, and can serve as important migration corridors. Because riparian areas and wetlands are so rare in the arid west, their protection is very important (Jones et al., 2011).

Wildlife

Presence of wildlife is an important aspect of our study region. Many wildlife species are important economically as they are significant game animals and attract hunters and anglers from around the state and country. Several species are of particular concern as their populations have been dwindling, and a variety of stakeholders are involved in the restoration and conservation of their habitat.

Significant species in the area include two varieties of sage grouse: the greater sage grouse and the Gunnison sage grouse. The Greater sage grouse is found mostly in the northern part of Utah and only partially in the study area. The Gunnison sage grouse is only found in San Juan County in Utah and has a very limited range and population numbers. Both species of sage grouse depend heavily on sagebrush for their survival and have seen declines in population numbers, causing concern in the state. Factors influencing the decline of sage grouse include conversion of habitat to other land uses, intensive grazing, invasion by noxious weeds, and fire suppression. Management activities for sage grouse include monitoring, working with coalitions formed for the conservation of sage grouse, habitat conservation, and habitat restoration.

Another important species in the region is Bison. Currently, bison distribution in Utah is very limited. There is a herd of bison in the Henry Mountains in the study area (Utah DWR), as well as one in the Book Cliff mountains. The herd is free roaming and occupies about 300,000 acres, inhab- it elevations ranging from 4,800ft – 11,500ft. They occur primarily on BLM land (258,022 acres), some SITLA land (33,793 acres), and a very tiny bit on private and federal land. Current management actions include hunting permits, purchasing of grazing allotments, operator conversion of domestic sheep grazing allotments to cattle to reduce disease transmission, vegetative treatments, and water developments.

Other major wildlife species in the study area include Rocky Mountain Elk, Desert Bighorn Sheep, and Pronghorn, many of which are important game animals for hunters in the area. Management usually includes surveys, habitat management, and hunting permits.

Figure 11: Bison (Photo: Cooperativeconservation.org)

Geology and Soils

The Colorado Plateau has historically been a fairly geologically stable region. It consists of older strata of rock dating from the Cretaceous to the Permian. There are eolian deposits throughout the study area resulting in sandy shallow soils.

Soils near mountainous regions have a tendency to become more nutrient rich through the erosion of the mountain range. The La Sals, Henry's, and the Abajos notably have better soil content and hence better vegetation growth, as well as along the Book Cliffs and the Wasatch Range.

Some agricultural grade soils are available in areas near mountain ranges where deposition from erosion has occurred, allowing for more nutrient rich, loamy, and thicker soils to be available. These are mostly in the western portion of the study area and near the mountain ranges.

The geologic formations in this region normally tend to be horizontal in nature with only localized steep tilting. This provides large areas of nearly uniform rock ages throughout the region. Steeply tilted areas of rock are known as hogbacks, such as Capitol Reef or Comb Ridge. These formations date to the Laramide Orogeny about 65 million years ago. Hogbacks are interesting formations because they expose sedimentary record dating back millions of years.

During the Oligocene Epoch about 23 to 29 million years ago, the three mountainous regions in the study area were formed. The Henry's, the Abajos, and the La Sals were formed when magma rose up and domed the rock above them, rather than melting the rock away as other volcanoes had done. This gives these ranges a core of rock known as dolomite.

Much of the visible rock that now draws visitors from around the world comes in the form of sandstone or mudstone from the Triassic to Jurassic Epochs. The sandstone in this area is rich in iron, giving the area its trademark red coloring. Much of the remaining area consists of metamorphic rock, shale, sedimentary formations, and eolian deposits as seen in Figure 12. (Hintze, 2005)

Southeastern Utah has many natural geological formations that are known around the world. Arches National Park is home to many natural arches which are formed through erosion of ridges that have weaker portions of rock for the erosion to work on. Natural Bridges National Monument has geologic bridges that span great areas formed through other processes of weathering and erosion. These sandstone formations are draws for many throughout the world, and combined with the natural reds of the iron deposits in the sandstone, create great natural vistas for visitors to see.

<u>Biological soil crusts</u>

Also known as crypto biotic soils, this area is home to living soil crusts. These are crusts formed by living organisms. This crust binds the soil particles together creating a habitat for the organisms to continue growth. Most of the crust is made up of cyanobacteria, lichens, and mosses. These crusts play an important role in the region as they hold the soil in place, limiting the possible erosion and increase the amount of water available for other plants and themselves by pinnacling (texturing) the land around them. Studies show that plants that grow near or on biological soil crusts show an increase in survival and nutrient content as opposed to bare soil. These are invaluable assets for this arid region. Soil crusts are very slow growth, taking decades to create and maintain a biological soil crust community (soilcrust.org).

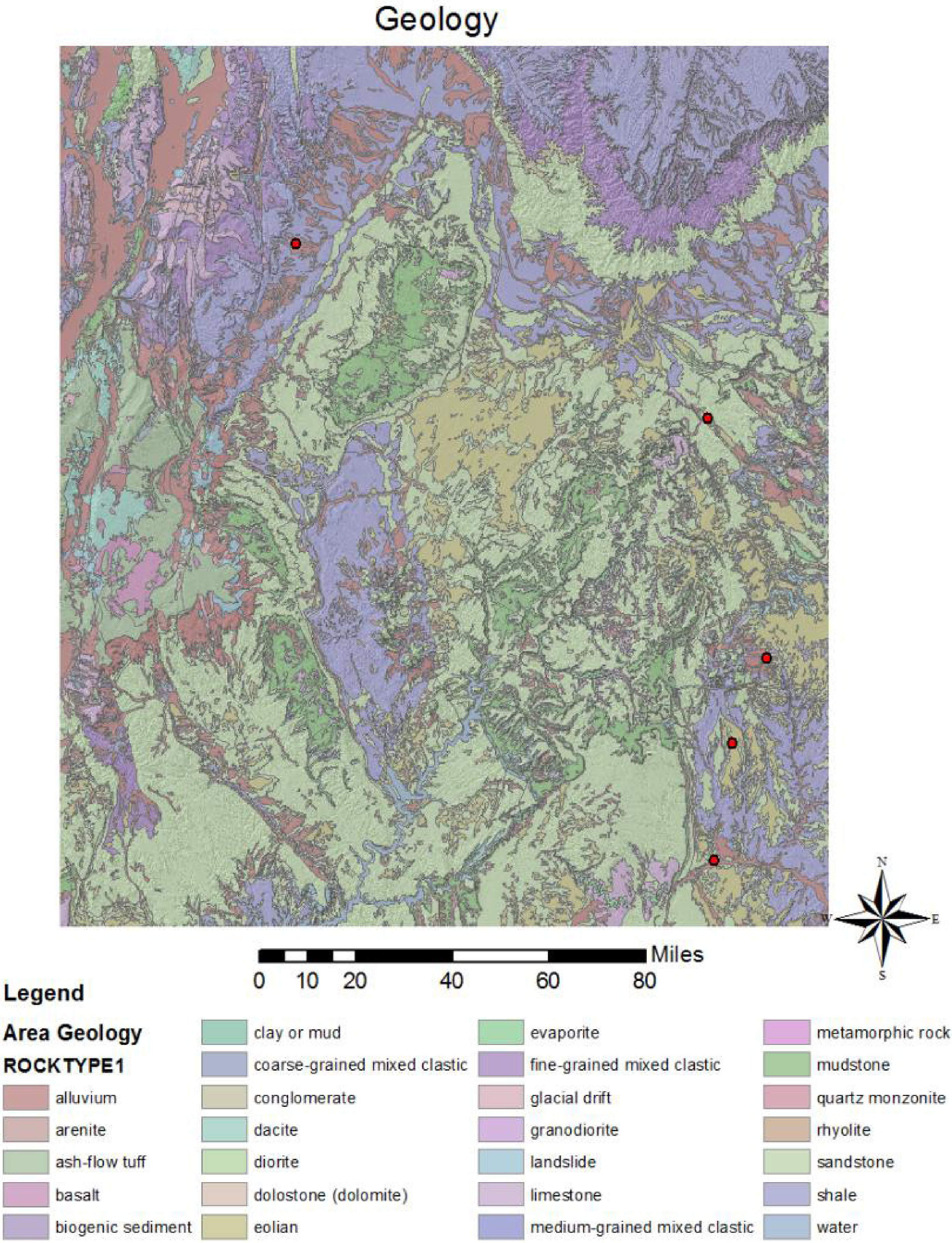

Figure 12. Geology of Southeastern Utah (Map from Utah's Spectacular Geography)

Climate

Utah is at the intersection of four unique regions: the basin and range country of the Great Basin, the alpine peaks of the Rocky Mountains, the canyon country of the Colorado Plateau, and the Mojave Desert. The climate within study area is the result of a combination of various geographic characteristics. Geomorphic characteristics and features such as latitude and longitude, the Colorado Plateau and the Wasatch Thrust all play an integral role in the climatic features prevalent within the study area. These conditions also influence both the human settlement and biophysical development of the area. Historically, climate conditions have influenced human development throughout the region and will continue to do so in the future. Regional climate and its interrelationship with precipitation, water quantity, and vegetation/wildlife distribution should be a focus of monitoring and policy planning for future human development.

History and Settlement

Understanding the present and planning for the future requires a critical examination of the past. The history of southeastern Utah is an intriguing story of survival, solitude, determination, and success despite a harsh and incredibly rough and arid environment. The southeastern portion of Utah within the Colorado Plateau is, according to Joseph Bauman (1994), “the least-tamed country remaining in the lower forty-eight states.” The history of the settlement of southeastern Utah is one of overcoming the extreme climate and remote nature of the area.

Native American settlement

The human history of southeastern Utah begins with indigenous Native Americans. These groups of Native Americans had no written language and thus, the only information we know of them is derived from studies of their artifacts and remains. Archeologists’ have identified three different prehistoric groups that occupied the Utah portion of the Colorado Plateau; in chronological order they are: 1) Desert Gatherers, 2) Anasazi, and 3) the Fremont.

Following the decline of pre-historic Native American groups, the area was inhabited by Paiute, Ute and Navajo. The Native American tribes that remained in southeastern Utah after the departure of the Anasazi and Fremont cultures lived primarily after the manner of their Desert Gatherer ancestors. The Southern Paiute lived in small groups using small seeds and roots to live on. They also grew maize, calabashes, melons, wheat, amaranth, and indigo by using simple ditch diversion irrigation systems (Ellsworth, 1985). The Ute Indians lived from the Uintah Basin in the north to the San Juan River in the south and from central Utah to the Great Plains (Ellsworth, 1985). They lived much like the Desert Gatherers up until the Spanish explorers came to the area. The Utes dominated southeastern Utah until the arrival of white settlers.

Figure 13. Native American Petroglyphs - Newspaper Rock (Photo: Tyler Allen)

Spanish explorers, Old Spanish Trail

The first white men to set foot in the Colorado Plateau were Spanish explorers and traders. The Dominguez-Escalante expedition of 1776 crossed the Colorado River and Uintah Basin (Petersen, p. 372, 1989); trading parties later shortened their route and extended it, crossing the San Rafael Swell through the pass by which I-70 now crosses the Wasatch Plateau, down Salina Canyon to Salina Valley. This route later became known as the Old Spanish Trail and extended from Santa Fe, through the southeastern area of Utah, and then to southern California (Petersen, p. 372, 1989)., the Old Spanish Trail is part of the federally designated national historic trails system.

US government surveyors and explorers

As geographic knowledge increased, the US Government sought to gain an understanding of unexplored areas. In the 1850s, John C. Fremont and John W. Gunnison were the first surveyors assigned to the region. John Wesley Powell, who was already famous for his initial exploration of the Colorado River in 1869, started on a second expedition to survey the Colorado Plateau Region in 1871. He completed his survey in 1879, giving boundaries, labels, and names to a virtually unknown landscape (Larson & Petersen, 1989). Powell also made significant contributions as an advocate for conservation and careful planning of southwestern lands (Bearnson, 1994). He helped create the Geological Survey (USGS), founded the Bureau of Ethnology, and was an instigator of the Reclamation Service (Stegner, 1981).

Settlement of southeastern Utah

Cattle Companies

Before the Mormon Pioneers arrived in the southeast, the area was used primarily as a vast rangeland for cattle companies. Cattlemen in the 1870s, such as George and Silas Green and Joshua Hudson, began to establish herds in the present day Moab and Monticello areas. The cattle would pasture on the La Sal and Abajo mountains in the summer and then move down to the lower plateau country in the winter (Larson & Petersen, 1989).

Mormon Pioneers

In 1877 Mormons crossed the Wasatch Range from the Great Basin and began settlements in Price, Huntington, Orangeville, and Castle Dale (Larson & Petersen, 1989). The settlers primarily raised livestock, cattle, and sheep for a living. Overgrazing of the area quickly exhausted the ranges and led to widespread flooding and erosion until checked by the designation of forest reserves by the federal government (Larson & Petersen, 1989). The Mormons, threatened by the great livestock companies, turned their interests to livestock as well (Larson & Petersen, 1989). An intense competition for grazing control ensued. Settlers were sent to establish Monticello and Verdure and to enter competing claims for water and pasture claimed by other cattle companies earlier (Larson & Petersen, 1989). Eventually Mormon interests bought out many of the large cattle companies in the area.

Minerals and Coal

The earliest attempts to mine coal in the Emery and Carbon Counties occurred in the 1870s, resulting from an extension of mining across the Great Basin in Sanpete County (Larson & Petersen, 1989). In 1876, the Pleasant Valley Coal Company was organized, with operations occurring where Scofield Reservoir was later impounded. Fueled by cities along the Wasatch Front, the Pleasant Valley Coal Company became one of the territory's largest coal producers. By the end of the 19th century, the Carbon-Emery area was producing millions of tons of coal and had become the coal center of the West (Larson & Petersen, 1989).

Current Human Activity

Demographics

Utah's 2010 population was estimated to be 2.76 million. According to the U.S. Census Bureau, Utah ranked first among states with a population growth rate of 2.5% and was the youngest state with a median age of 28.5 from 2007 to 2008. Among the state's occupied housing units, 70.4 percent were owned, compared with 29.6 percent that were rented.

Economy

Utah has a largely mixed economy covering industries like tourism, mining, agriculture, manufacturing, information technology, finance, and petroleum production.

