UTAH COUNTY

RESOURCE MANAGEMENT PLAN

Utah County
HEART of UTAH

RURAL COMMUNITY CONSULTANTS

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INTRODUCTION

BACKGROUND

The Utah State Legislature updated the state code regarding general plans (HB 323 in 2015, and HB 219 in 2016) and now requires all counties to address environmental resources on federal public lands within a county in a Resource Management Plan (RMP). This legislation put forth 28 items or resources that must be addressed in the RMP, and the requirement to develop findings, objectives, and policies for the management of each resource. Some of these resources were addressed in the updated 2014 Utah County General Plan, in which case the relevant guidance was brought forward into the new RMP. This document serves to consolidate the baselines and objectives regarding each resource into one place. Legislators allocated one-time funding for the initial county RMP process and Utah County began the process in 2016.

This RMP is a component of the county's general plan. According to state code, a general plan is an advisory document that establishes a vision, influences growth, justifies ordinances, protects private property rights, and anticipates capital improvements. The Utah County RMP identifies local knowledge and develops management objectives and policies related to natural resources on public lands. The RMP is based on the needs and preferences of the county, the residents, and the property owners. It is the county's basic document for management of the public lands and the basis for communicating and coordinating with land management agencies on land planning and resource management issues.

BEST AVAILABLE INFORMATION

The best available information was gathered in a regional effort by BioWest in 2016; some data sources were found and added by Rural Community Consultants later in the process. The county recognizes that new data will always be forthcoming and future management and use decisions should be based on the latest, best available information. In using data to make evidence-based decisions, it is in the best interest of Utah County residents, the economy, and the environment to analyze resource condition trends rather than single points of data.

Process

As previously described, in 2015, HB 323 was approved by the Utah Legislature, mandating every county add a resource management plan to their general plan. In 2016, the Mountainland Association of Governments (MAG) contracted with Bio-West to gather environmental data for all four counties in the association. Information on current local policy and on current environmental conditions was gathered and compiled into a database.

After the data was gathered, the county contracted with Rural Community Consultants to engage the public, develop policy, and draft the resource management plan. A widely-accessible, public-facing website (UtahCountyPlan.org) was developed for the initiative, and included background information, a survey, and drafts of the plan. The availability of the website and plan development process was advertised through the county's website and social media. The planning commission and county commission held hearings and meetings that followed state noticing protocol to shape the plan. In the summer of 2017, the RMP was formally adopted by the Utah County Commission as part of the general plan.

Citizen Input

The opinions and values of Utah County residents and property owners are extremely important to the county commission. Proper noticing procedures were followed throughout the process and a public open house was held in Provo to publicize the initiative and garner input on resource management. The consultant focused on creating access to the survey for all residents of Utah County by utilizing electronic and paper surveys. The county feels that the sentiments and values of residents were well captured in the public engagement and outreach activities.

Purpose

This RMP outlines the county's objectives and policies for the use and management of natural and cultural resources on public lands. It is the basic document for communicating county objectives and policies concerning public land resources to federal land management agencies. The plan is a tool to coordinate between public land planning and county resource management goals.

Coordination and Cooperation

Utah County expects that federal land management agencies will coordinate with Utah County's local officials and staff, and use the best available information in their planning and decision-making. Coordination is the process by which federal land management agencies meet their mandated responsibility to determine management practices and try to create federal plan consistency with local government plans. Coordination also requires that federal agencies review and keep apprised of local

government plans and provide local government with opportunities for meaningful involvement in the development of federal plans.

The Council on Environmental Quality (CEQ) issued a memo in 2002 that provides for a federal agency to invite a local government to be a "cooperating agency" in the preparation of analyses and documentation required by the National Environmental Policy Act (NEPA), including resource management plans. County government has jurisdiction by law and special expertise on environmental issues that should be addressed in an environmental analysis, and therefore qualifies as a cooperating agency.

Because of the legal requirement for coordination of federal plans with local plans, the county's status as a cooperating agency by legal jurisdiction, and its expertise in the local custom and culture, it is Utah County's position that:

1) Federal agencies shall conduct a consistency analysis of their plans with the county plan and strive for consistency as allowed by law; and

2) Federal agencies shall offer cooperating agency status to the county in all actions or efforts that are subject to compliance with NEPA as early as possible in planning processes.

This resource management plan was adopted as part of the Utah County General Plan on July 25th, 2017 by the Utah County Commission.

Land Use

The purpose of this section is to outline the legal frameworks and county's positions associated with resource management planning and public lands issues. This section of the county's Resource Management Plan is intended to provide a broad outline of the parameters for influence on federal public lands and should not be considered an exhaustive dissertation of all possibilities. This section does not set forth objectives or policy for zoning, nor is it meant to influence urban or private lands. Please also refer to the other land use section in the Utah County General Plan 2014 and the Utah County Land Use Ordinance.

1. *Definition*

a. The designation, modification, and management of land for agricultural, environmental, industrial, recreational, residential, or any other purposes.

2. *Related Resources*

a. Wilderness, Recreation and Tourism, Energy, Land Access, Wild and Scenic Rivers, Law Enforcement, Water Quality and Hydrology, Threatened, Endangered, and Sensitive Species, Cultural, Historical, Geological, and Paleontological

3. *Findings*

a. Overview
    i. In Utah County, 42 percent of the land is private, 40 percent is public (BLM and USFS), 14 percent is various state land, and 3 percent is wilderness.
    ii. Private Property:
        1. Private lands are regulated by land use ordinances and zoning districts, as approved by local and county governments. Zoning districts, and the regulations established within the zoning districts, are authorized by Utah Code § 17-27a-505 and 10-9a-505. Land use ordinance and zoning maps are legislative decisions and are established through planning processes open to public discussion and adopted by county and city councils.
    iii. Utah County:
        1. Utah Code § 17-27a-401 requires counties to create a general plan that includes findings, objectives, and policy statements for the resources within its boundaries. It also allows Utah County to "define the county's local customs, local culture, and the components necessary for the county's economic stability."
    iv. U.S. Bureau of Land Management (BLM):

1. Utah County BLM lands are managed by BLM Field Office in Salt Lake City. Decisions for all BLM-administered lands are made according to mandates stipulated in the Federal Land Policy and Management Act (FLPMA) of 1976. FLPMA requires the BLM to manage lands under a multiple-use philosophy. A component of FLPMA is the requirement for an open and public land use planning process in the development of resource management plans (RMP). Each BLM Field Office must develop a RMP to guide future land use activities on public lands. The RMP defines goals, objectives, and rules for commercial and extractives industries, transportation, recreation, and conservation. BLM also has management authority over various isolated tracts of land in Utah that were not included in land and resource management plans. In some cases, BLM seeks to transfer these lands out of federal ownership (BLM 2001).

v. U.S. Forest Service (USFS):
   1. National Forest System lands in Utah County include portions of the Uinta-Wasatch-Cache National Forest and the Manti-La Sal National Forest.
   2. The USFS develops forest plans under the National Forest Management Act of 1976 (P.L. 94-588). Forest plans provide strategic direction for management of all resources on a National Forest for 10 to 15 years. Forest plans describe the desired conditions and provide guidance for projects. They do not make site-specific decisions or require any specific actions, but all projects conducted on a national forest must be consistent with the strategic direction in its forest plan.

vi. National Park Service (NPS):
   1. The NPS manages national parks and national monuments, including the Mount Timpanogos Cave. The agency prepares a variety of planning and environmental documents to help guide management of park resources and visitor use and activity. Plans follow NPS planning procedures and comply with the Organic Act of 1916.

vii. Military Lands
   1. Camp W. G. Williams, known as Camp Williams, is a National Guard training site operated by the Utah National Guard. It is located north of Saratoga Springs and Cedar Fort and straddles the border of Utah and Salt Lake Counties. Camp Williams is also home to the Non-Commissioned Officer's Basic Leader Course.

viii. State Institutional Trust Lands Administration (SITLA):
   1. Trust lands are parcels of land throughout the state that were granted by Congress to Utah at the time of statehood. Although trust lands support

select public institutions, they are not public lands. Trust lands were allocated specifically to generate revenue to support designated state institutions, including public schools, hospitals, teaching colleges, and universities.

2. Unlike public lands, trust lands are parcels of land held in trust to support 12 state institutions, primarily public schools, but also state hospitals, teaching colleges, and universities. While 67 percent of Utah is held in public domain, only about 6 percent of the state's acreage is set aside as trust lands (Utah SITLA n.d.).

ix. Sovereign Lands

1. "The State of Utah recognizes and declares that the beds of navigable waters within the state are owned by the state and are among the basic resources of the state, and that there exists, and has existed since statehood, a public trust over and upon the beds of these waters. It is also recognized that the public health, interest, safety and welfare require that all uses on, beneath or above the beds of navigable lakes and streams of the state be regulated, so that the protection of navigation, fish and wildlife habitat, aquatic beauty, public recreation and water quality will be given due consideration and balanced against the navigational or economic necessity or justification for, or benefit to be derived from, any proposed use" (Utah Lake Commission 2009).
2. "The Equal Footing Doctrine serves as the basis for Utah's claim to fee title ownership of sovereign lands (more widely known as submerged lands). The Equal Footing Doctrine is a principle of Constitutional law that requires that states admitted to the Union after 1789 be admitted as equals to the Original Thirteen Colonies in terms of power, rights, and sovereignty including sovereign rights over submerged lands. The Utah Enabling Act, enacted by the U.S. Congress on July 16, 1894, officially declared Utah as a state 'to be admitted to the Union on an equal footing with the original States'" (Utah Lake Commission 2009).
3. "The Utah State Legislature has designated the Division of Forestry, Fire & State Lands as the executive authority for the management of sovereign lands, and the state's mineral estates on lands other than school and institutional trust lands. Sovereign lands are defined by the Utah State Legislature as 'those lands lying below the ordinary high water mark of navigable bodies of water at the date of statehood and owned by the state by virtue of its sovereignty'" (Utah Lake Commission 2009).