Utah is not a large agricultural state, even though appreciable crops, livestock, and dairy products are produced within its boundaries. Only 4 percent of the land is under cultivation, but approximately 35 percent of the land area is utilized for livestock grazing purposes. Livestock represent the largest portion of farm income within the state. The largest crop is wheat, most of it being "winter" or "dryland" wheat. Other principal crops are barley, oats, hay, potatoes, corn, and sugar beets. Lesser crops include other grains, fruits, vegetables, berries, melons, dry beans, and alfalfa and sugar beets for seed. Range feeds and dryland crops in non-irrigable areas, particularly in the southern portion, often suffer from lack of moisture.

Mining and manufacturing are the two other basic industries in Utah. The state ranks high in the quantity and value of minerals it produces each year, mainly copper, lead, zinc, gold, and silver. The total value of non fuel mineral production in Utah was approximately $4.42 billion in 2010. The state was ranked in 9th place nationally in the output of non fuel minerals. In addition, Utah mines produced significant quantities of beryllium, cement, magnesium compounds, sand and gravel, and salt.

Tourism is a major industry in Utah, and it is well known for its year-round outdoor recreational activities. The Utah ski industry experienced the fourth best season on record and visitation at national parks for the fourth year in a row in 2010. 6.0 million recreation visits were made to Utah's five national parks during 2010. State park visitation also increased an estimated 1.4%. In 2009, 20.2 million visitors traveled to Utah (Utah Office of Tourism, Governor's Office of Economic Development). Taken together, outdoor recreation and tourism represent one of the largest and fastest growing sectors of Utah's economy, with tourism accounting for an estimated $6.23 billion in traveler spending and 110,508 tourism-related jobs in 2009. These visitor's spending generated $625 million in state and local tax revenues, which helps pay for services and infrastructure Utah residents and visitors use and enjoy. The Utah tourism industry continues to be a significant driver of the state's economy.

Recreation

Outdoor recreation in the United States has developed and blossomed since the end of World War II. Nine state parks and three national parks, Arches National Park, Capitol Reef National Park and Canyonlands National Park, are located in the study region, offering an exceptionally wide variety of outdoor recreation opportunities ranging from hunting, picnicking, skiing, boating, fishing, mountain biking, camping, off-highway vehicle use, hiking, wildlife viewing, to rock climbing (Johnson, 1989). Most of the outdoor recreation occurs on public lands managed by federal and state agencies (Figure 14).

Though outdoor recreation brings tremendous economic benefits, there are also costs and conflicts associated with outdoor recreation and tourism. The increase in participants may have some negative impacts on the local community and natural resources: destruction of rangeland vegetation through soil erosion by off-road motorcyclists, harassment of livestock being chased by motorized vehicles, among others (Johnson, 1989). Outdoor recreation also brings some other social, economic, and environmental conflicts. This includes one of the longest-standing conflicts over appropriate uses of public lands in the American West: recreational use versus energy development.

Energy

The unique geologic history, geography, and climate of Utah have resulted in an abundance of energy resources, including fossil fuels such as oil, coal, natural gas, and uranium, and renewable resources like geothermal, solar, and wind energy.

After the 1920 Mineral Leasing Act, public lands were allowed leasing, exploration, and production of selected commodities such as coal, oil, and gas (BLM, 2007). There are about 3,677 producing oil wells and 6,328 producing gas wells in Utah. Utah's nine producing coal mines (seven companies) are located along the Book Cliff Mountains and in the Wasatch Plateau – Carbon, Emery, and Sevier Counties.

Figure 14: Four-Wheeling (Photo: Moabutah.info)

Figure 15: Coal Power Plant (Photo Jane Li)

Currently, 355 million barrels of proven oil reserves are in the state, and the value of extracted crude oil and gas in Utah in 2007 was more than $1.2 billion and $1.5 billion respectively (UGS, 2009).

While Utah currently has access to enough petroleum and gas to meet its needs, prices are increasing and supplies are diminishing. Increases in population and wealth in Utah will probably result in increased demand for energy products (UGS, 2009). However, in Utah, much (66%) of the remaining domestic oil and gas resources are on Federal lands. Exploring and developing these resources depends on improving access. Access covers a variety of issues, from obtaining leases and permits to protecting environmental and cultural resources.

Uranium, as a source of nuclear power energy through mining activities in Utah and other western states, has ceased. However, experts indicate that there is still substantial ore deep underground. Should demand for nuclear power revive and the market become viable, the Colorado Plateau may once again teem with the mines and mills of the atomic years. Uranium Mill Tailings Radiation Control Act (UMTRCA) was enacted to protect the public and the environment from potential radiological and non-radiological hazards at inactive uranium-ore processing sites.

Significant short-term issues expected to impact the mineral industry in Utah include the availability of capital to fund exploration and development of new mineral resources, conflicts in commodity leasing (for example, oil and gas versus potash), permitting delays, and the decreased incentive to explore for metal and mineral commodities in a declining price environment. Long-term issues include the change in rural Utah from a resource-based to a tourism-based economy that will continue to have a significant long-range impact on the availability of lands open for exploration and the willingness of the public to accept mineral development in areas they consider environmentally sensitive (UGOPB, 2009).

Assessment Models

Assessment models are used to provide a spatial representation of selected and specific attributes of the landscape. This includes creating GIS models to spatially display information gained in previous phases of the study in useful ways. This is an iterative process which includes evaluation and reassessment of variables used in order to accurately represent the element which the model is depicting.

Extractive Natural Resources Assessment Model

The study area boasts significant deposits of oil, natural gas, and coal, as well as other minerals. This extractive natural resources assessment model is a combination of these deposits in order to render a region-wide assessment of extractive natural resources. Data was gathered from the Utah SGID database and the US Department of Energy's energy Information Administration (EIA) website (US Department of Energy).

<u>Coal and non fuel mineral deposits assessment</u>

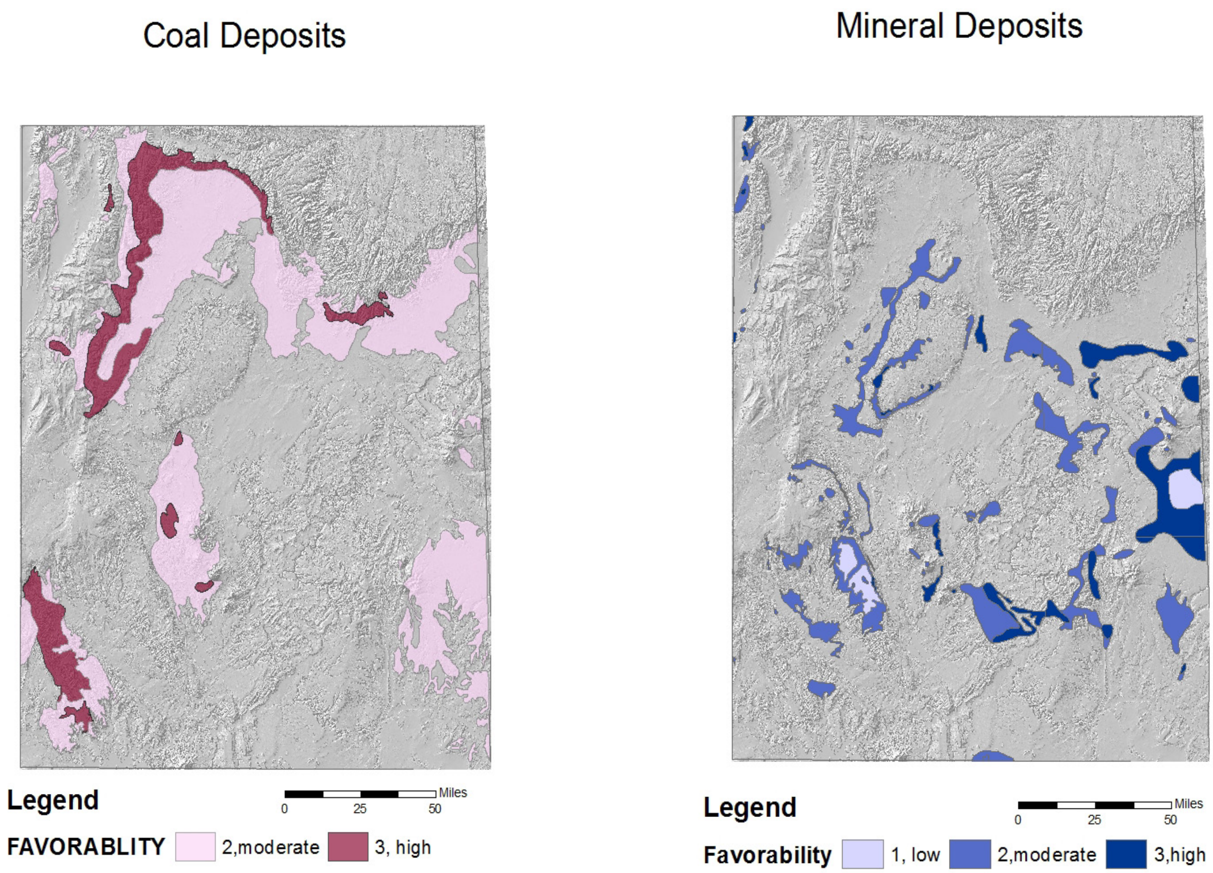

Figure 16. Coal and Mineral Deposits Assessment Models. Coal deposits were ranked according to the value of production and resource: 1) High Value Known Mineral Deposit Areas (KMDA), 2) Moderate-Value KMDA, 3) Low-Value or unknown/unranked areas. Based on this KMDA classification, a favorability rank is created indicating the mineral potential: 1 = low, 2 = moderate, 3 = high.

Oil and natural gas reserves assessment

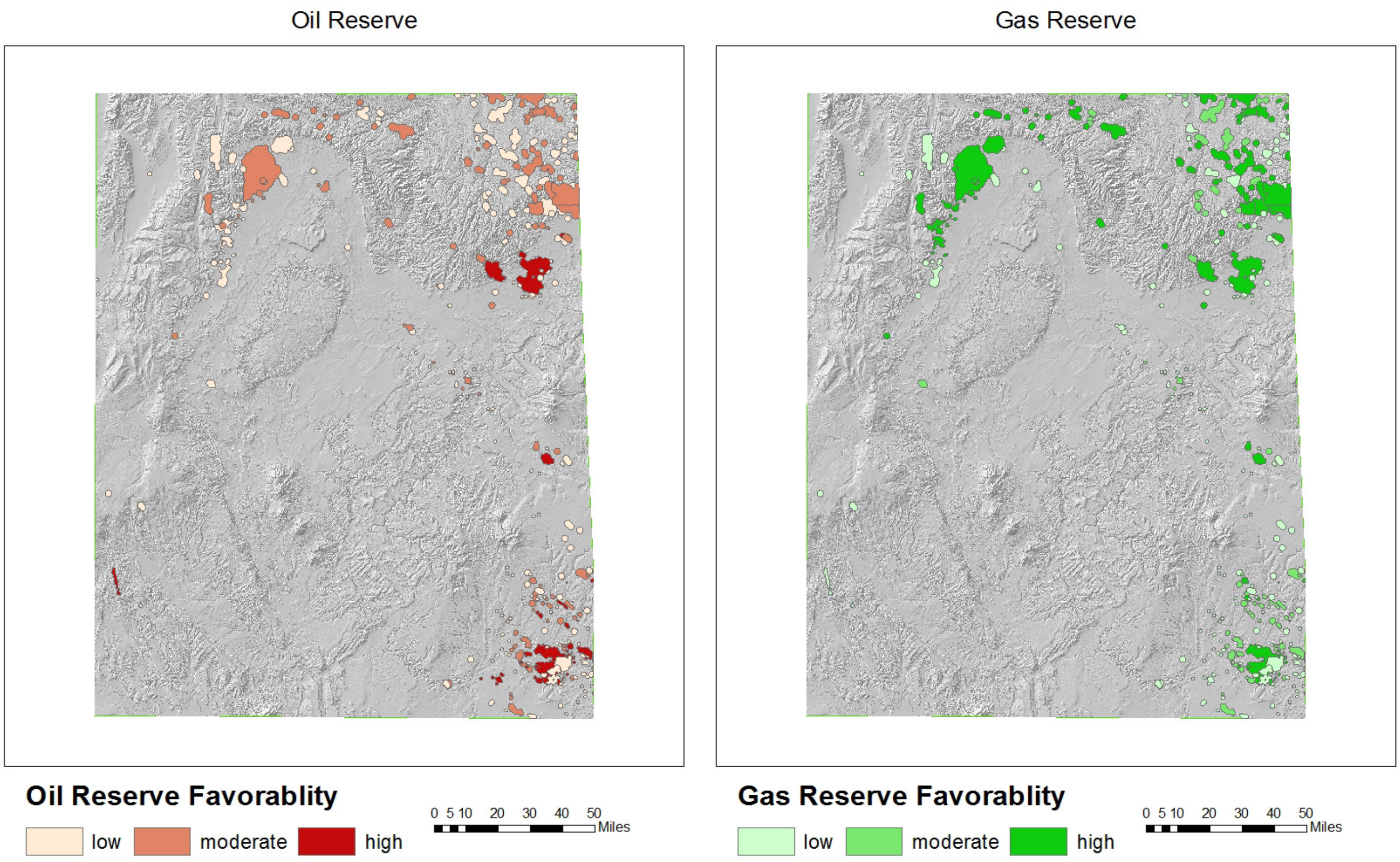

Figure 17. Oil and natural gas reserves, based on 2001 data

Cumulative extractive natural resources assessment

The cumulative assessment model was derived by layering each of the previous analyses. This results in a spatial representation of the relative value of natural resource extraction in the region as a whole. This map is an attempt at finding a relative natural resource value for the region, and not as a definitive highest value map. Its primary use is for planning purposes, and any mineral exploration would need a site-by-site decision prior to any land trades.