x. Other State Lands

1. The Utah Department of Transportation (UDOT) owns 259 acres of land in the MAG region. These lands are related to rights-of-way purchased along state highways (Bio-West 2016).

b. Control and Influence
    i. Most developable land in the county is privately owned. Zoning within the county is left up to local and municipal governments. Zoning districts, and the regulations established within the zoning districts, are authorized by Utah State Code (17-27a-505) and municipalities (10-9a-505).

c. Economic Considerations
    i. "Land use" is not a resource in the same sense as most other resources to be considered in county resource management plans. In this case, land use is the designated, preferred, or allowable uses of a given piece of land based on the planning preferences of the landowner or jurisdiction responsible for the land. The implementation and management of those uses, such as agriculture, wildlife, water quality, etc., are examined in the respective chapters of this document. Important public policy concerns are the costs of administering public lands and the revenues generated from public land uses. Economic cost-benefit analyses should be completed prior to considering shifts in land use.
    ii. "Payments in Lieu of Taxes" (PILT) are Federal payments to local governments that help offset losses in property taxes due to non-taxable Federal lands within their boundaries. PILT payments help local governments carry out such vital services as firefighting and police protection, construction of public schools and roads, and search-and-rescue operations. The payments are made annually for tax-exempt Federal lands" (U.S. Department of the Interior 2017).
    i. In fiscal year 2014, Utah County received $1,711,416 in PILT payments. 70.6 percent of these payments were made available as unrestricted funds, and the rest were designated for improvement of schools and roads (Headwaters Economics 2016).

d. Custom and Culture
    i. Before the first white settlers arrived in Utah County in the 1800s, native peoples used the land for hunting, gathering, and agriculture. The original white settlers farmed and ranched, bringing livestock to the valley for grazing. These land uses are part of the custom and culture of Utah County, even as the use changes dramatically to focus on urban development.

4. *Policies*

a. Support utilizing public lands for multiple uses. Vigorously pursue multiple-use land policies on public lands, where traditional and appropriate.
b. Identify areas of public lands with high scenic, wildlife, or watershed value and protect these areas from further development. Endeavor to protect scenic and wildlife resources

without unduly interfering with landowners' ability to utilize their lands. Preserve scenic vistas and wildlife habitat by limiting hillside development.

c. Public land management agencies should consult with the county and municipalities on potential dark sky regulation.
d. Encourage public land management agencies to implement measures to ensure natural quiet is not degraded.
e. Support land exchanges that are advantageous to Utah County residents for reasons such as:
    i. Protection of community watersheds;
    ii. Protection of lands that are important to county residents for recreational or other economic values;
    iii. Protection of lands from developments that might otherwise lead to a net increase in county costs for infrastructure and public services; or
    iv. Consolidation of land-ownership patterns to reduce fragmentation.
f. Cooperate with land management agencies to preserve, in as near as natural condition as possible, areas or features of unique natural phenomenon.
g. Support the creation and maintenance of a public shooting range in order to encourage firearm safety and minimize safety risks to the public and environment.
h. Utah County shall remain active in federal land planning.

5. *Desired Management Practices*

a. Federal public lands that are within or adjacent to a municipality's proposed annexation boundary or that are relatively small and not contiguous with larger, managed federal parcels should be prioritized for disposal.
b. Federal public lands with flat or moderate slopes, or lands with close proximity to a road classified as a minor collector, or a road classified for greater volume, or lands within a mile of a platted subdivision should be prioritized for disposal.
c. State and federal agencies should privatize public lands suitable for agriculture and road material.
d. Make public land available for a variety of rights-of-way, alternative energy sources, and permits, where consistent with resource goals, objectives, and prescriptions.

Economic Considerations

Findings

The level of success of a local or regional economy touches every person, family, business, and government organization. Strong economies create jobs and payrolls, and generate tax revenues to provide infrastructure and services. All natural resources and public services described in this RMP are related to the local economy.

Utah State Code (17-27a-401) states that a general plan "may define the county's local customs, local culture, and the components necessary for the county's economic stability."

Sustainable economic growth does not just happen. Developing infrastructure, identifying resources, and preserving access to those resources on federal public lands for commerce requires careful planning by stakeholders. A holistic approach to planning and resource management should include economic considerations, resident quality of life and welfare, and natural impacts.

Issues like water supply, air quality, and law enforcement are vital to the health, safety, and welfare of residents, as well as regional economic success. Recreational access and opportunity are also very important to the quality of life of residents and sustain some businesses. Utah County has some of the highest agricultural yields of any county in the state, but the vast majority of these products are produced on private lands. The county doesn't intend to alter the private property rights of local landowners with this resource management plan. Where economic activity occurs on federal public lands (e.g. livestock grazing, recreation, tourism), the county seeks to influence federal policy for positive economic returns. The county desires to increase the number of quality jobs in all industries within its borders and champions employment opportunities for the current workforce and future generations.

Individual economic considerations are accounted for in individual resource sections. Not all economic considerations have been studied; therefore, some data is unavailable.

Policy

1. The encouragement of water sports or recreational activity on public lands or public lands adjacent to recreation areas is to the advantage of the economy of the county and its residents.
2. Encourage federal agencies to provide the opportunity for sustained economic growth of industries and communities dependent upon public lands outputs.
3. Establish an environment which is friendly to new industries that diversify the economic base, use local labor, and are sensitive to environmental concerns.

Desired Management Practices

1. Promote tourism of public lands and regional attractions.

2. Identify recreational and cultural attractions on public lands for interested tourists or residents within the county.

Agriculture

1. Definition

a. The practice of farming, including cultivation of the soil to grow crops and the rearing of animals to provide food or other products.

2. Related Resources

a. Water Rights, Irrigation, Canals & Ditches, Noxious Weeds, Water Quality, Land Use, Land Access, Livestock & Grazing, Economic Considerations

3. Findings

a. Overview
   i. Crops, including fruits and vegetables but primarily grains, are all grown in Utah's soils. Feed crops intended for livestock make up much of the state's production. Additionally, many materials used for technological purposes are derived from crops, such as building materials and medical supplies (BioWest 2016).
   ii. According to the Utah Agriculture Sustainability Task Force (2012), "The number and size of farms and ranches has dramatically changed in Utah. From 1900 to 1990, the number of Utah farms decreased. Beginning in 1990 the number of farms began to increase again. The 2011 Utah Agricultural Statistics report recorded 16,600 farms." The average age of the principal farm operator in Utah County was 58.8 in 2012 (USDA 2012).
   iii. Factors affecting agricultural productivity include:
      - Water supply and quality
      - Lack of protection and vision for arable lands
      - Urban development
      - Displacement or fragmentation of farms
      - Reallocation of irrigation water
      - Changes in roadways and circulation routes needed to transport agricultural products
      - Acceptability of agriculture activity in the urban interface
      - Loss of productivity to invasive species and weeds
      - Plant and animal disease
      - Soil quality
      - Air quality
      - Regulations on resources may also impact agriculture productivity (BioWest 2016).

b. Crops

i. According to the 2012 Census of Agriculture and USDA Natural Resources Conservation Service records, the top crops by acreage are forage-land used for all “hay and haylage, grass silage, and greenchop,” which accounts for 43,149 acres. These amounts place Utah County as the 9th out of 29 counties in the state for this type of acreage.

ii. Other top crops by acreage, in descending order of area, include “wheat for grain, all” (12,432 acres), “winter wheat for grain” (12,272 acres), “corn for silage” (5,617 acres), and “cherries, tart” (3,792 acres) (USDA 2012).

iii. According to the USDA Census of Agriculture (2012), the county has 723 acres of “vegetables harvested for sale.” Overall, in Utah County there are 2,462 farms covering 343,077 acres. There are 6,015 acres of orchards on 192 different farms. Utah ranks second nationally in tart cherry production. Tart cherries are produced primarily for processing and canning (UDAF 2012).

iv. The Utah County Resource Assessment (NRCS 2005) stated that “Control of noxious and invasive plants is an ever increasing problem” and “small, part-time farms are less likely to adopt conservation due to cost and low farm income.”

c. Livestock

i. Livestock are also considered part of agriculture. In Utah County, there are 18,132 beef cows on 780 farms and 15,518 milk cows on 45 farms (USDA 2012).

d. Control and Influence

i. In Utah County, private property owners and farm operators control this resource. Most crop farming occurs on private land with little outside influence. The public agency with the most influence on agriculture in the county is the Natural Resources Conservation Service. The county and municipalities have influence over land uses and zoning, which will impact agriculture. Some grazing takes place on public lands within the county.

e. Economic Considerations

i. Utah County’s agriculture contributes to local, regional, and national food security, as well as the economy.

ii. According to the 2012 Census of Agriculture, the market value of products sold in Utah County was more than $222 million, and average per farm was $90,426.

iii. According to the USDA Agricultural Statistics Services (2012), Utah County is one of the most agriculturally diverse counties in Utah, producing a wide variety of agricultural products including fruit, honey, and potatoes. It is also one of the state’s largest producers of alfalfa hay, wheat, and livestock. Utah County has the second highest market value of agricultural products sold in Utah (behind Beaver County) due to its strong crop and livestock production.

iv. A recent report published through Utah State University (2016) showed that agriculture contributes more than 15 percent of the state's total economic output. "Agriculture processing and production sectors combine to account for