Cumulative Extractive Natural Resources Assessment

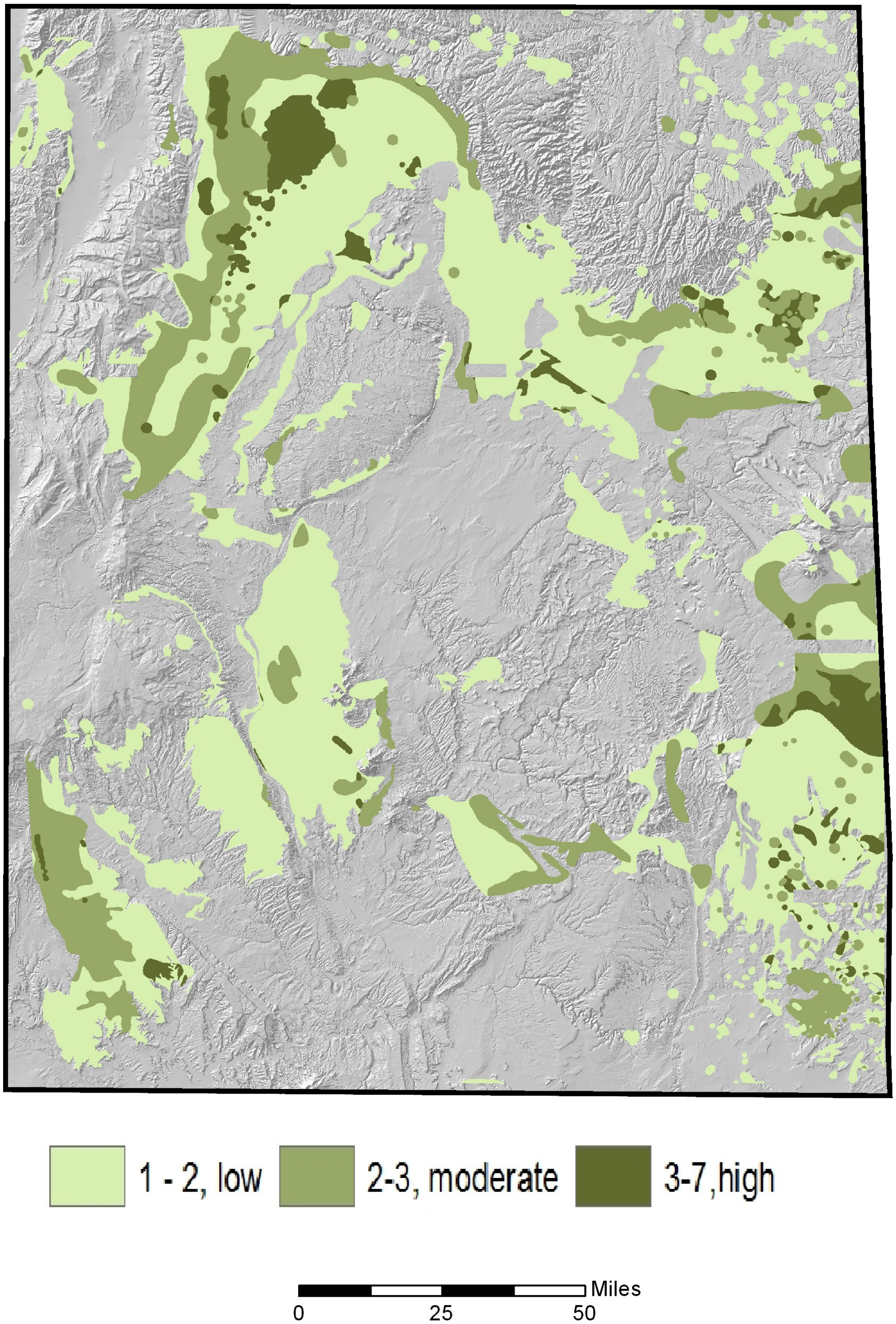

Figure 18. Cumulative Natural Resource Assessment

Renewable Energy Assessment Model

The renewable energy assessment model, based on the Utah Renewable Energy Zones (UREZ) Task Force, is used to identify Utah's utility-scale electrical renewable energy resources and to assess transmission to bring those resources to load centers in Utah. In this model, wind, solar, and geothermal technologies were identified as the primary technologies that are likely to provide large quantities of energy at costs that are competitive in energy markets. Approximately 3,170 square miles solar energy zone, 173 square miles geothermal energy zone and 527 square miles wind energy zone have been identified. The multitude of factors that could not be taken into account at this point of the assessment include project-level resource data; land use and environmental restrictions; federal, state, and local regulatory policies; and economic considerations that may complicate or restrict development.

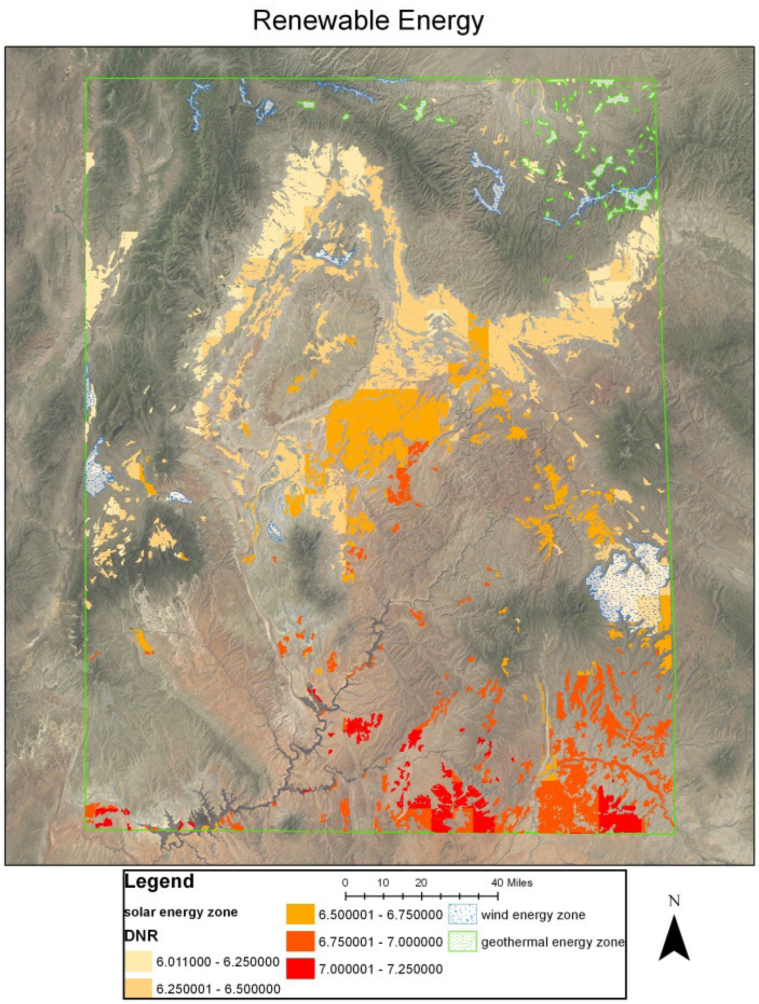

Figure 19: Renewable Energy

Criteria for the Renewable Energy Resource Model included eliminating environmentally sensitive areas including national parks, wilderness areas, and wetlands. Criteria for solar included areas with greater than 6 kwh/m2/day or greater and areas with less than a 3% slope. Criteria for wind power included a maximum elevation of 9,500 ft, eliminating highly rugged areas and also eliminating military operations areas. Criteria for geothermal included an estimate of natural reservoir volume and the efficiency of the reservoir to transfer heat by porosity and sweep efficiency. Proxy's used for this model included: a 50 megawatt (MW) parabolic trough concentrating solar thermal power plant to estimate electrical energy capacity and a wind turbine, General Electric 1.5 sle model, to estimate electrical energy capacity from identified sites.

Conservation Assessment Model

The conservation assessment model uses a variety of criteria to identify areas that are of high conservation value in the study area. The model ranks areas as high, medium, or low conservation priority. The conservation assessment models show current conditions on the landscape that influence the area's potential conservation value. Criteria used for the conservation assessment model included: wilderness study areas, major wildlife species richness, threatened and endangered species richness, a 2 mile buffer around National Parks, and a 300 f.t buffer around riparian areas.

Threatened and endangered species richness

The study area contains a relatively large number of threatened and endangered species. Areas with large numbers of threatened and endangered species are important areas to be considered for conservation. Presence of threatened and endangered species is ranked as high, medium or low based on number of species per quad. This information is based on the most current specific data available. Exact locations of threatened and endangered species are not published due to the sensitive nature of this information.

Major wildlife species richness

The major wildlife species richness model was created to show areas of important habitat to some of the major wildlife species in the study area. All available wildlife habitat data layers were overlaid and summed together. Areas were ranked as high, medium, or low wildlife species richness based on the number of wildlife species in that area.

Wilderness study areas

Wilderness study areas are designated areas that are roadless and potentially have characteristics of wilderness areas. These are areas that may possibly be suited to Wilderness designation (BLM 2011).

Figure 20: Gunnison Sage Grouse (Photo: Ron Stewart, Utah Division of Wildlife Resources

Assessment Models

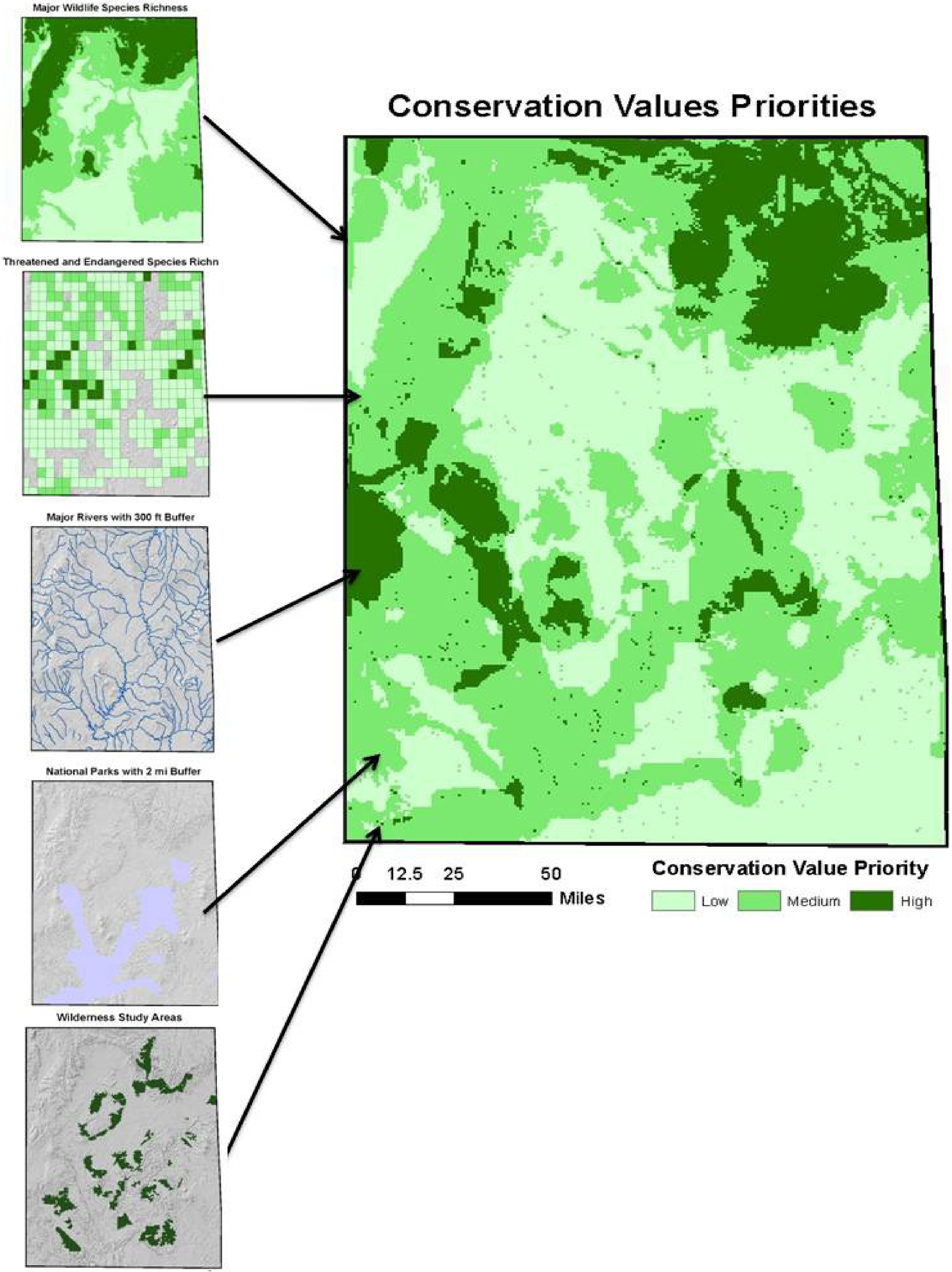

Figure 21 . Conservation Value Priorities

Working Lands Assessment Model

Working lands is an important aspect of the landscape in the study area. It provides jobs and income to the residents in this region. It has been a traditional aspect of life in this region from the time of settlement and continues today in much of the region. It is important to account for working lands when planning the future of this region due to this aspect of the region's heritage and its importance to the residents within our study area.

The working lands assessment model focused on identifying key attributes of the landscape associated with good working lands conditions. These factors were limited due to data availability at the time of the study. The factors taken into account include slope, distance from perennial streams and rivers, current agricultural lands according to GAP analysis, land ownership, and Animal Unit Months (AUM's) per acre. The AUM's per acre was calculated using BLM data on maximum AUM's per allotment and the allotment size, giving a rough approximation of productivity on each allotment.

Below and on the next page are the results of the working lands assessment model. From left to right, starting on the first row: 1) Current agricultural land, 2) Federal land ownership except BLM lands, and 3) Slope in the study area. Second row: 1) AUM's per acre 2) Distance from perennial streams 3) Distance from perennial rivers. The following page includes the completed spatial model incorporating all of these elements.