$21.2 billion in total economic output in Utah after adjusting for multiplier effects (compared to $15.2B in 2008)" (Ward and Salisbury 2016). In terms of employment and taxes, the study found "A total of 79,573 jobs are agriculture related generating compensation $3.5 billion (compared to 66,500 jobs in 2008)," and that "The agriculture production and processing sectors generate $497 million in state and local taxes (compared to $350 million in 2008)" (Ward and Salisbury 2016).

v. "Economic sectors include: jobs, income, and quality of life to both rural and urban areas within the state. In 2011 production agriculture (including the value of commodities produced and used on the operation where they were produced) accounted for 3.1% of the state economy. The effect of total employment associated with production agriculture was estimated at 21,254 jobs, and labor income was estimated at $356 million. Production agriculture, along with its associated processing sector, accounted for 14.1% of the total state economic output, employed approximately 78,000 individuals, and yielded $2.7 billion in labor income. The yearly contribution of agriculture to fiscal revenues (taxes) for state and local entities is estimated at $298 million. An additional $285 million is contributed to federal entities" (Jakus et al. 2013).

vi. Agricultural production within Utah contributes to both stability and diversity to the local, regional, and national economy. Utah's farm income for all commodities in 2014 was almost over $2.4 billion. This total can be divided into two main categories:

1. Income from Livestock and Animal Products: $1,843,108,000
2. Income from Crops: $532,111,000 (UDAF 2015)

vii. The primary crops produced in Utah include wheat, feed crops (barley, corn, hay, oats), safflower, onions, and fruits (apples, apricots, cherries, peaches). The highest cash receipts in 2014 were from hay production (nearly $258 million) and wheat ($42 million). The total value of hay production was $442 million and includes both cash receipts and hay retained by the producer as feed for their own livestock (UDAF 2015).

f. Custom and Culture

i. Agriculture became an integral endeavor of Utah County as pioneers settled in the area. Agriculture was not new to the western United States, but the intensity and scale of crop production significantly increased the demand created by the pioneer settlers (BioWest 2016).

ii. After the veritable plague of grasshoppers from 1854 to 1856, Mormon settlers began "eating whatever they had remaining and adding wild mushrooms, sego lily bulbs, and many other roots and berries to their diet, the Mormons eventually established viable agricultural communities in Utah County that sustained them and their families" (Holzapfel 1999).

iii. In 1970, “the fruit industry began a revival as growers started buying cheaper land outside of urban areas. Many fruit producers moved and developed land around southern Utah County. As part of that expansion, we‘ve seen significant growth in tart cherries and apple trees. They are now two of the largest fruit crops produced in the state . . . Utah also ranks high nationally in the production of other fruit. We are third in production of apricots, eighth in sweet cherries, ninth in pears and 18th in peaches. Utah County is the state’s largest producer of tree fruit, except apricots” (UDAF 2012).

iv. In the 20th century, agriculture was still practiced and honored. “The Utah Century Farms Committee honored the Ted Clifford Voorhees farm in Utah County as its first "Century Farm" during ceremonies in December, 1995” (UDAF n.d.).

v. “The Voorhees farm has been continuously operated by members of the same family for 140 years (as of 2013), and is one of the oldest farm/ranch operations in Utah. The farm was homesteaded on March 17, 1873, by Christian Olsen (C.O.) Hansen in the area now known as Leland, located west of Spanish Fork. In 1888 John J. Hansen built a home on his section of the homestead. That home still stands” (UDAF n.d.).

vi. Today, there are approximately 54 designated Century Farms in Utah County, with 23 in Spanish Fork City alone (UDAF n.d.). These farms represent the continued shared heritage of agriculture.

vii. According to a survey completed in 2016, agriculture, livestock, and grazing received one of the lowest rankings when respondents were asked about county resource management planning priorities.

4. *Objectives*

a. Communities have healthy economies that include the agricultural production of food, feed, and fiber.
b. Best agricultural practices on public lands, including water saving measures, are standard within the county.

5. *Policies*

a. Protect rangeland and cropland by controlling noxious weeds on public lands and surrounding areas.

Air Quality

1. Definition

a. The degree to which the ambient air is pollution-free, measured by a number of indicators of pollution.

2. Related Resources

a. Fire Management, Energy, Mining

3. Findings

a. Overview
    i. Air pollutants are those substances present in ambient air that negatively affect human health and welfare, animal and plant life, property, and the enjoyment of life or use of property. Ambient pollutant concentrations result from the interaction between meteorology and pollutant emissions. Because meteorology can't be controlled, emissions must be managed to control pollutant concentrations.
    ii. "The Clean Air Act (CAA) requires the Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The CAA establishes two types of air quality standards: primary and secondary. Primary standards are set to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards are set to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings... The EPA has established health-based NAAQS for six pollutants known as criteria pollutants. These are carbon monoxide, nitrogen dioxide, ozone, particulate matter, sulfur dioxide, and lead... The Division of Air Quality monitors each of these criteria pollutants, as well as several non-criteria pollutants for special studies at various monitoring sites throughout the state" (Utah Division of Air Quality 2015).
b. Utah Valley
    i. "The same mountain and lake combination that moderates the climate also contributes to the presence of frequent wintertime temperature inversions. Temperature inversions, periods when the coldest air is trapped close to the ground, lock in stagnant air and pollutants which progressively intensify. Inversion periods that produce cold, fog, icy roads, and air pollution can last up to several weeks in Utah County. The layer of hazy pollution associated with the inversions comes from the increasing number of automobiles and their emissions

and pollutants from the commercial and industrial uses associated with the growing county population. This layer of haze makes it difficult for sunlight to penetrate to the surface of the ground and resolve the inversion problem by heating the lower layer of air. In such an inversion situation, relief is only available when a weather front moves into the county with enough energy to break the inversion and bring in fresh air and sunlight" (Utah County Commission 2014).

ii. "Testing for carbon monoxide, nitrous oxide, ozone, and particulate matter has been in progress for a number of years in Utah County. Historically, the county has exceeded air quality standards for carbon monoxide, and more recently, particulate matter, largely due to heavy automobile use and industrial discharges; and particulate matter, from industry, wood burning stoves, construction disturbance, road dust, diesel engine discharges, agriculture operations, and illegal refuse burning" (Utah County Commission 2014).

iii. Based on historical sampling, Utah County is designated as a non-attainment area for large particulate matter (PM_{10}) and the western portion is a non-attainment area for small particulate matter ($PM_{2.5}$). Provo is a maintenance area for CO (carbon monoxide) (Utah Division of Air Quality 2015).

iv. "Utah County's Health Department runs the Bureau of Air Quality. Their mission is to improve the quality of life for Utah County residents by monitoring and controlling harmful air pollutants. Motor vehicles are a major source of air pollution resulting in the need for an inspection maintenance (I/M) program. The Bureau of Air Quality Programs perform a variety of inspections, both covert and overt, on nearly 200 certified gas I/M stations located throughout Utah County" (Utah County Bureau of Air Quality 2011).

c. Control and Influence

i. The Clean Air Act (1970), as amended, sets the laws and regulations regarding air quality, gives authority to the EPA to set standards and rules, and delegates regulatory authority to individual states with EPA oversight, provided certain standards are met. The purpose of air quality conformity regulations, enforced by the EPA and the DAQ in Utah, are to protect public health and welfare by decreasing pollutant concentrations through emissions reduction. Construction and mining projects require assessment of air quality impacts and may require an emissions permit and/or a fugitive dust control plan from the DAQ. Fines of up to $10,000 per day may be issued if rules and laws are not properly followed.

ii. The State has adopted a Smoke Management Plan in which prescribed fires scheduled for completion should be coordinated with the State Smoke Coordinator prior to ignition and follow the requirements of the State's Enhanced Smoke Management Plan.

iii. d

d. Economic Considerations
    i. Economic consequences of poor air quality may include:
        1. Increased time away from work and health care costs associated with stroke, heart disease, chronic and acute respiratory diseases including asthma, and premature death.
        2. Decreased appeal of tourism.
        3. Deterring new businesses and industries from moving to the area.
        4. Increased operating expenses for significant pollutant sources due to pollution control measures as required by air quality management plans.
        5. Stunted growth and yield of agricultural crops.
        6. Threat of additional federal regulation and potentially reduced highway funding (World Health Organization 2014, Pope et al. 1992, Utah Economic Council 2014, UDAQ 2012, NOAA 2009).
    ii. For these reasons, maintaining air quality is important to Utah County.
e. Custom and Culture
    i. "Preservation of water and water features, maintaining healthy air quality, awareness of natural hazards, wildlife protection and forest conservation, are all important for the residents and visitors of Utah County" (Utah County Commission 2014).

4. *Policies*

a. The county recognizes that one of the threats to the county's air quality is catastrophic wildfire and encourages agencies to enact programs that allow prescribed burning, forest improvement techniques such as forest thinning, pruning, and removal of brush and insect-killed trees, and other methods for reducing fire hazard that ultimately protects air quality.
b. Prescribed burns should be consistent with the State of Utah Division of Environmental Quality (UDEQ) permitting process and timed in conjunction with meteorological conditions so as to minimize smoke impacts.
c. Encourage the best economic use of energy sources on public lands to reduce the discharge of air pollutants.

5. *Desired Management Practice*

a. Agencies should establish forest management programs that encourage fuel reduction of forests and wildlands by means other than burning, utilizing all means of fuel reduction including but not limited to: logging, forest thinning, and chipping, brush mastication, livestock grazing, herbicide use, and public firewood utilization.
b. Federal agencies should manage emissions to prevent deterioration to air quality in Class I airsheds.

Canals and Ditches

1. Definition

a. The man-made passageways to move water from one area to another.

2. Related Resources

a. Land Use, Livestock and Grazing, Irrigation, Agriculture, Water Rights, Water Quality and Hydrology, Wetlands, Riparian Areas, Fisheries, Recreation and Tourism, Wild and Scenic Rivers, Wildlife, Fire Management, Threatened, Endangered, and Sensitive Species.

3. Findings

a. Overview
    i. Ditches, canals, and pipelines are used to convey diverted water from the source to the location where beneficial use is taken. Open channels are not suitable for many uses, so piping must be used for water that must be safe to drink or supplied via a pressurized network. Traditionally, irrigation water has been distributed via a network of canals and ditches from rivers and streams, but with time and circumstances dictating, many have been converted to pipelines. Additionally, because of the extensive conversion of agricultural lands into more urban uses, some irrigation water is now distributed through secondary irrigation supply lines that often parallel the municipal culinary water supply, allowing people to irrigate using water previously allotted to farmland. Water deliveries are an essential component of agricultural production, and may also be relied upon for urban landscape watering and gardens (Bio-West 2016).
b. Control and Influence
    i. Canal and irrigation companies are outside of the county's control, but could be influenced by private shareholders. According to the Utah Division of Water Rights, there are dozens of water companies in Utah County operating with various company rights, share statements, exchanges, and supplemental numbers (Utah Division of Water Rights 2014).
    ii. Canal safety plans are protected by law and held private by the irrigation companies. The canals generally are maintained by individual canal companies and a good amount of drainage water has unrestricted access to dump into canals.
c. Economic Considerations
    i. Without ditches and canals, the county would have very little agriculture.
    ii. Many organizations holding water rights operate on finite budgets for which regular available funding is limited. These funds typically cover only basic

maintenance and intermittent minor upgrades. Occasionally, such organizations can apply for and receive funding to accommodate more extensive upgrades. Funding sources are available for water delivery systems to pay for post-break repairs, maintenance, or the capital upgrades that are necessary to preserve public safety (Bio-West 2016).

d. Custom and Culture
    i. To sustain the influx of pioneer settlers, canals and ditches were constructed throughout Utah, making agriculture possible despite the dry climate. Subsequent development of agriculture brought further expansion of ditches and canals (Bio-West 2016).
    ii. "Two separate canals, the High Line and the Mapleton, eventually brought Strawberry water to a large area in southern Utah County. The eighteen-mile-long High Line Canal, which extended southwesterly from the powerhouse, passing Salem, Payson, Spring Lake, and Santaquin and then through Goshen Pass, furnished water to 17,000 acres of farmland near Payson, Salem, Santaquin, and Genola. The 6.8-mile-long Mapleton Canal served the Springville and Mapleton area" (Holzapfel 1999).
    iii. "Survey responses regarding the importance of water resources derived from public lands and used to irrigate crops and pastures were fairly uniform across Utah... few respondents in any area of the state considered irrigation water to be not important or only slightly important. In each of the county clusters, a large majority of respondents considered water resources for irrigation to be "very important," with the percentage of respondents selecting that response ranging from 63.5% in the Davis/Salt Lake/Utah/Weber county area to approximately 92% in the Piute/Sanpete/Sevier clusters" (Krannich 2008).
    iv. In the same study, 85.5 percent of respondents from the Davis/Salt Lake/Utah/Weber County area expressed that the importance of water resources used to supply homes and businesses to the overall quality of life for people living in their community is "very important" (Krannich 2008).

4. *Objectives*

a. Ditches and canals on public lands are protected, as needed, to deliver water to water rights holders.
b. Ditches and canals on public lands are managed for the safety of the public.
c. Ditches and canals on public lands are managed for optimum efficiency and conservation.

5. *Policies*

a. Public canals and ditches on public lands or their rights-of-way should be protected for future agricultural uses, as well as recreational use (e.g., trail development).

b. During and after emergencies, canals and ditches running through public lands should have open access for people, vehicles, OHV, and mechanized machinery with the intent to restore or protect canals and ditches, or prevent or mitigate damaging water flows that were created by the disruption of the canal or ditch.

Cultural, Historical, Paleontological, and Geological

1. Definition

Generally speaking, this refers to human and natural resources which have intrinsic value because of their age, anthropological, heritage, scientific, or other intangible significance.

a. Cultural: of or relating to culture; societal concern for what is regarded as important in arts.
b. Historic: of, or pertaining to, history or past events.
c. Geological: the study of the Earth, its rocks, and their changes.
d. Paleontological: includes the study of non-human fossils to determine organisms' evolution and interactions with each other and their environments.

2. Related Resources

a. Recreation and Tourism, Land Use, Land Access, Energy, Law Enforcement, Mining, Mineral, Air Quality, Water Quality and Hydrology

3. Findings

a. Overview
    i. Cultural and historical
        1. Cultural resources include archaeological sites, standing structures (e.g., buildings, bridges), and even places of importance that are more than 50 years of age. Many historical and cultural resources are very sensitive and protected by law.
        2. "Generally, the prehistory of the Great Basin region is divided into three distinct stages. The first, a period spanning several thousand years to about A.D. 500, is known as the Archaic... The second, a period ranging from A.D. 500 to the 1300s is known as the Fremont, or Formative, period. The third and final period dates from the 1300s until European contact in 1776 and is known as the Late Prehistoric period. It should be noted that Archaic and Fremont refers to a strategy of subsistence and settlement, not to a particular people" (Holzapfel 1999).
        3. Some of the earliest human remains found in Utah County are dated between 3,649 and 3,352 B.C (Holzapfel 1999).
        4. "Many Fremont sites are found along the old channels of Utah Valley's rivers, including Currant Creek and the Provo River. Numerous mounds, formed by the collapse of adobe-walled surface structures and earth

lodges, were also found along streams and rivers in Utah Valley before they were leveled by early white farmers. The George Montague Wheeler expedition (1872-73) noted in its published report a description of some of these mounds in Utah Valley: 'West of the town [Provo], on its outskirts and within three or four miles of the lake, are many mounds.' Additionally, 'Northwest of Provo on the level fields, half-way from the town to Utah Lake is a field containing a number of mounds more or less perfectly preserved; some are entirely untouched, except on the outer edges, where the Mormons' grain patches encroach upon them.' More than a hundred such mounds were located west of Provo in the 1930s" (Holzapfel 1999).

5. Today the National Register of Historic Places lists 174 sites in Utah County (National Parks Service 2016).

ii. Paleontological

1. The Utah Antiquities Act (UCA 9-8-404 et seq.) protects significant paleontological resources and applies to all paleontological resources that are on or eligible for inclusion in the State Paleontological Register.

iii. Geological

1. Geologic resources include fossils (paleontological resources) that are defined as the remains, traces, or imprints of ancient organisms preserved in or on the earth's crust, providing information about the history of life on earth. The Utah Antiquities Act (UCA 9-8-404 et seq.) protects significant paleontological resources and applies to all paleontological resources that are on or eligible for inclusion in the State Paleontological Register. Other regional geologic resources of significance include Timpanogos Cave National Monument and thermal springs in Midway (Bio-West 2016).
2. "Much of Utah County's landscape is layered rocks that come in many colors and configurations and range from rocks formed more than two billion years ago to strata being laid down today" (Holzapfel 1999).
3. "Much of the scenery that impresses county residents and visitors began to form 386 to 320 million years ago. During that time, limestone and other sediments that became the Oquirrh Mountains and the highest peaks of the Wasatch Mountains were deposited. Later, mineral-laden fluids and molten rock flowed into the existing rocks, making ore deposits of various metals" (Holzapfel 1999).

iv. Seismicity

1. "Utah straddles the boundary between the extending Basin and Range Province to the west and the relatively more stable Rocky Mountains and Colorado Plateau to the east. This boundary coincides with an area of

earthquake activity called the Intermountain Seismic Belt (ISB). Utah's longest and most active fault, the Wasatch fault, lies within the ISB. Unfortunately, the heavily populated Wasatch Front (Ogden – Salt Lake City – Provo urban corridor) and the rapidly growing St. George and Cedar City areas are also within the ISB, putting most of Utah's residents at risk" (Utah Seismic Safety Commission 2008).

2. The Wasatch fault zone extends about 240 miles along the Wasatch Front from Malad City, Idaho, on the north to Fayette, Utah, on the south. The fault is divided into 10 segments based on various geologic criteria; fault movement on a given segment is capable of generating earthquakes as large as M 6.5–7.5. Geologic evidence indicates that the five central segments between Brigham City and Nephi are the most active. These five segments coincide with the most densely populated part of Utah (Utah Geological Survey 2010).
3. Even though no large earthquakes have ruptured the Wasatch fault in the 163 years since Mormon settlers first arrived in Utah, abundant geologic evidence shows that the central Wasatch fault has generated more than two dozen large (M ~7) earthquakes in the recent geological past. An earthquake of this size is a serious threat to the citizens of Utah and has the potential to be extremely destructive (Utah Geological Survey 2010).
4. The Wasatch fault is an active fault; geological evidence shows earthquakes have occurred within the last 300 years, which have created vertical displacements of 15 to 20 feet in some segments of the fault. Less severe earthquakes have occurred, on average, every ten years in Utah County. Surface fault ruptures can damage or destroy buildings and may sever transportation routes and utility and water supply lines, causing additional dangers for fighting fires and restricted mobility of medical and safety personnel (Utah County Commission 2014).
5. Ground shaking is the most common hazard associated with earthquakes and exists countywide. In areas with a high water table or near a water feature, ground shaking can cause soils to become temporarily unstable. This temporary condition of soil instability is known as liquefaction. Structures affected by liquefaction may not be shaken apart, but may tilt, sink, or list over on their side. The State of Utah has adopted certain building codes, which include standards and requirements relative to seismic concerns (Utah County Commission 2014).
6. Much of Utah County is at risk for liquefaction in the event of an earthquake. The risk is low west of Utah Lake, but there is a high risk from Provo to Payson (Anderson et al. 1994).