Figure 22 . Bioregional Planning Studio

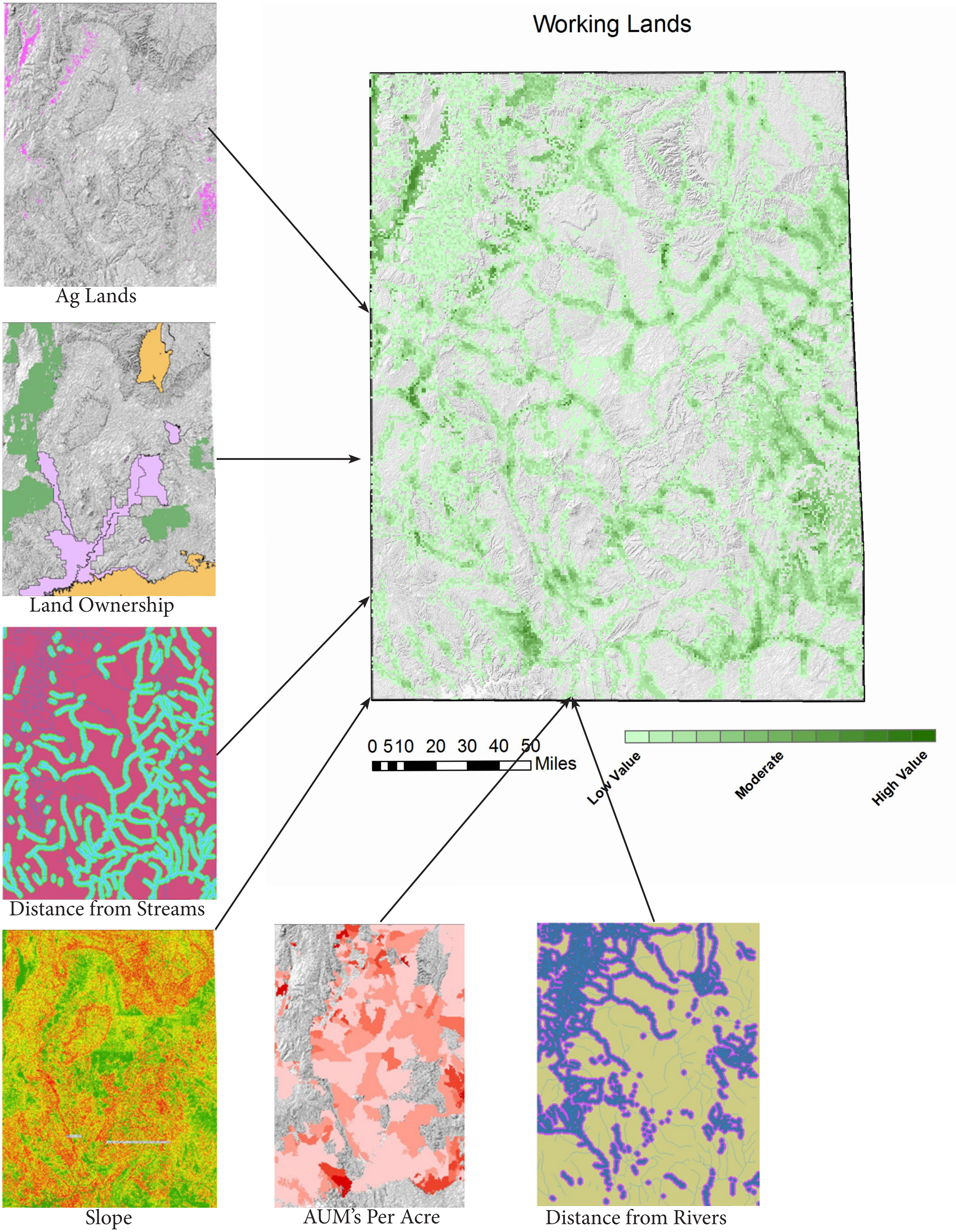

Figure 23. Working Lands Assessment Model

Recreation Assessment Model

In the Western United States and especially Utah, issues revolving around recreation are often at the political forefront. An example that is particularly pervasive in the West is disagreement between local rural residents and the federal government regarding transportation management plans. The goal of the Recreation Assessment Model is to provide a framework that spatially identifies where different opportunities for recreation in the study area exist. These opportunities are based on a set of criteria called the Recreation Opportunity Spectrum (ROS) that federal land agencies already use in recreation planning. The Recreation Assessment Model is intended to provide a planning aid that allows land managers to best coordinate recreation management for multiple purposes.

The recreation assessment model is composed of the composite of three separate spatial assessments. The first assessment conducted measured road density in the study area. Using the latest road census data, gathered by the US Census Bureau, and the density tool in ArcGIS, a road density map was created. The output of the road density calculation is displayed in a monochrome color-schematic that displays areas with the most roads as white and areas with the least amount of roads as black.

The second assessment measured distance from roads. We used distance from roads as a surrogate measurement for isolation. As with the road density calculation, the distance from roads assessment utilized road census data and the distance tool in ArcGIS to produce an output. The third and last assessment was a qualitative assessment that used land ownership, national parks, wilderness areas, state parks, and private lands to assign land parcels to an ROS category. The ROS categories in the figure above used criteria such as the amount of human-induced alteration to a landscape, availability of facilities, proximity, degree of risk, degree of isolation, and the presence or absence of roads allowing motorized vehicles. Each section of land in the study area was classified into one of four groups (see Figure 24): urban, low-risk high-access, natural motorized, and natural non-motorized.

Finally, the output of the ROS assessment model was combined into a composite model with the other two assessments. The composite of the three different assessments is the recreation assessment model. The model shows that there is potential for high-risk, high-isolation, wilderness type recreation areas in the Book Cliff mountains and areas adjacent to Canyonlands and Lake Powell. Conversely, low-risk, close proximity recreation opportunities are clearly most evident near cities and private property. Later in the planning process, this assessment will be used as criteria for the recreation future model.

Figure 24. Study Team in Arches National Park (Photo: Richard Toth)

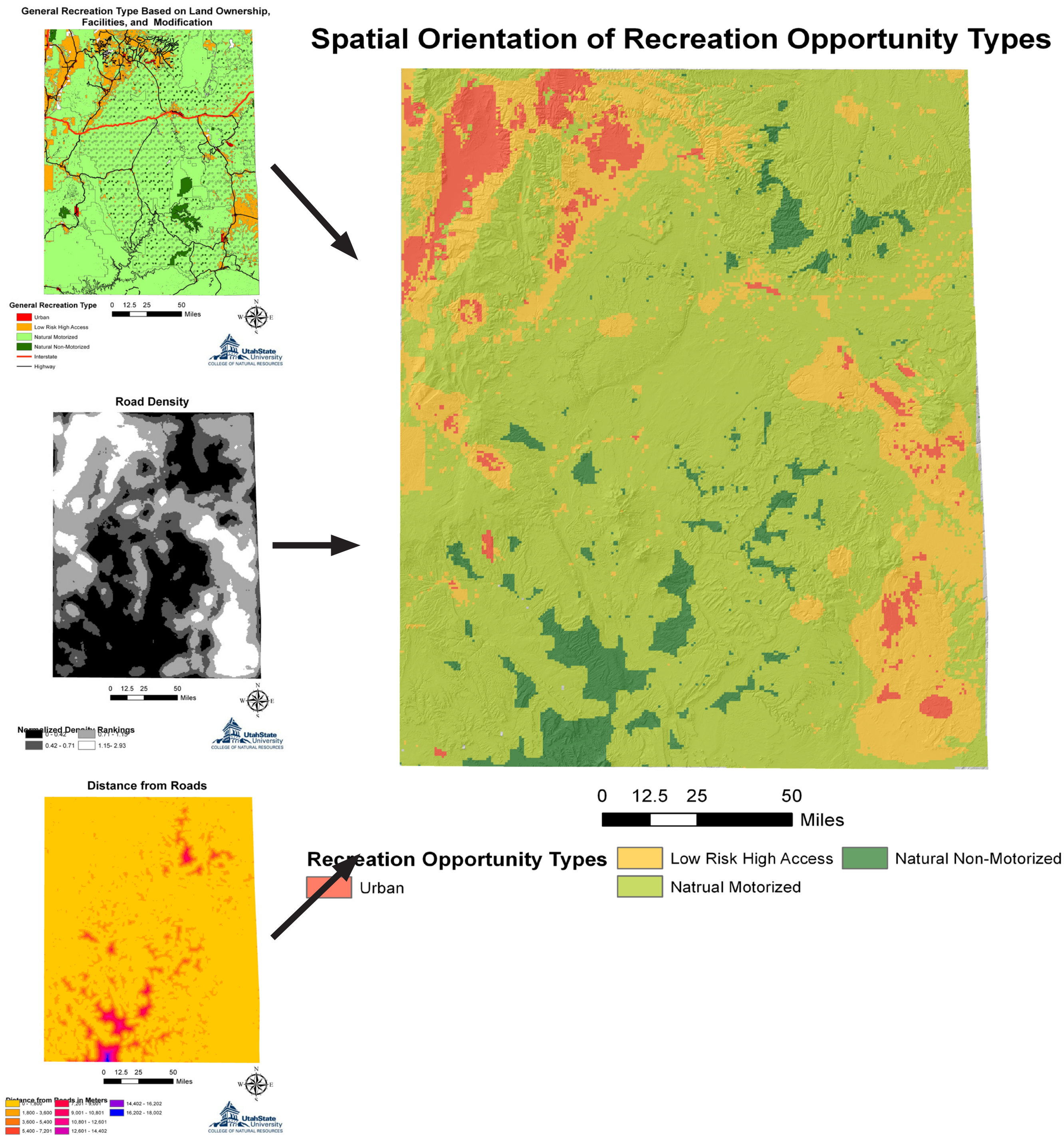

Figure 25. Recreation Opportunity Types

Public Health, Welfare, & Safety Assessment Model

The public health, welfare and safety (PHWS) model identifies areas of the landscape that have the potential to negatively affect the health, welfare, and safety of people living in the study area. Hazards incorporated into the model include landslide risk, steep slopes, fault lines, floodplains, wetlands, and river areas.

Landslides are defined as “rock falls and topples, debris flows and debris avalanches, earth flows, mudflows, creep and lateral spread of rock and soil” (United States Department of the Interior, 2008). Susceptibility factors include steep slopes, loss of vegetation, intense precipitation, and flooding.

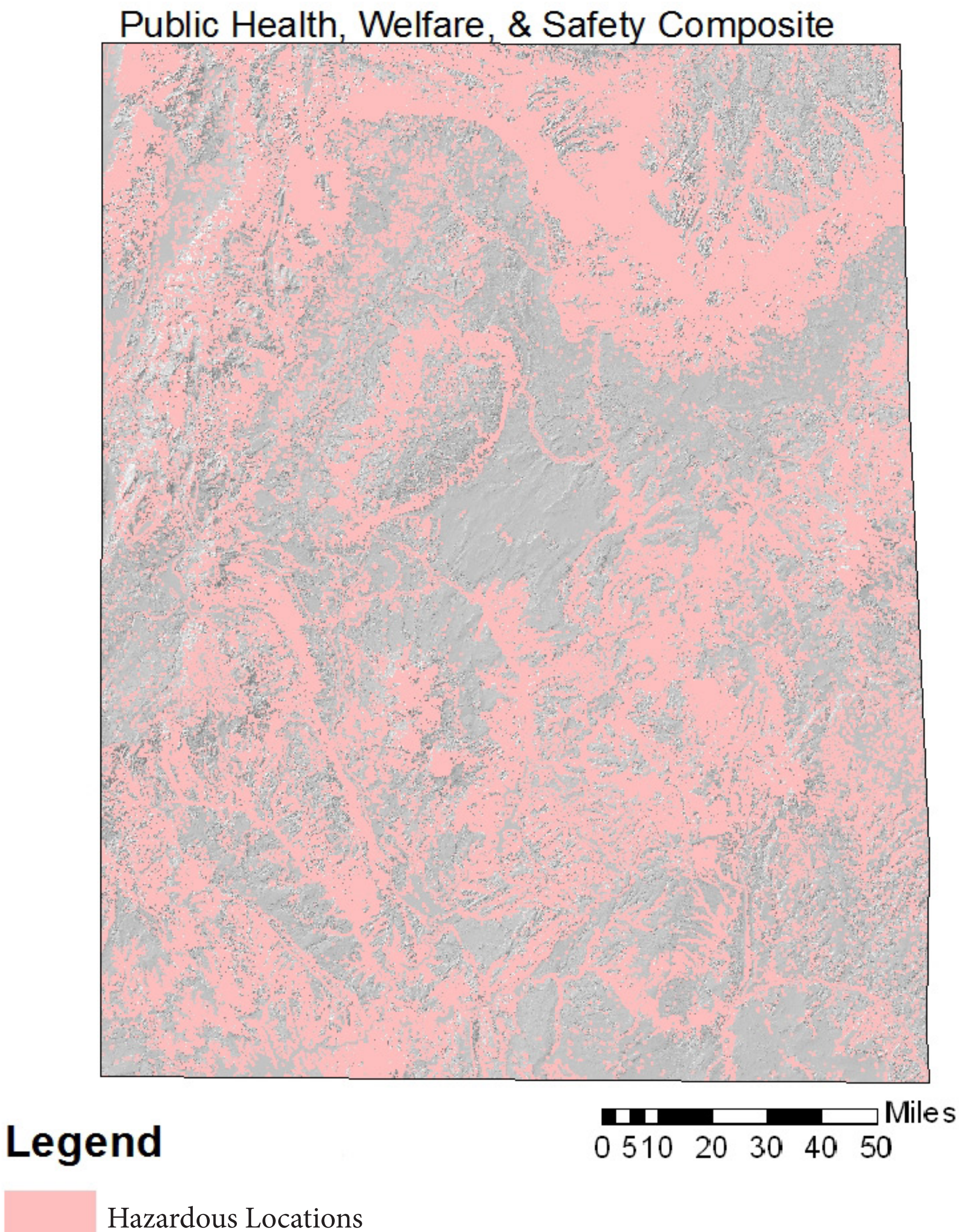

Figure 26. Public Health, Welfare and Safety Assessment Model

Assessment Models

Steep slopes are correlated with higher potential for landslides and increase fire hazard (Utah Governor's Office of Planning and Budget, 2009). Slopes greater than 30% are considered a risk to the public.

Fault lines are fractures in the earth's crust along which there has been relative movement and are the source of earthquakes (United State Department of the Interior, 2008). A 100-meter buffer around fault lines is used to reduce risks to public health and safety.

Floodplains have the potential to threaten human health, damage structures and infrastructure, and increase health care costs. This part of the model locates areas that have high floodplains based on an 100-meter buffer.

Wetlands play a key role in ecosystem by protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters, and maintaining surface water flow during dry periods (US EPA, 2001). Wetlands are included in the public health and safety assessment model as a way to reduce the likelihood of damage to structures due to flooding, guard against erosion from waves and currents, boost quality of life, and protect attractive open space (US EPA, 1999). A 100-ft buffer was put around wetlands in this model.

Rivers and riparian areas provide essential services to communities and ecosystems in this region. Rivers deliver water that is diverted and used for agricultural and municipal needs. Riparian areas stabilize riverbanks to reduce flooding and provide habitat for many species, and these areas contribute to recreation activities and visual amenities that add to the quality of life. A 300-meter buffer zone is applied to this region to protect these values. Hazards associated with river areas, such as flooding and water quality impact due to runoff from agricultural or residential lands, can be mitigated (USGS, 2008).

Figure 27 Study team meeting on assessment models (Photo Richard Toth)

Quality of Life Assessment Model

This assessment model consists of the initial PHWS model as well as including a one-mile buffer around major roads in order to account for ease of expansion of existing infrastructure. A distance from major services was also calculated, including a distance from schools, fire stations, police stations, and hospitals and health care centers. Finally, a relative distance from cities to major recreation points was calculated for quality of life of individuals living in these regions.