7. Building codes that meet seismic standards are controlled by the county, and in some places the individual municipalities.

v. Landslides, rockfall, and debris flow

1. "Steep sloping ground and an unusual amount of water can result in landslides, mud flows, or debris flows. Certain types of rocks in Utah County, such as the Manning Canyon Shale, have a structural makeup that has a propensity for landslide activity, especially during a period when these soils are saturated from heavy rainfall or snow melt. Debris flows, defined as a mass of mud, rock fragments, soil, and water, moving much like a stream, occur mainly in the cloudburst flood channels of the mountain front. When fire destroys vegetation on the mountain-front, the risk for, and scale of, debris flows may be Increased" (Utah County Commission 2014).
2. "Rock fall can occur during an earthquake when exposed rocks on steep slopes are dislodged by ground shaking, or as an individual event when broken free from the mountainside by the freeze-thaw regime of winter climate. In either case, large rocks rolling and bouncing down the slope of the mountainside can be damaging and dangerous to those living near the base of the mountains" (Utah County Commission 2014).
3. In 1983, a "major landslide occurred in Utah County above the town of Thistle. The landslide blocked the Spanish Fork River, which flooded the town of Thistle until it was underwater. The event caused 1 fatality and 2 injuries as well as damages topping $200 million" (National Weather Service n.d.).
4. "Record-breaking precipitation in the fall of 1982, followed by a deep winter snow pack, then warm spring temperatures and rapid snowmelt in 1983 set the stage for the Thistle landslide. Once triggered, the slide reached a maximum speed of 3.5 feet per hour and dammed Spanish Fork River within a few days" (Milligan 2005).
5. "The landslide ultimately reached 1000 feet in width, nearly 200 feet in thickness, and over one mile in length. The lower end of the slide formed a 220-foot-high dam where it abutted against a sandstone cliff at the base of Billies Mountain. Behind this dam, 'Thistle Lake' reached a maximum depth of 160 feet before being drained by diversion culverts" (Milligan 2005).
6. "The Thistle landslide and 'Thistle Lake' severed railroad service between Denver and Salt Lake City, flooded two major highways (U.S. 6 and U.S. 89), devastated the town of Thistle, and resulted in Utah's first Presidential disaster declaration. Direct damage exceeded $200 million

(in 1983 dollars), making Thistle the most expensive landslide to date in U.S. history" (Milligan 2005).

7. "The 1983 landslide consisted of detritus from the North Horn and Ankareh Formations that moved along a trough-shaped depression in deeper bedrock (a paleovalley). Landslides in Spanish Fork Canyon are nothing new. In fact, the area of the 1983 landslide has undergone repeated historical and prehistoric movement" (Milligan 2005).
8. "Furthermore, the Thistle Landslide and immediate area has continued to move intermittently since the 1983 wet year. Minor mudslides (earth flows) periodically occur near its flanks and head. Following a wet winter, almost the entire slide (except for the 'dam' section) moved in spring of 1998. This 1998 reactivation also enlarged the head of the slide by an area about the size of several football fields" (Milligan 2005).

b. Economic Considerations
    i. Though unmeasured in the economy, the value brought to the county by paleontological research and tourism is important.
    ii. Cultural, historical, geological, and paleontological resources are often connected with tourism and recreation. For example, the Utah Geological Survey has created a GeoSites online interactive map to help people explore Utah's geological sites.
    iii. Historic buildings and districts provide character, a sense of stability, and a unique marketing angle for businesses; thus, community planners can draw upon local historic resources to stimulate economic development.
    iv. A study by the Utah Heritage Foundation (2013) found that, "Utah benefited by $717,811,000 in direct and indirect spending by visitors to Utah heritage sites and special events, and $35,455,268 in investment that stayed in Utah rather then sent to Washington, D.C. because of projects that utilized the Federal Rehabilitation Tax Credit."
    v. "Historic preservation in Utah is not about putting a fence around monuments. The historic resources of Utah are part of the daily lives of its citizens. However, the historic resources of Utah are also providing a broad, significant contribution to the economic health of this state" (Utah Heritage Foundation 2013).

c. Custom and Culture
    i. The custom and culture of Utah County is to respect all cultures and preserve or honor significant historical stories, figures, objects, structures, or events. It is the custom of the county and its residents to rely on the land and geology for fuel, fiber, food, and minerals. Mining, mineral extraction, and ranching have been a way of life for more than a century. Historic photos and accounts evidence the tradition of resource utilization and dependence in Utah County.

4. Policies

a. Seek to identify, preserve, and protect significant cultural resources and ensure that they are available for appropriate uses by present and future generations.
b. Seek to reduce imminent threats and resolve potential conflicts from natural or human-caused deterioration, or potential conflict with other resource uses by ensuring that all authorizations for land use and resource use will comply with the National Historic Preservation Act (NHPA).
c. The county favors management that makes cultural, historic, geological, and paleontological resources available for educational purposes that can be enjoyed by the public.

5. Desired Management Practices

a. Describe, as appropriate, high interest or unique geological, paleontological, biological, archeological, or historical features for public information and, as appropriate, develop interpretive information for these sites.
b. Identify all cultural and historic sites on federal land in the county. Prioritize the importance of, and prospects for, protecting these sites.

Energy Resources

1. Definition

a. Renewable or nonrenewable resources used to obtain energy

2. Related Resources

a. Mining, Mineral Resources, Cultural, Historical, Geological, and Paleontological, Water Quality and Hydrology, Water Rights, Air Quality, Land Use, Land Access

3. Findings

a. Overview
   i. "The unique geologic history, geography, and climate of Utah have resulted in an abundance of nonrenewable and renewable energy resources. Nonrenewable energy resources include fossil fuels, such as oil, coal, and natural gas, as well as naturally occurring elements, such as uranium. Renewable energy resources are those that are replenished by natural processes and include geothermal, solar, and wind energy" (Utah State University 2009).
   ii. Public and private utilities draw upon renewable and nonrenewable resources to provide electric and fuel (natural gas, propane, oil, gasoline) energy supplies (Bio-West 2016).
   iii. Utah produces 4.3 percent of its power from renewable sources, which ranks 35th among all states in the United States. Of the power produced in the Mountainland Association of Governments (MAG) region, about 4 percent is produced from renewable sources, primarily from hydroelectric and wind facilities (Bio-West 2016).
   iv. Natural gas, oil, nuclear, geothermal, and coal are not extracted or exploited in a significant way in Utah County. The Tabby Mountain Coalfield does extend into the southeastern parts of the county, but this area hasn't seen commercial production of coal. Energy resources most likely to affect Utah County on private or federal lands are solar and wind power (Utah State University 2009).
   v. Geothermal
      1. Most of the geothermal springs in the Utah Valley are fault controlled (Klauk 1984).
      2. While there are a number of geothermal springs in Utah County, they are not presently being utilized for energy production (Utah State University 2009).
   vi. Wind

1. According to Rangeland Resources of Utah (USU 2009), there are three wind canyon drainage sites in Utah County, all on the west side of the Wasatch Mountains.
2. The Spanish Fork Wind Park at the mouth of Spanish Fork Canyon is an 18.9-megawatt wind powered facility. The park is owned by NRG Energy and began operations in 2008. PacifiCorp is purchasing 100 percent of the turbines' output. There are nine 2.1-megawatt turbines (PacifiCorp 2017).
3. Wind turbine technologies continue to improve, and turbines are now able to generate economically competitive electricity in lower wind speed areas through the use of longer turbine blades, taller hub heights, and advanced controls. Also, improvements in wind resource forecasting, wind plant control technologies, and energy storage now allow wind plants to generate electricity at a smoother, more consistent rate than in the past. These factors enable more accurate predictions of output for management by the electric utilities that generate and/or purchase the power generated by wind projects (Four Corners Wind Resource Center, unpublished report).

vii. Solar

1. The Utah Renewable Energy Zone Task Force did not identify any areas in the county as exceptionally suitable for utility-scale parabolic-trough solar collectors (Berry et al. 2009). Other counties may have more suitable topography and land area available for large arrays, but many homeowners are choosing to supplement their energy budget with rooftop solar installations. The cost of solar photovoltaic installations has fallen dramatically in recent years and continues to decline, making solar an increasingly economically attractive source of electricity (Four Corners Wind Resource Center, unpublished report).

viii. Oil and Gas

1. From 2013 to 2017, Utah County saw no Applications for Permit to Drill according to the Utah Division of Oil, Gas and Mining (DOGM; 2017).
2. Utah County produced no recorded oil, natural gas, or coalbed methane gas from 2012 to 2016 (DOGM 2017).
3. The Lake Side Power Station is a natural gas turbine power station east of Utah Lake in Vineyard.

b. Control and Influence

i. Private industry and municipalities develop and sell energy resources. Rocky Mountain Power provides power to all of Utah County and most of Utah; the headquarters is in Salt Lake City and it employs approximately 5,700 people in three western states (Rocky Mountain Power 2017).

c. Economic Considerations
    i. "Having access to urban wind power provides many economic, social and environmental benefits to surrounding communities" (May et al. 2013).
    ii. Development of the renewable energy resources in the Utah County has the potential to be an important contributor to the local economy. Wind and solar resource development costs have dropped dramatically in the last several years. In some places, electricity from solar and wind resources is now cost competitive with other sources of new and existing electricity generation (Four Corners Wind Resource Center, unpublished report).