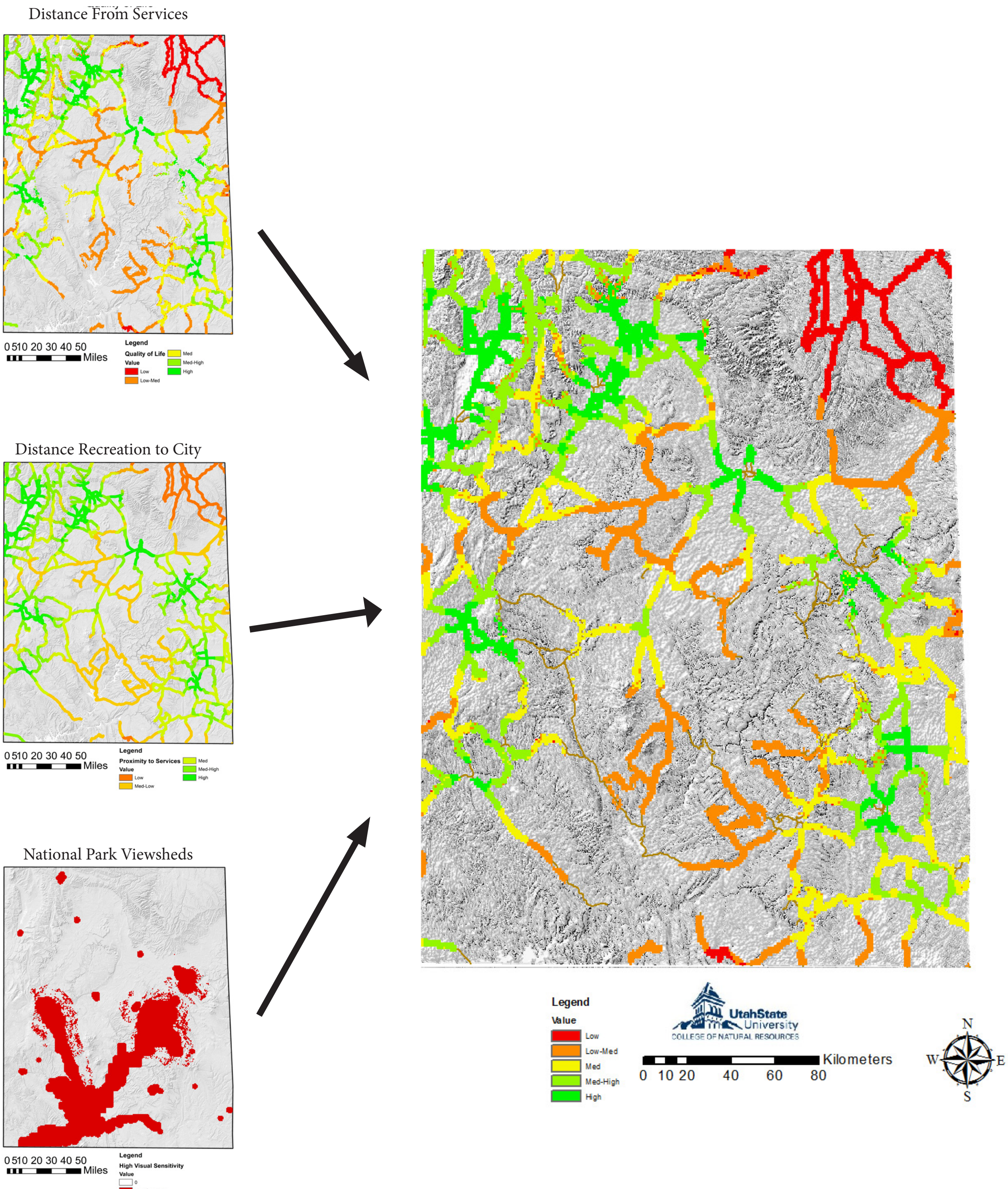

Figure 28. Quality of Life Assessment Model

High Potential Economic Value Lands Assessment Model

This model aims to identify high potential economic value lands in this study region. Criteria incorporated into this model include all the extractive and non-extractive natural resources deposits and renewable energy locations. A half-mile buffer around municipalities was added as potential development areas. Working lands was also added to the model. In the final composite map, only high potential economic value lands were taken into account for this model.

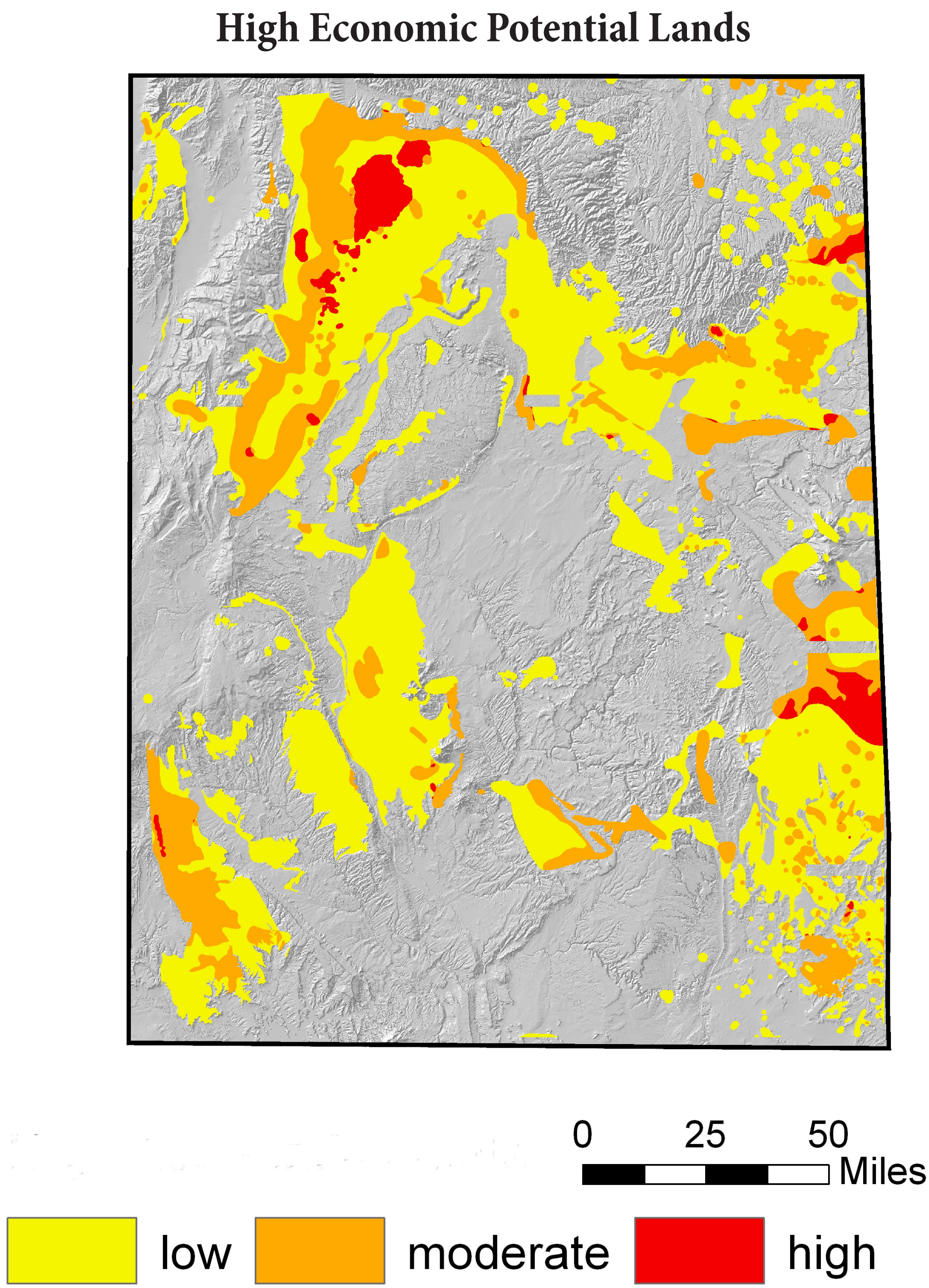

Figure 29. High Economic Potential Assessment Model.
Opposite page various meeting and presentations throughout the process with stakeholders and faculty.

Alternative Future Models

The creation of alternative futures allows for a spectrum of choices for policy makers. These are recommendations based upon different combinations of assessment models to provide guidelines toward separate outcomes. This gives policy makers choices as to which direction they wish to take, rather than have a binary choice of a single future versus current policy and actions. Alternative futures are meant to show a spectrum of choices from which to choose. The futures which are explored in this study include a plan trend model, which suggests a continuation of the current policies and actions and acts as a baseline for other futures. Also researched during the course of the study was a maximum conservation value, and conservation and energy development futures. These focused primarily on preserving the landscape and endangered or threatened species. Next was an analysis focusing on the maximization of SITLA profit, which focused on natural resource extraction with minimal focus directed to the natural flora and fauna. The fourth future is a BLM optimum management future. This addresses the need for a proactive approach for BLM's future concerns by seeking to obtain land trades early which correlate to the BLM's mission. The final future which will be presented consists of a synthesis of each of the other futures. It primarily acts to find the points of correlation between each of the previous futures.

Future - Plan Trend

The first of the alternative futures created was the plan trend future. This is an evaluation of the current state of land tenure, as well as its pros and cons. The plan trend model therefore becomes a baseline by which other alternative futures can be compared. The net result of this future is the current spatial arrangement will continue.

- Criteria –
  - Current land tenure
- Pros
  - Allows for a maximization of options for SITLA due to the scattered land ownership pattern which is currently on the landscape
- Cons
  - Fragmented land ownership
  - Potentially fragmented ecological situation
  - Inhibits SITLA from reaching its full economic potential
  - Creates an ad hoc development policy and patterns

This future requires no land exchanges; however, current conflicts, conservation issues such as threatened and endangered species, and economic drawbacks resulting from fragmented land ownership will continue in the region.

Figure 30 Landscape Arch (Photo: Richard Toth)

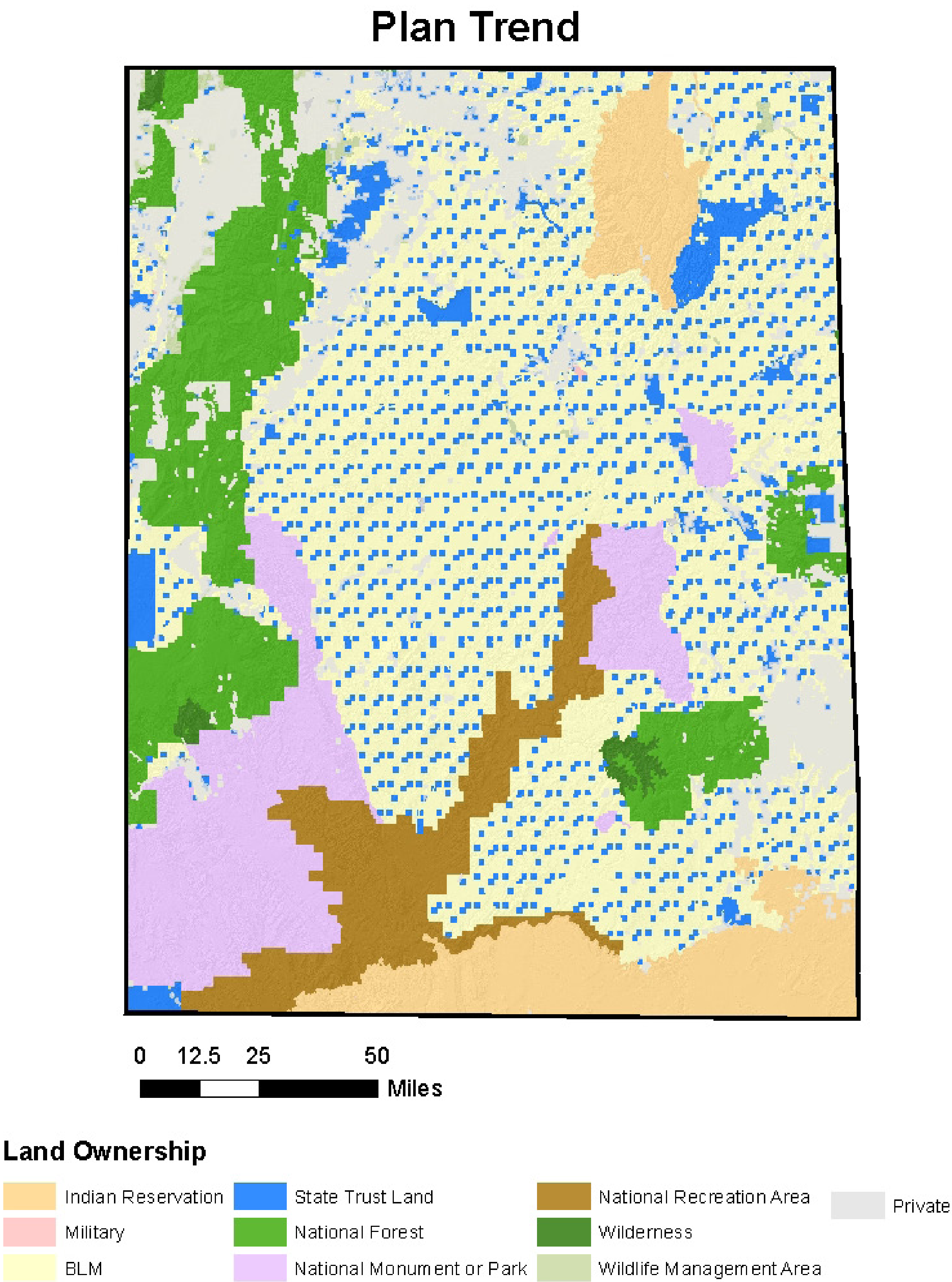

Figure 31. Plan Trend Future

Future - Maximum Conservation

The maximization of conservation alternative future aims to preserve the lands that have the highest conservation value. All lands with high conservation value owned by the BLM would be retained by the BLM. All lands with high conservation value belonging to SITLA would be traded to the BLM. See appendix 1.