4. *Policies*

a. Promote the efficient use of natural resources and the conservation of energy.
b. Minimize impacts to ecology and scenery from fluid and solid mineral development on public lands while still allowing such development to continue to benefit the economy. Encourage oil, gas, and mining companies to use the best technology and mitigation techniques to protect natural amenities and natural resources.
c. Promote energy development through education, coordination, and pooling of public lands for more efficient development and landowner participation.
d. The county will encourage solar renewable energy development in areas where impacts on vegetation and other resources will be minimized through appropriate mitigation measures because of inherent properties of the site.
e. Support agencies in providing opportunities for mineral exploration and development on public lands under the mining and mineral leasing laws subject to legal requirements to protect other resource values.

5. *Desired Management Practices*

a. Provide appropriate opportunities for and manage activities related to locating, lease of, exploration, development, and production of mineral and energy resources on public lands.

Fire Management

1. Definition

a. The actions to control, extinguish, use, prevent, or influence fire for the protection or enhancement of resources as it pertains to wildlands.

2. Related Resources

a. Recreation & Tourism, Land Use, Land Access, Energy, Law Enforcement, Air Quality, Floodplains & River Terraces, Water Quality & Hydrology, Wildlife, Noxious Weeds, Forest Management

3. Findings

a. Overview
   i. Wildfire is the most prevalent natural disturbance in the state of Utah, and it affects biotic communities statewide. It is an integral component of our forest, range, and desert lands and affects thousands of acres on an annual basis (National Interagency Fire Center 2016).
   ii. In less developed areas at lower elevations, a key management concern is the spread of cheatgrass that predominantly invades semidesert shrub communities. Cheatgrass has been blamed for much of the reduction of fire return intervals and the occurrence of larger fires (Utah State University 2009).
   iii. Response to fire incidents, especially wildland fires, relies on proper oversight, guidance, and partnership among a variety of trained professional organizations. Establishing a fire management system is a critical step to the protection of both urban and rural communities (USFS 2016).
   iv. Fire management refers to the principles and actions to control, extinguish, use, or influence fire for the protection or enhancement of resources as it pertains to wildlands. It involves a multiple-objective approach strategy including ecosystem restoration, community preparedness, and wildfire response (USFS 2016).
   v. Fire management refers to the principles and actions to control, extinguish, use, or influence fire for the protection or enhancement of resources as it pertains to wildlands. It involves a multiple-objective approach strategy including ecosystem restoration, community preparedness, and wildfire response (USFS 2016). Response to a wildland fire can involve a basic monitoring status placed on a remote wilderness fire, or involve multiple agencies overseen by an incident-management team encompassing hundreds of firefighters to manage. At a basic level, firefighting resources can be grouped into two broad categories: ground

resources and air resources. Often times, both types of resources are dispatched to a wildland fire.

vi. There are two main firefighting groups that fall within the "ground resources" category; they include handcrews and engines. Handcrews are specifically trained to fight wildfires. Wildland engines are specially equipped fire engines, often with all-terrain capabilities, to transport water to firelines. Both handcrews and engine crews are sponsored by federal land management agencies such as the USFS, BLM, National Park Service, U.S. Fish and Wildlife Service, and the U.S. Bureau of Indian Affairs (Bio-West 2016).

vii. One management tool for forests and fires is prescribed burning, also known as controlled burning. "Prescribed burning is an ecologically sound way to improve wildlife habitat. Land management plans that integrate prescribed burning can enhance the habitat of game species and plants and/or animals of concern. It can open areas for increased movement, reduce ground litter, control brush encroachment, increase nutritional value, and diversify plant species" (Utah State University 2009).

viii. "A large percentage of land area within the boundary of Utah County is rural and mountainous with a variety of fuels vulnerable to wild land fire. Vegetation types range from grasses and brush to heavy scrub and timber. Even with the efforts to eliminate accumulated fuels through clearing and controlled burns, most of these areas have large amounts of fuel which can burn violently when ignited. Homes have also been constructed within these wild land fire areas that complicate fire management and control. Protection of natural resources, life and property, and firefighters and their equipment, has continued to add to the cost of fire suppression. Besides the immediate danger to life and property and the loss of vegetation, wild land fire can create secondary concerns of erosion, flooding, landslides, debris flows, water quality degradation, displacement of wildlife and livestock, as well as aesthetic impacts. Wild land fires occur each year in Utah County. The number of fires can be reduced by fire safety education and using common sense during periods of high fire danger. The intensity of these fires can vary due to weather conditions and the abundance of fuel" (Utah County Commission 2014).

b. Control and Influence

i. "The Utah County Fire Marshal coordinates fire prevention, suppression, and fire investigation throughout the unincorporated area, while the Wild Land Fire Division of the County Sheriff's Department specifically provides for the prevention and suppression of wild land fires in the unincorporated private lands and cooperates with the state and federal agencies when wild land fires are initiated on public lands or cross over onto such lands. The adoption by Utah County of the International Fire Code and the Urban/Wildland Interface Area

section of the Utah County Code has increased the effectiveness of fire prevention and has reduced the risks, costs, and adverse impacts of wild land fire" (Utah County Commission 2014).

ii. In Utah, the state legislature tasked the Utah Division of Forestry, Fire and State Lands to devise a comprehensive statewide wildland fire prevention, preparedness, and suppression policy, which is now known as SB-56, 2015. Under this plan, a master cooperative wildland fire management and Stafford Act response agreement is signed each year between numerous federal land management agencies and the State of Utah for cooperation during wildland fire incidents that occur throughout the state (Utah Division of Forestry, Fire and State Lands 2013).

c. Economic Considerations

i. Fire suppression is expensive to taxpayers. In the past 30 years, money spent by federal agencies nationwide on firefighting has increased from $2.5 million in 1985 to well over $2 billion in 2015 (National Interagency Fire Center 2015). With climate change and expected increase in temperatures and drought periods, fires suppression costs are projected to rise. In Utah, fire suppression costs averaged $33.4 million per year during the 10-year period of 2003–2012 (University of Utah, Bureau of Economic and Business Research 2014). One area of major concern is the wildland-urban interface. As development in this interface continues, firefighting costs will increase (Utah Division of Forestry, Fire and State Lands 2013).

ii. Wildfires come with serious costs; the cost of fire suppression is only a fraction of the true, total costs associated with a wildfire event. Some of the costs associated with wildfire suppression include the direct costs (resources lost and structures burned), rehabilitation costs (post-fire floods and land restoration), indirect costs (lost sales and county taxes), and additional costs (loss of life and damage to air quality). A synthesis of case studies reveal a range of total wildfire costs anywhere from 2 to 30 times greater than the reported suppression costs (Western Forestry Leadership Coalition 2009).

d. Custom and Culture

i. Fire fighting and management is, and always has been, important to citizens in Utah County. Proper fire prevention, management, and mitigation is critical to protecting the health, safety, and welfare of the county and its residents. As evidenced in historic stories and photos, people in Utah County have been training and preparing for structure and wildland fires for decades.

4. *Policies*

a. Work with the Utah Division of Forestry, Fire and State Lands to implement the Wildland Fire Plan and to reduce wildfire hazard in the wildland-urban-interface on public lands.

b. Wildland fire should be utilized to protect, maintain, and enhance resources and, when possible, will be allowed to function in its natural ecological role.
c. The county supports comprehensive fire management that helps reduce catastrophic wildfires.
d. The county values fire management as a protection for the aesthetic beauty of the county, the local economy, and the citizens of the county.

5. *Desired Management Practices*

a. Use pre-planned prescribed fire resulting from planned or unplanned ignitions to accomplish resource management objectives, such as reducing fuel load build-up, range or wildlife habitat improvement, etc.
b. Fuel reduction in forests is managed through silviculture, timber harvesting, and livestock grazing.

Fisheries

1. Definition

a. The places where fish breed and live, or where people hunt for fish. The term also includes game and nongame fish species.

2. Related Resources

a. Canals & Ditches, Irrigation, Floodplains & River Terraces, Riparian Areas, Water Quality & Hydrology, Water Rights, Wetlands, Wild & Scenic Rivers, Wildlife, Recreation & Tourism

3. Findings

a. Overview
    i. A fishery refers to the species composition of fish within rivers, streams, and lakes. The term typically implies management actions, such as stocking, to meet specific objectives for a given water body. Fisheries in the Mountainland Association of Governments (MAG) region of Utah are predominantly managed for sport fish (e.g., trout, bass) (Bio-West 2016).
    ii. "A variety of fish are found in Utah Lake and most all streams, lakes and ponds have native and planted trout. Stretches of the Provo River, through Utah County, are designated as a blue ribbon trout fishery" (Utah County Commission 2014).
    iii. Statewide, Utah's current fish and wildlife resource is highly diverse. Approximately 647 vertebrate species inhabit the state; of these, 381 are considered permanent residents, including 78 species of fish (Powell 1994).
    iv. Important components that affect management and use of fisheries are: sportfishing, the presence of exotic and invasive aquatic species, diseases that have a negative effect on target organisms, and threatened, endangered, and sensitive species.
b. Fishing
    i. "During calendar year 2011, DWR issued 483,806 Utah resident and non-resident fishing or combination hunting and fishing licenses, a 17% increase over the number of licenses sold in calendar year 2005 – the last year in which a statewide angler activity survey was conducted. [The data] estimated a total of 2,448,299 fishing trips by resident and non-resident anglers over the 2011-2012 study period. Statewide, trip numbers were highest during July and August, with over 350,000 trips estimated for each of those months" (Krannich et al. 2012).
    ii. UDWR stocks fish in many waters around the state. Utah's system of state fish hatcheries makes it possible to supply more people with a better quality fishing

experience involving higher catch rates and/or larger fish specimens than would otherwise be possible given the capacity of our waters to produce fish and the population's demand for fishing opportunities.

iii. The UDWR maintains community fisheries such as ponds and reservoirs that are stocked with fish. Utah County has nine ponds stocked by UDWR, such as the Salem Pond, Spring Lake, Highland Glen Park, and many others (UDWR 2016).

iv. The Lower Provo River above Olmstead Diversion is arguably one of the best trout fisheries in the western United States. This tailwater fishery provides anglers with access to large brown trout and numerous fish between 14 and 18 inches long. Anglers visiting this fly and lure-only section will be treated to a truly memorable Blue Ribbon experience (UDWR 2015).

c. Sensitive Species

i. The following are on the Utah Sensitive Species List in Utah County:

1. Bluehead sucker (*Catostomus discobolus*)
2. Bonneville cutthroat trout (*Oncorhynchus clarkii utah*)
3. Colorado River cutthroat trout (*Oncorhynchus clarkii pleuriticus*)
4. June sucker (*Chasmistes liorus*)
5. Least chub (*Chasmistes liorus*)
6. Roundtail chub (*Gila robusta*)
7. Southern leatherside chub (*Lepidomeda aliciae*) (UDWR 2015)

d. Aquatic Invasive Species

i. Aquatic invasive species (AIS), also referred to as aquatic nuisance species, are defined by the UDWR as nonnative species of aquatic plants and animals that cause harm to natural systems and/or human infrastructure. Not all nonnative fish species are considered AIS, such as those that are desirable for sport fishing. These may include nonnative rainbow trout, largemouth bass, and catfish (UDWR 2009).

ii. Invasive mussels in Utah waters have no natural competitors, so once they are established, they spread quickly, colonizing nearly any and all underwater surfaces. They are currently impossible to remove from contaminated water bodies and are easily spread to other waterbodies. The mussels can clog water transmission and power generation infrastructure, harm water-based recreational equipment, and outcompete both native and nonnative game species for nutrients. All these impacts can have profound impacts on sport fish populations (UDWR 2009).

iii. Preventing the spread of AIS is currently the most effective management action. The UDWR has a statewide system of boat cleaning/decontamination stations, inspection check-points, and angler education efforts.

e. Control and Influence

i. The UDWR is responsible for managing fisheries, aquatic pests (quagga mussel), and boat washing in Utah. Fish habitats (i.,e., the state's streams, rivers, lakes, ponds, and reservoirs) are managed by the underlying landowner, which can include state and federal agencies.

f. Economic Considerations
   i. "Recreational fishing provides a significant economic impact to the Utah economy and economic benefit to anglers" (Kim and Jakus 2013).
   ii. "Economic impacts or contributions are based on anglers' expenditures associated with the fishing trips. Expenditures affect the local and regional economy through the interrelationships among different sectors of the economy. Input-output (IO) analysis of expenditure patterns traces the effects 'upstream' and 'downstream' through the economy, resulting in the multiplier effects. The angler survey, conducted in the months of March, April and May of 2012, revealed that a typical angler spent $84 per trip on a fishing trip in Utah in 2011. Average expenditure to visit a BRF was estimated to be $90 per trip" (Kim and Jakus 2013).
   iii. Fishing of over 78 species in Utah represents a significant sector of Utah's tourism economy. Almost $400 million was spent in association with fishing, hunting, and wildlife appreciation activities in 1985 (Powell 1994).

g. Custom and Culture
   i. "The Utes living on the shores of Utah Lake were known as 'Fish Eaters,' suggesting the abundance of this food source in early historic times" (Holzapfel 1999).
   ii. Not all fishermen have appropriately managed fisheries as described in Holzapfel (1999): "Eventually, by the early 1870s, the yield of trout from Utah Lake decreased as a result of the methods of fishing, lack of strict enforcement of existing laws regulating fishing, irrigation practices that often left fish high and dry, chemical changes in the water, and, later, the introduction of new species of fish in the lake. The introduction of black bullhead catfish (1871), carp (1880s), channel catfish (1888), and large-mouth bass (1890) in the lake were among the main reasons for native Utah trout becoming extinct."
   iii. Recreational fishing has been part of the local custom and culture for more than 100 years.

4. *Policies*

a. Support natural resource management entities within Utah to prevent invasion of aquatic invasive species (AIS) into the state, and to contain AIS through accepted management practices to areas that are either already infested or become infested.
b. Support Utah natural resource management entities in establishing and increasing outreach efforts directed at public education. The intent is so Utah's public, particularly

the media, governmental agencies, outdoor-associated recreational organizations, boaters, and anglers will realize the threats and impacts from AIS, and become partners in AIS education, interdiction, decontamination, and management.

c. Coordinate with UDWR to establish and maintain Blue Ribbon fisheries.
d. The county supports efforts to maintain healthy fisheries within the county for biological diversity as well as recreation and tourism.
e. Support the use of local private fisheries for stocking and breeding fish in Utah County.

Floodplains and River Terraces

1. Definition

a. A floodplain is the low-lying area near a river, stream, or drainage which floods when the water level reaches flood stage. A river terrace is the bench or step that extends along the side of a valley and represents a former level of the valley floor.

2. Related Resources

a. Fire Management, Livestock & Grazing, Land Use, Noxious Weeds, Fisheries, Wildlife, Water Quality & Hydrology, Wetlands, Wild & Scenic Rivers, Canals & Ditches, Irrigation, Riparian Areas, Recreation & Tourism, Agriculture

3. Findings

a. Overview
   i. Rivers are dynamic systems. River channels can migrate laterally as a result of bank erosion and deposition, and vertically as a result of bed aggradation or degradation. Floodplains, terraces, and other features are formed by these processes, and are therefore part of the river system (Bio-West 2016).
   ii. Floods occur when a river channel reaches its maximum capacity, often during times of heavy rain or snow melt. Water overflows the river's streambanks and floods into nearby areas that would otherwise be dry. This is especially true when water is delivered at a rate faster than the associated soils can absorb it. Floods also occur when a dam or water impoundment gives way and large amounts of water are released suddenly. For the most part, flooding is a natural process that supports channel maintenance, ecological processes, and riparian vegetation. Nevertheless, floods can cause severe human impacts and therefore must be among resource planning considerations.
   iii. Within the Mountainland Association of Governments (MAG) region, flooding most often occurs from two distinct event types: (1) spring runoff from melting snowpack at high elevations, and (2) summer rainstorms (Hylland and Mulvey 2003). While either event can trigger flooding, the dynamics of each are different. Snowmelt is a relatively predictable occurrence dependent on the amounts of winter snowpack and rising spring temperatures. Large accumulations of snowpack melting in spring contributes to some localized flooding of floodplains of stream and river channels. In contrast, summer cloudburst events, especially those driven by monsoonal moisture, cause sporadic and localized flooding events on otherwise dry washes and canyons. Thunderstorm-triggered floods are exacerbated in locations recently affected by

wildfires where vegetation cover is absent and soils are more exposed to erosion and channeling water down slope.

iv. Floods are the leading cause of natural disaster deaths worldwide. Floods also have the potential to cause significant financial impacts in the form of severe damage to structures, transportation systems, and other infrastructure. Wildfire is a secondary cause of flooding because when vegetation is burned, soils are exposed to erosion. Debris flows below fire scars is a considerable risk until vegetation is reestablished. Planning for revegetation through seeding and other mitigation efforts after fires should be addressed in resources management documents (Bio-West 2016).

v. "Utah County can experience three types of floods: flash floods, riverine floods, and lakeside floods. Flash floods occur when torrential rain delivers water in an upland area at a volume greater than the soil can absorb, when unusually warm spring weather melts the snow pack too quickly, or when a dam, landslide or other obstruction impounding water gives way" (Utah County Commission 2014).

vi. "Riverine floods occur on the natural flood plain as part of the normal process where water from high stream flows are stored outside the river banks until the flow diminishes" (Utah County Commission 2014).

vii. "Lake side floods on land surrounding Utah Lake are dependent upon how much water is stored in the winter snow pack, the manipulation of the storage reservoirs upstream and the irrigation releases at the outlet of Utah Lake. Dredging of the Jordan River, the outlet from Utah Lake to the Great Salt Lake, has been used to help reduce flooding along the shoreline of Utah Lake" (Utah County Commission 2014).

viii. "The Federal Emergency Management Agency, FEMA, has identified the Utah Lake flood plain and several riverine flood plains in Utah County and requires Utah County government to administer special protective regulations in these areas. The FEMA maps show the areas subject to 1% annual chance floods (100 year floods) and areas subject to 0.2% annual chance floods (500 year floods) and have placed those maps in the office of Utah County Community Development. Development in areas subject to 1% annual chance floods should meet floodproofing standards to mitigate flooding concerns. Requirements should be established to regulate the location of human occupied structures near flood channels not subject to FEMA regulations" (Utah County Commission 2014).

b. Control and Influence

i. At the federal level, the Federal Emergency Management Agency (FEMA) provides flood data that classifies areas based on their different flood hazards through the National Flood Hazard Layer (NFHL) and National Flood Insurance Program (NFIP). This enables elected officials, emergency responders, and the

public to be informed and to reduce, or avoid altogether, impacts from floods, to guide development, and to reduce the risk of floods (Bio-West 2016).

ii. Federal agencies manage riparian areas and floodplains under Executive Orders 11988 and 11990, Sections 303 and 404 of the Clean Water Act, and the Endangered Species Act. Riparian areas are also managed under individual resource management plans and other agency policies and guidelines, such as the Bureau of Land Management's (BLM) Riparian Area Management Policy.

iii. The Utah Division of Water Rights processes stream alteration permits in conjunction with the U.S. Army Corps of Engineers.

iv. Flooding along major rivers is sometimes controlled at the discretion of the dam operators. Individual cities have floodplain ordinances that are supported by the county.

c. Economic Considerations

i. Major economic considerations for floodplains include higher development costs to mitigate flood risks. Costs include earthen fill to raise building footprints above flood elevations and other flood-control structures on private lands. Flood-control costs may also be passed on to municipal and county governments during flood emergencies.