Criteria:

  - Distance from roads
  - Major rivers with 300-ft buffer
  - Threatened and endangered species richness
  - Major wildlife species richness
  - Wilderness study areas
  - National Parks with 2-mile buffer
- Pros:
  - Conservation of areas with critical habitat characteristics such as high wildlife species richness or high richness of threatened and endangered species
  - Conservation around critical riparian areas
  - Conservation around National Parks and wilderness study areas
- Cons:
  - No economic benefit from conservation for SITLA
  - No assessment of other beneficial uses for land

Figure 32. Newspaper Rock (Photo: Richard Toth)

Maximum Conservation

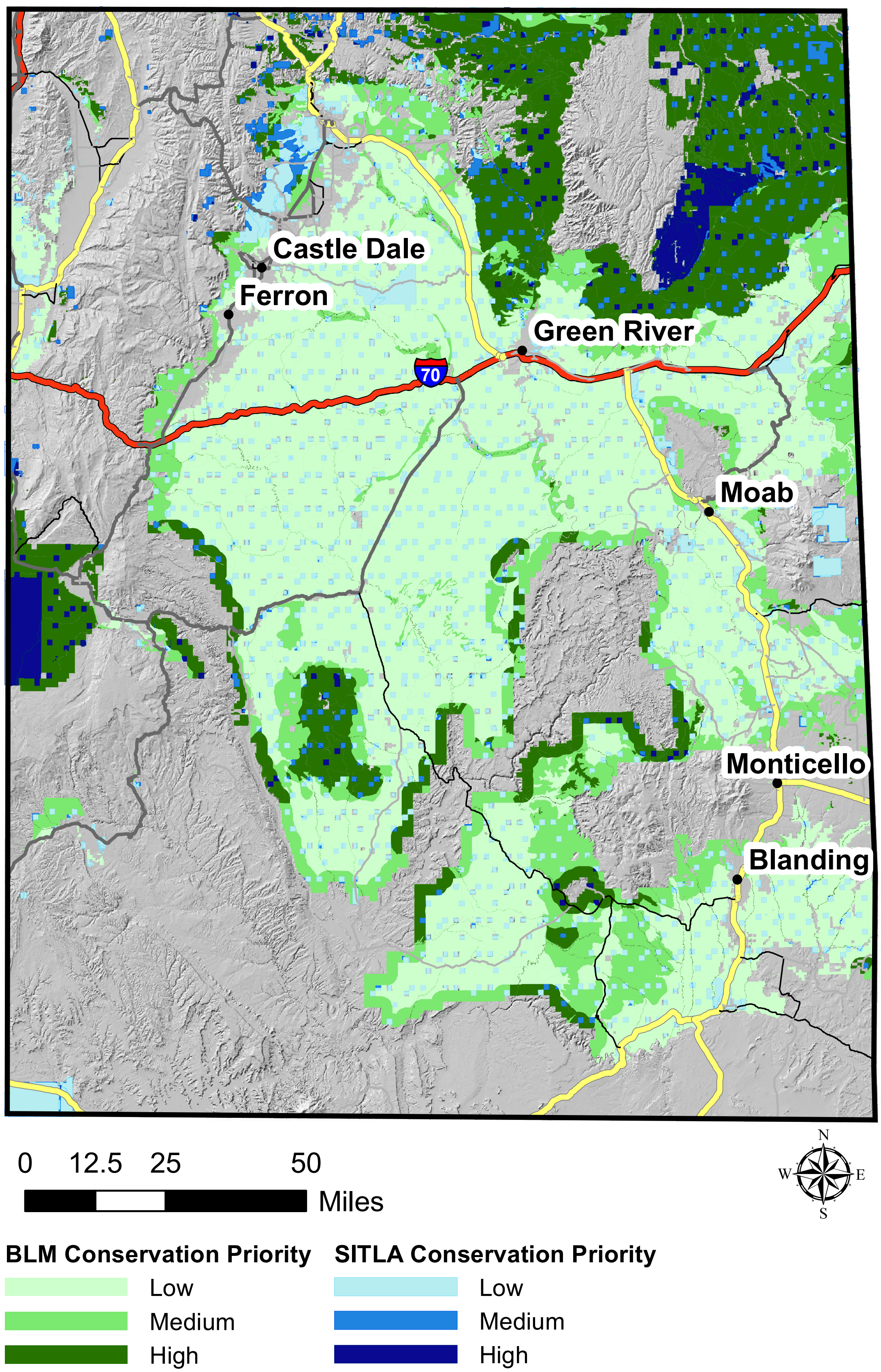

Figure 33. Maximum Conservation Future

Future - Conservation and Energy Development

The conservation and energy development future aims to strike a balance between conservation and development of energy for profit. Under this future scenario, all high-conservation lands belonging to the BLM would be kept under BLM ownership, and all high-conservation lands belonging to SITLA would be traded to the BLM. In turn, the BLM would trade out some areas of high energy development potential to SITLA. See appendix 2

- Criteria:
  - Energy development potential
  - Development potential
  - Conservation value priorities (based on output from maximum conservation future)
- Pros:
  - Conservation of areas with high conservation value by BLM
  - SITLA gains lands with high energy potential
  - Accomplishes conservation and economic goals simultaneously
- Cons:
  - Some compromises between areas which are good for conservation and those for development

Figure 34 Capital Reef National Park (Photo: Richard Toth)

Conservation and Energy Development

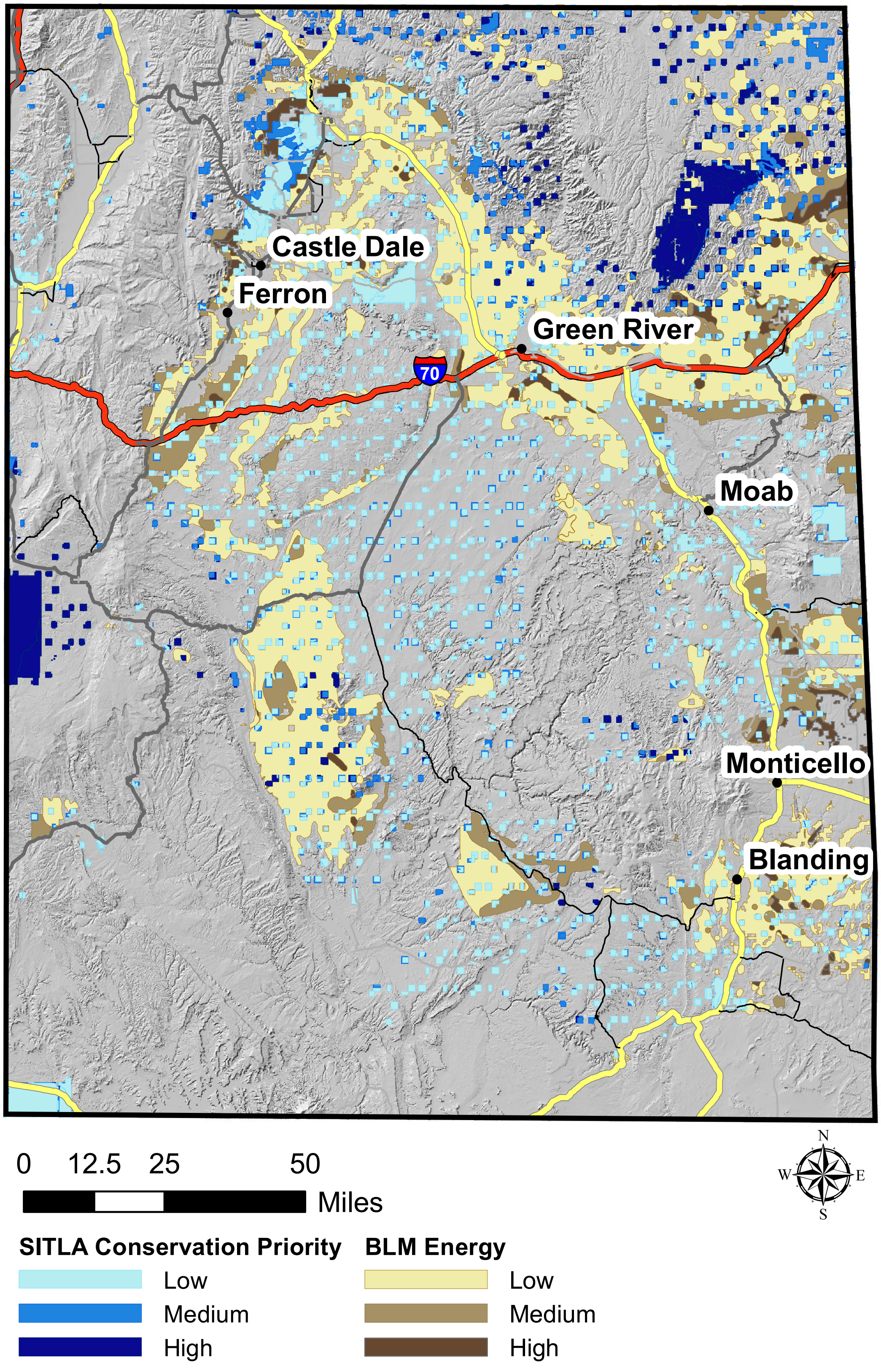

Figure 35. Conservation and Energy Development Future. In this future trades would take place dark blue for dark brown

Future - Maximization SITLA Interests

The maximization of SITLA interests future scenario aims to maximize the energy and development opportunities within the study region for SITLA, through reallocating all the high-economic value lands to SITLA's property. Development and natural resources development have played an important role in many land-use decisions for both SITLA and the BLM. Extraction of energy resources is one of the main pillars for economic growth and expansion in this study area. In the future scenario map, the tan areas show high economic potential on BLM lands, and areas in blue show high economic potential on SITLA lands. Lands in red are the lands SITLA should trade out of; lands in green are the targets for SITLA to trade into with the BLM.

The maximization of SITLA profit future scenario relied upon natural resources extraction and residential development models derived for the study area. The resulting lands benefit SITLA's profits and indentify potential lands for SITLA to trade into with the BLM. However, conservation priority, public health, welfare and safety are not taken into account in this model. Meanwhile, this model doesn't provide the best economic benefits for the BLM. See appendix 3.

- Criteria:
    - Energy development potential
    - Development potential
    - SITLA & BLM lands with high economic value
- Pros:
    - Maximizes economic profit on SITLAlands
    - Identifies potential areas to trade into with high economic benefits for SITLA
- Cons:
    - Does not account for conservation or public health, welfare, and safety
    - Provides no economic benefits for the BLM

Figure 36. Lake Powell (Photo: Richard Toth)

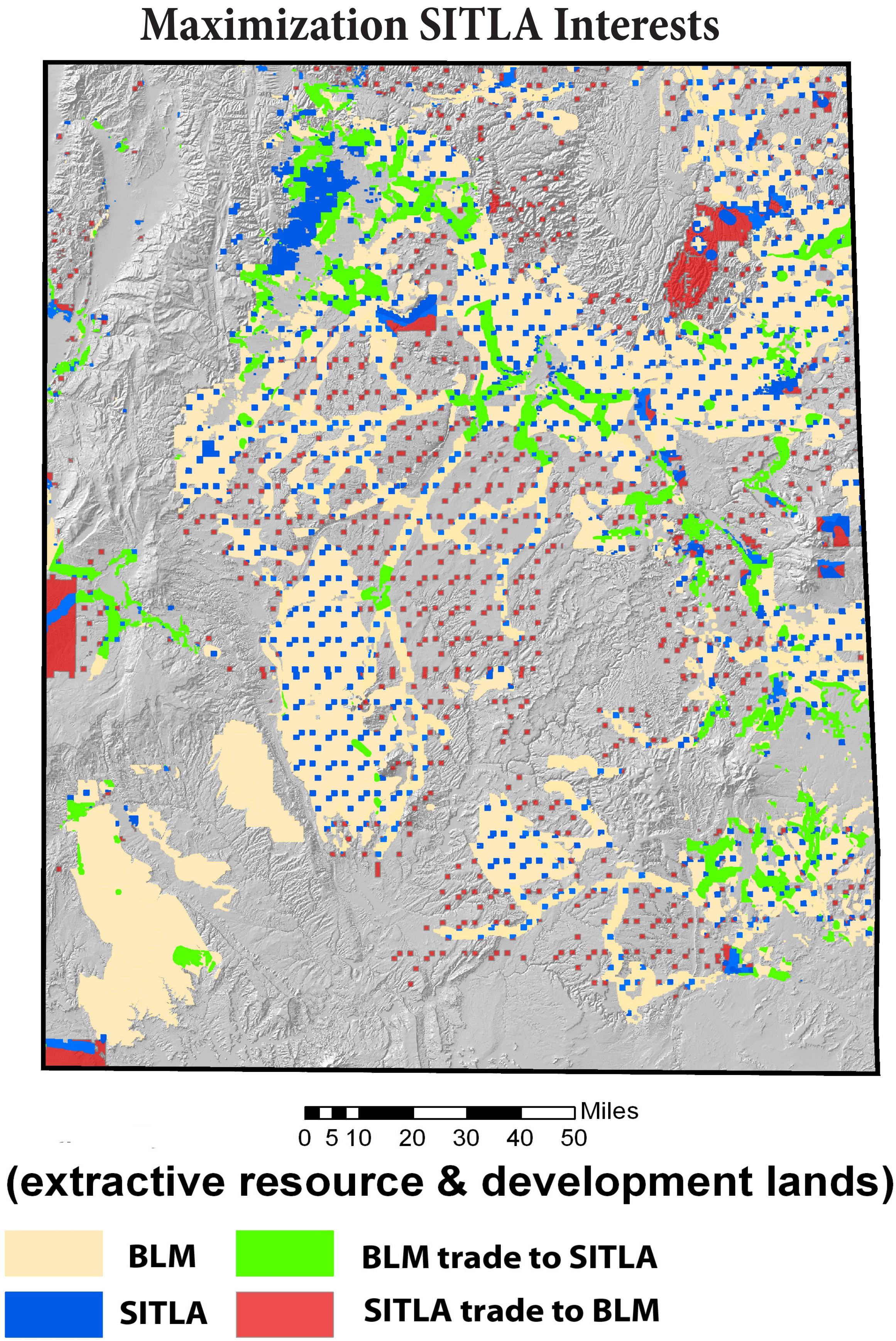

Figure 37. Maximization of SITLA Profit Future

Future - BLM Optimum Management

The BLM optimum management future creates a series of land trades designed to ease management concerns throughout the region for the BLM. This is accomplished through a reduction in the fragmentation on the landscape and clustering SITLA ownership. This will allow for a more continuous ownership of the landscape by the BLM and a more consistent program of landscape-level policies throughout the region. The BLM is moving toward larger landscape-level planning and as such, a more comprehensive land ownership system would be to its advantage: See appendix 4.

Pros

- Reduction of conflict near national parks, conservation areas, and remote recreation lands
- Accomplishes conservation and recreation goals simultaneously
- Organizes and focuses development away from sensitive resources
- Reduces management fragmentation

Cons

- SITLA loses opportunities that may arise from fragmented land tenure
- Focuses primarily on conservation and not on monetary goals for either BLM and SITLA

Figure 38. Manti La-Sal National Forest (Photo: Richard Toth)

BLM Optimum Management

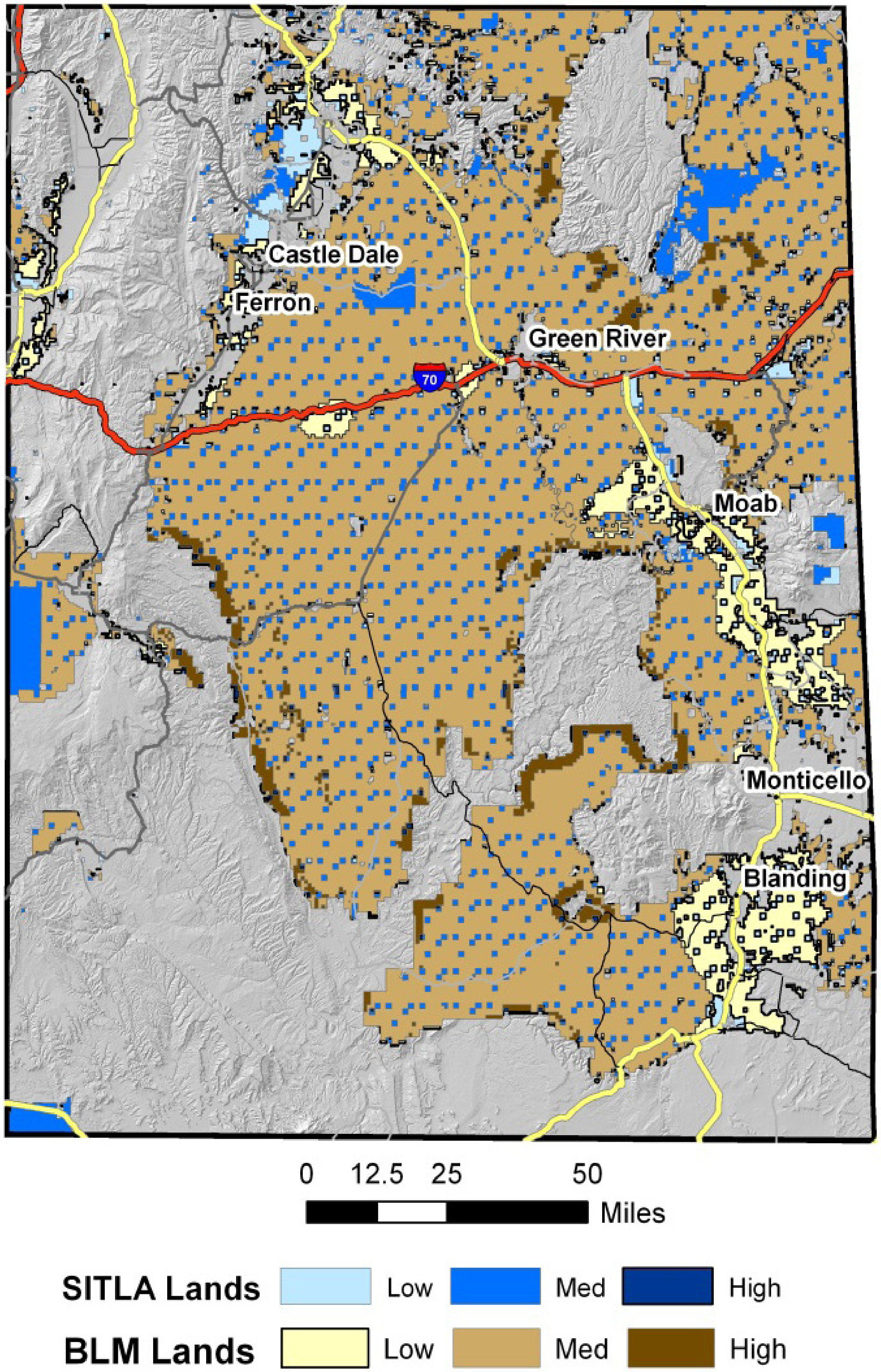

Figure 39. BLM Optimum Management Future. In this future the darker the colors on this map the more interest the BLM would have in either acquiring or retaining these lands. The lightest colors would be of lowest concern.

Composite Future

This future seeks to incorporate features of each of the previous futures into one. This is focused primarily on where beneficial uses for conservation and for economic advantage are encountered when compared with each other. Each level of conservation was given a value from one to three on each map while corresponding areas of economic incentive were given reciprocal values. Once the model was complete, areas which have conservation value were placed into the BLM's control, and areas where economic incentive was greater than the amount of conservation value was given to SITLA's control. Anyplace that was equal in both economics and conservation was assigned to the BLM as well. This is by no means an end map; it is, however, a very helpful map which gives suggestions of locations for future expansion by SITLA and for future conservation efforts by the BLM. See appendix 5.

- Pros
    - Allows for maximum options for both the BLM and SITLA for potential future trades
    - Accounts for conservation efforts as well as economic advantage
    - Reduction of current management fragmentation on the landscape
- Cons
    - Shows more land ownership for SITLA than currently is on the landscape
    - Eliminates the advantages that management fragmentation has for SITLA in number of options

Figure 40: Natural Bridges (Photo: Richard Toth)

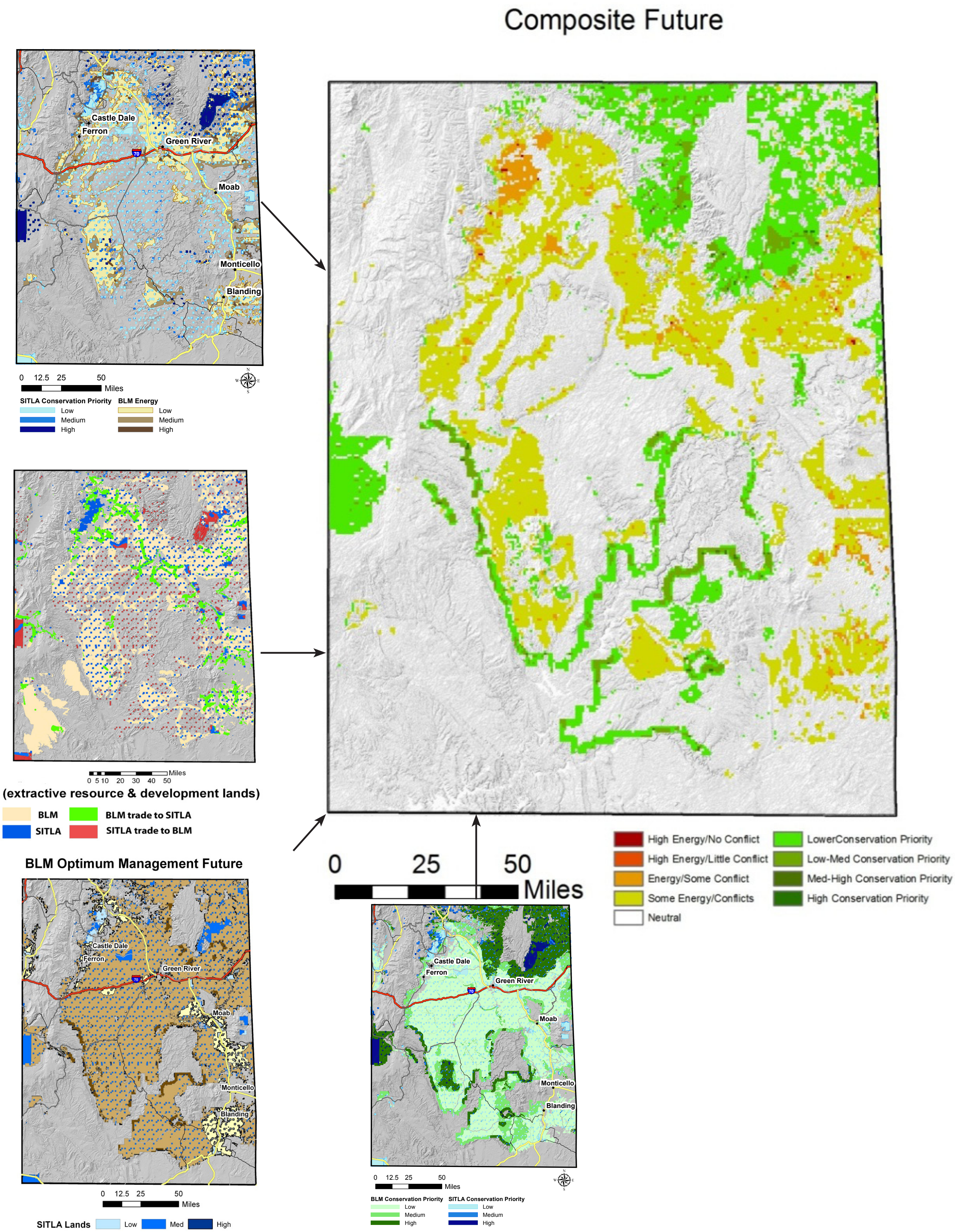

Figure 41. Composite Future

Composite Land Ownership

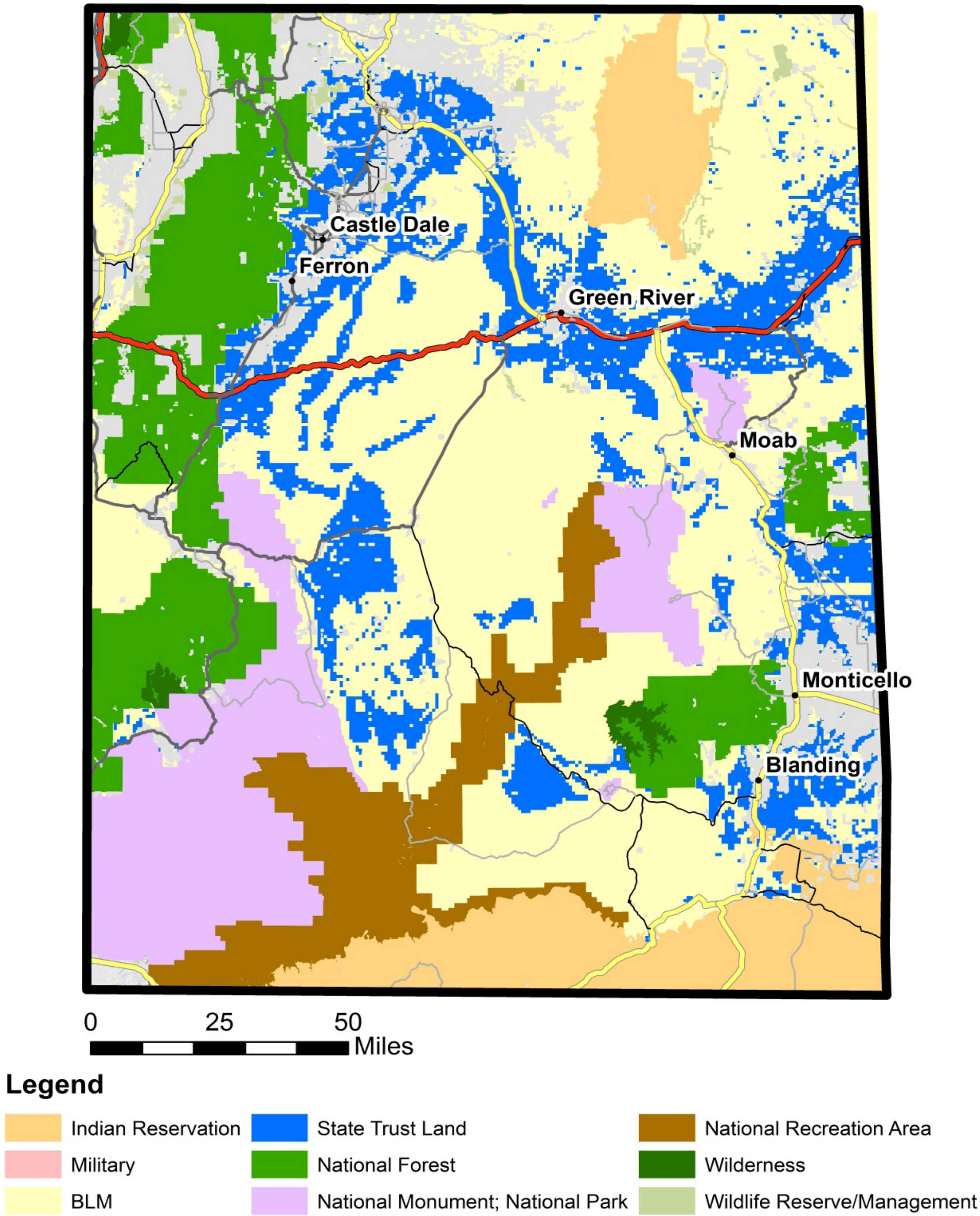

Figure 42. Composite Future Land Ownership

Evaluation of Alternative Futures

Each alternative future scenario created has individual strengths and weaknesses. The object of this portion of our study is to evaluate and describe each future's benefits and shortcomings. This should provide a quick reference for each future and how beneficial each course of action could potentially become. In every future, it is highly recommended that individual site studies be conducted in order to better understand the specifics of each trade value and equality for each party. See the following 5 maps.

Implementation Strategies and Recommendations

Implementation strategies for the alternative future recommendations could primarily be accomplished through land trades between the BLM and SITLA. This has been the usual method for the reallocation of land in Utah. While occasionally a very quick process, this is usually a time-consuming effort by both federal and state level agencies to come to agreements on trade options and values. It is our recommendation, however, that such a process be undertaken in an effort to better plan for the future of this region. The costs in the short-term will be less than the long-term ecological and economic difficulties of trying to manage a fragmented landscape of ownership policies.

Each trade must be evaluated at the ground level for the value of each parcel of land. Land managers must make decisions about which parcels to trade and which not to trade. Larger-scale trades are possible with multiple parcels at once being traded in order to best streamline the process. The alternative futures within this study are provided as a guide of management actions which would lead to each set of futures. It will be up to the BLM and SITLA leadership to decide which futures would be to each agencies' best advantage to work together to bring about those futures

Limitations and further research

The aim of this study was to conduct a landscape level-analysis of the various factors that might determine the best land use and spatial arrangement for BLM and SITLA parcels in the southeast region of Utah. Criteria used for the models were based on best publicly available and accessible data. While this landscape-level analysis gives a good general idea of which areas and regions it would be beneficial to carry out land trades, a more detailed site-level analysis would be beneficial to carry out before deciding on specific implementation strategies. A site-level analysis might include more detailed information about ecological condition on a site, cultural resources, and energy and economic potential.

This work is to be used as an example of large scale planning and land management. It is similar to the work of the BLM and its Rapid Ecological Assessments. The BLM on its website(http://www.blm.gov/wo/st/en/prog/more/Landscape_Approach/reas.html) states:

> "REAs synthesize the best available information about resource conditions and trends within an ecoregion. They highlight and map areas of high ecological value, including important wildlife habitats and corridors, and gauge their potential risks from climate change, wildfires, invasive species, energy development, and urban growth. REAs also map areas that have high energy development potential, and relatively low ecological value, which could be best suited for siting future energy development. In addition, REAs establish landscape-scale baseline ecological data to gauge the effect and effectiveness of future management actions."

This work represents an attempt to evaluate the landscape ownership pattern with elements of a rapid ecological assessment in its methodology. We hope that this study will be used in the future to help guide the land ownership in this region. It may also inform policymakers of alternative ways of evaluating the landscape from a regional perspective. The process should be applicable to other areas at varying scales. While this is a preliminary study, further studies with more detailed analysis will provide further options for policymakers to pursue.

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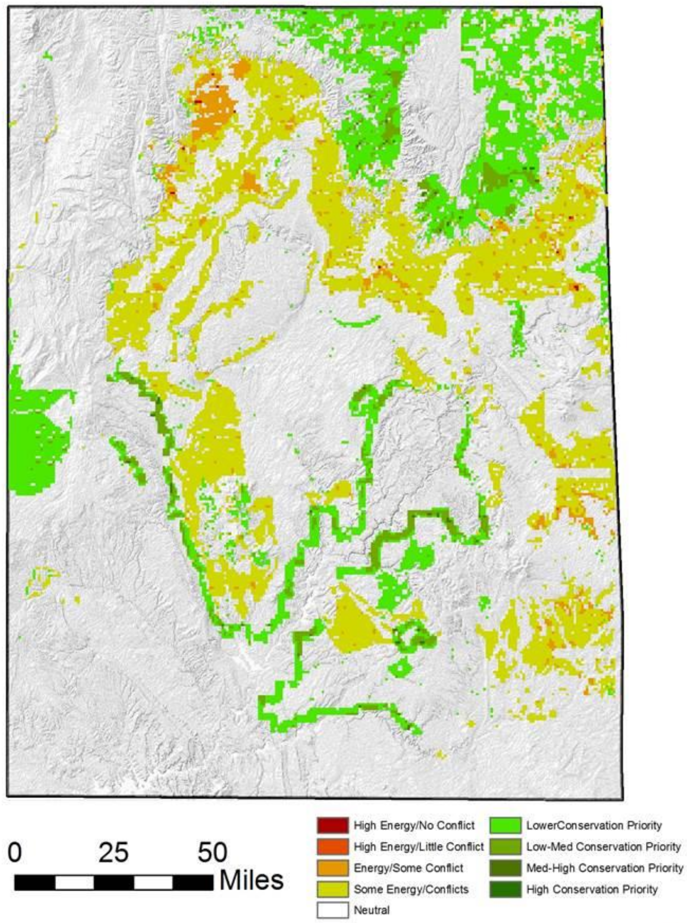
All GIS data layers were gathered from the Utah AGRC

Composite Future Scenario

The composite future is an effort to find the commonality between each of the other alternative futures. This incorporates both conservation efforts as well as energy potential throughout the region. It also helps to mitigate the current fragmentation upon the landscape by aggregating land ownership for better ease of management.

Criteria:

- Maximization of Profit (SITLA Oriented)
- Fluid Management (BLM Oriented)
- Maximum Conservation
- Conservation and Energy Development



Pros:

- Allows for energy development for SITLA in the study area
- Recognizes the need for conservation priorities in the study area.
- Aggregates land management to reduce fragmentation across the landscape

Cons:

- Probable uneven distribution of land area.

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Conservation and Energy Development Future

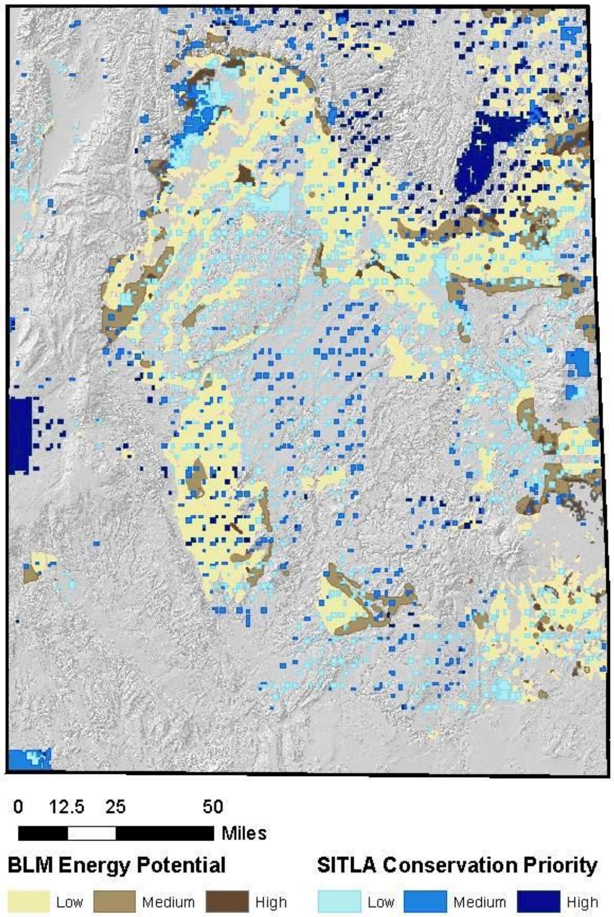
The Conservation and Energy Development Future identifies area of high conservation value in SITLA lands and identifies areas of high energy on BLM lands that SITLA could trade those lands for.

Criteria:

Energy Development Potential

Development Potential

Conservation Value Priorities



The map shows areas with high energy potential on BLM lands, and high conservation value on SITLA lands. High conservation value lands on SITLA should be traded with BLM high energy potential lands.

Pros:

- Conservation of areas with high conservation value
- SITLA gains lands with high energy potential
- Accomplishes conservation and economic goals simultaneously

Cons:

- Small amount of potentially developable land for SITLA lost to conservation

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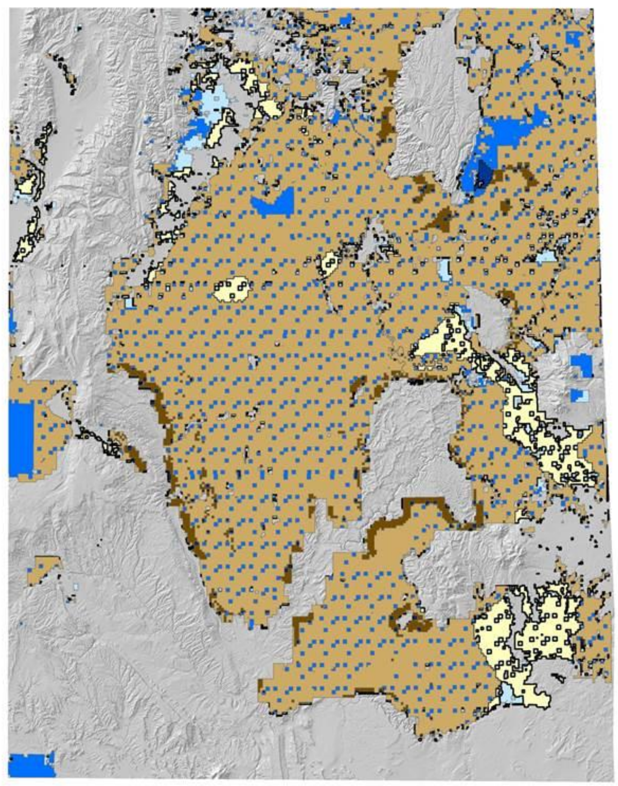
Optimization of BLM Management Future

The BLM Optimum management future seeks to provide ideal management conditions for the BLM through land tenure adjustments. This model is especially concerned with conservation, recreation and visual quality.

Criteria:

- 2 mile Buffer of National Parks
- Conservation Value Priorities Layer
- Recreation Opportunity Spectrum Layer
- 10 Mile Viewshed Overlap of Points within Arches, Canyonlands, and Capitol Reef National Parks



Legend		Legend	
BLM Lands		**SITLA Lands**	
	Low		Low
	Med		Med
	High		High

0 12.5 25 50 Miles

This map shows areas of high management conditions on both BLM and SITLA lands. BLM should attempt to acquire dark blue lands (high management potential) from SITLA.

Pros:

Reduction of Conflict
- Near National Parks
- Conservation
- Remote Rec. Lands

Accomplishes Conservation and Recreation Goals Simultaneously

Organizes and Focuses Development Away from Sensitive Resources

Reduces Management Fragmentation

Cons:

SITLA loses opportunities that may arise from fragmented land tenure

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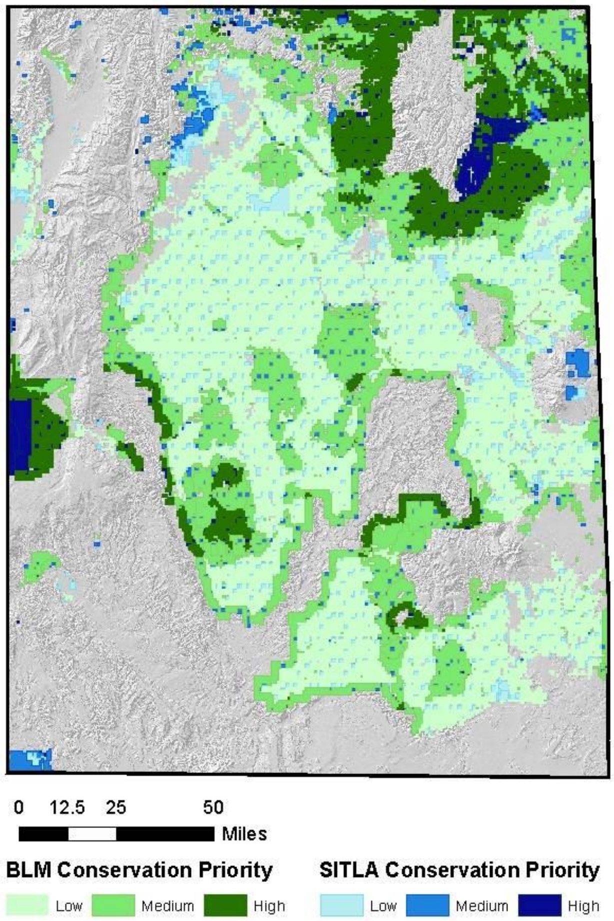
Maximum Conservation Scenario

The Maximum Conservation Future identifies areas of high conservation value based on major wildlife species richness, threatened and endangered species richness, riparian buffers, distance from roads and buffers around National Parks.

Criteria:

- Distance From Roads
- 300 Ft. Buffers of Major Rivers
- Threatened and Endangered Species Richness
- Major Wildlife Species Richness
- 2 Mile Buffer of National Parks



Land for both the BLM and SITLA is ranked high, medium of low conservation priority based on the above factors. Areas of high and medium conservation priority should be retained by BLM, and BLM should try to acquire areas of high of medium conservation value from SITLA.

Pros:

- Conservation of areas with high wildlife species richness
- Conservation of areas with high number of threatened and endangered species
- Conserves buffer lands around National Parks
- Conserves buffer zones in riparian areas

Cons:

- No economic benefit from conservation for SITLA
- No assessment of other beneficial uses for land

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Maximization of SITLA Profit Future Scenario

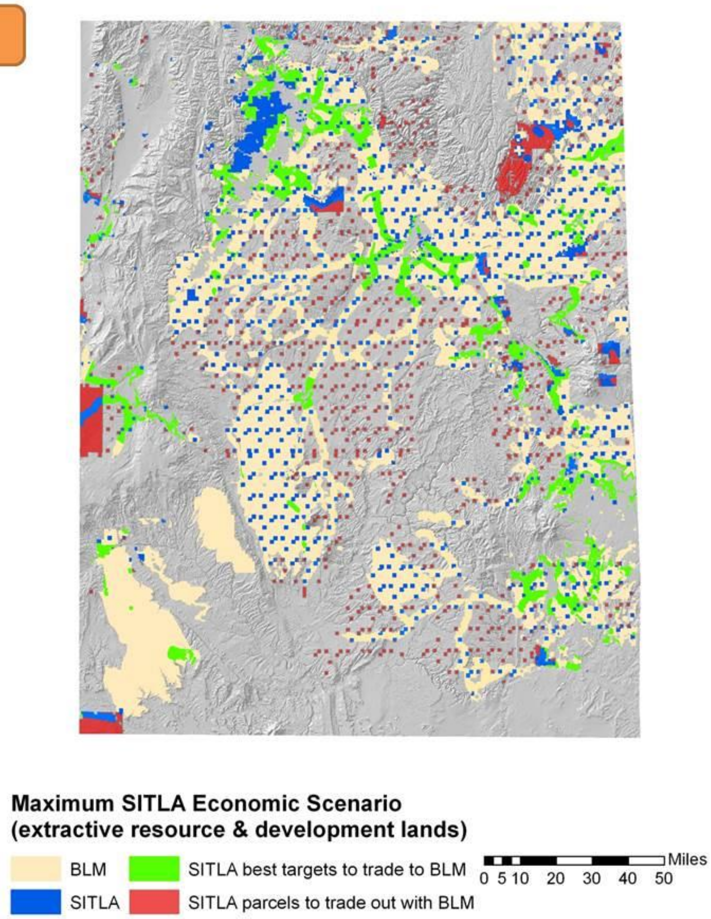
The Maximization of SITLA Profit future identifies areas that are of high economic value to SITLA in regards to energy and residential development.

Criteria:

Energy Development Potential

Development Potential

SITLA & BLM Lands with High Economic Value



Tan areas show high economic potential on BLM lands, and areas in blue show high economic potential on SITLA lands. Lands in green should be traded from the BLM to SITLA, and lands in red should be traded from SITLA to the BLM

Pros:

Maximizes economic profit on SITLA Lands

Identifies potential areas to trade into with high economic benefits for SITLA

Cons:

Does not account for conservation or public health, welfare, and safety

Provides no economic benefits for BLM

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