ii. Another economic consideration is the cost of floodplain insurance to homeowners. Development in areas subject to floods should meet additional flood-proofing requirements. Laws and regulations regarding floodplain management usually vary between communities.

iii. In 1983, a "major landslide occurred in Utah County above the town of Thistle. The landslide blocked the Spanish Fork River, which flooded the town of Thistle until it was underwater. The event caused 1 fatality and 2 injuries as well as damages topping $200 million" (National Weather Service n.d.).

iv. "The Thistle landslide and "Thistle Lake" severed railroad service between Denver and Salt Lake City, flooded two major highways (U.S. 6 and U.S. 89), devastated the town of Thistle, and resulted in Utah's first Presidential disaster declaration. Direct damage exceeded $200 million (in 1983 dollars), making Thistle the most expensive landslide to date in U.S. history" (Milligan 2005).

d. Custom and Culture

i. "The settlers eventually built Fort Utah along the banks of the Provo River. The initial site presented problems for the group of settlers, however. Periodic flooding became a real concern, so in 1850 a second fort was established somewhere in the vicinity of present-day North Park (500 West 500 North)" (Holzapfel 1999).

ii. "The county livestock industry contributed to range overgrazing and erosion problems, however, which ultimately resulted in major flooding in the county in 1930 and 1952. Cooperation between ranching interests and the federal

government eventually brought about several erosion-control projects and increased supervision of the public lands by the federal government" (Holzapfel 1999).

iii. Preventing floods and mitigating natural disasters has always been a priority for landowners in Utah County. The custom and culture of the area is to be responsible about structure and infrastructure placement, and respect the inevitable changes in flowing water.

4. *Policies*

a. The county supports thoughtful management of floodplains and river terraces as a way to protect human health and safety.
b. The county values floodplains and river terraces as an important part of the local ecosystem.

Forest Management

1. Definition

a. The actions for the regeneration, use, and conservation of forests.

2. Related Resources

a. Fire Management, Noxious Weeds, Wilderness, Wildlife, Water Quality and Hydrology, Livestock and Grazing, Recreation and Tourism, Agriculture

3. Findings

a. Overview
   i. Utah forests are as diverse as the landscape itself. Over 15.1 million acres of forests are administered by federal, state, and local agencies. Another 3 million acres are privately owned (Utah Division of Forestry, Fire & State Lands 2014).
   ii. Trees and forests are an important resource to the people of Utah. With the urbanization of the last decade, air quality along the Wasatch Front is often poor. This is especially true during inversions in the winter months. Trees help trap and filter particulate pollution in the air. They help reduce energy costs and add to property values.
   iii. "With more people building homes out into forested lands every year, wildfires are increasingly complex to manage and the danger to fire fighters and homeowners in the Wildland Urban Interface continues to grow. The after-effects of fire on the ground often include invasive species problems and large scale erosion" (Alpine and Timp-Nebo Conservation Districts 2013).
   iv. "Forests reduce erosion and help regulate snow melt within valuable watersheds. They provide critical wildlife habitat and high quality outdoor recreation opportunities. Invasive species (e.g., Russian olive and tamarisk), insect and disease problems, and grazing pressure from wild and domestic animals all pose threats to the health and function of these forests" (Alpine and Timp-Nebo Conservation Districts 2013).
   v. Several factors have contributed to the decline in forest health including a decline in historic logging, grazing patterns, fire exclusion, and invasive or noxious weeds. Drought conditions can negatively affect forest health, causing detrimental changes in vegetative conditions, especially if combined with these other management practices (Utah Division of Forestry, Fire & State Lands 2014).
   vi. "About 5.2 million acres, or 25 percent, of northern Utah is forested. Fifty-two percent of this forest area is capable of producing commercial wood products and is classified as timberland. Forty-eight percent is classified as woodland,

primarily pinyon-juniper. The predominant forest types on the timberland are aspen, Douglas-fir, lodgepole pine, and spruce-fir. The National Forest System manages 70 percent of the timberland; 23 percent is under private ownership, and 7 percent is under other public ownership (local, State, and other Federal). Thirteen percent of the timberland is withdrawn from commercial timber production and is in a reserved status. Most reserved timberland is found under National Forest System management. The total volume of growing stock on nonreserved timberland in northern Utah is 3.4 billion cubic feet. In order, Douglas-fir, lodgepole pine, aspen, Engelmann spruce, and subalpine fir species account for most of the volume. Net annual growth averages 38.6 million cubic feet after the impact of mortality, which averaged 47.9 million cubic feet annually" (U.S. Forest Service 1997).

vii. "Forests and woodlands cover a large percent of Utah County, with the majority belonging to the U.S. Forest Service. However, there is also a significant amount in private ownership" (Alpine and Timp-Nebo Conservation Districts 2013).

viii. Most forests in the county occur in the Wasatch Mountains, along the eastern edge of the county. Other forest types in the county include:

1. Urban forests within cities
2. Oak-maple forests in low elevations
3. Pinyon-juniper forests in low to mid-elevations
4. Douglas-fir forests in mid-elevations
5. Aspen forests in low to high elevations

Source: (McAvoy et al. 2012)

ix. In 2010 (updated for 2016), the Utah Division of Forestry, Fire and State Lands developed the Utah Statewide Forest Resource Assessment. The assessment:

1. Provides an analysis of the forest conditions and trends in the state;
2. Addresses current state and national resource management priorities;
3. Spatially delineates priority rural and urban forest landscape areas;
4. Ensures that state and federal resources are being focused on important landscape areas with the greatest opportunity for shared management priorities and achieve meaningful outcomes (see the Utah's Forest Action Plan data for priority areas); and
5. Enables the efficient, strategic, and focused use of limited program resources.

b. Uses

i. "Utah County has few stands that are useful for milling into lumber. Sporadic cuts of deciduous trees, such as cottonwoods, occur to make warehousing pallets, shipping crates, and supports for mine safety. Junipers are often harvested and trimmed to make fence posts. Various woods are utilized for home fireplace heating, and a few softwoods have been cut to supply local

sawmills with dimensional lumber. However, the most important use of the areas covered by the tree communities in Utah County is as watershed. Inexpensive supplies of culinary and irrigation water are produced in the mountain forests adjacent to Utah County's population and agriculture centers and require very little expense for treatment and transportation" (Utah County Commission 2014).

ii. "The forested land also produces a crop of browse used for grazing livestock, forage for game animals, and scenic landscape that is important to the recreationist. The tourists that are drawn to these mountains for their beauty and recreation aspects bring important out-of-county dollars into the county's economy annually" (Utah County Commission 2014).

c. Plants

i. "The tree community in any particular spot of Utah County is a product of climate, soils, land forms, and elevation. Trees constitute the major vegetative type in the county. This is true even though Utah County is a productive agricultural county. The majority are deciduous trees; aspen, maple, and oak, although the tree communities of many cool, north-facing slopes in the county are composed of evergreen fir and spruce. Smaller tree communities found west of the Wasatch Mountains are composed of mostly junipers and pinion pines" (Utah County Commission 2014).

ii. "Douglas fir bark beetle and fir engraver beetle are native pests with cyclic populations that can occasionally build up to epidemic levels without proper forest management. Douglas fir is the most valuable timber species in Utah County, and bark beetles can represent a significant threat to forested property values. The fir engraver beetle is more of a problem with true fir species, such as white fir and sub-alpine fir. These trees have little timber value, but large numbers of dead trees on a property reduce aesthetic value and pose a threat of wildfire" (Utah County Commission 2014).

iii. "Aspen forests provide some of the most biologically diverse habitats in the county. Aspen trees are being slowly replaced by conifer species that are more tolerant to shade and browsing. Generally, fire danger is low in these forests, but with an increase in conifers and a buildup of dead and fallen timber, the risk is increasing. In the absence of disturbance, aspen forests are declining. Events such as harvesting or burning are the best way to stimulate new aspen growth. Without proper management, the health and function of these forests can become irreversibly impaired" (Alpine and Timp-Nebo Conservation Districts 2013).

iv. "The extensive oak brush covered slopes of the Traverse Mountains and the foothills of the Wasatch Mountains is a highly fire prone vegetative type. Termed 'chaparral' in some studies, the chaparral is also the critical winter habitat for the

mule deer population and constitutes the majority of their food source when deep mountain snow force the deer to congregate in these lower elevations. Unlike the forested areas, the high shrub community has no significance for lumber or wood products. Its basic value is for watershed, browse, and scenic qualities" (Utah County Commission 2014).

d. Control andInfluence
    i. The Forest Service administers the Uinta-Wasatch-Cache National Forest. The Utah Division of Forestry, Fire and State Lands manages state lands and forests in Utah, while Utah State University contributes forestry research and the developing best practices for private landowners.
e. Economic Considerations
    i. Visitors from around the world, together with Utah locals, enjoy Utah's renowned forests that span from Canyonlands to the alpine zone. While Utah is only 29 percent forested, these forests have high scenic, recreation, wildlife, and other forest use values that make forest health very important (Utah Division of Forestry, Fire & State Lands 2014).
    ii. The market for forest products is very small in Utah, but it does exist. Forest products may be sold by board feet, by volume, or by piecemeal, depending upon the product and the buyer. A professional forester can assist the seller in choosing the correct unit of measure and in determining value of the product. The non-extractive products and benefits that come from Utah's forests, such as recreation, water quality, wildlife habitat, and aesthetics, are valuable. These contribute to the quality of life in Utah.
f. Custom and Culture
    i. "Other demands, including the use of public lands in the county, continued to draw the attention of local and national government leaders. The federal government's efforts to manage the Wasatch and Uinta National Forests in the region brought many changes, including the extension of the forest boundaries with the addition of 15,233 acres along the Wasatch Front in 1949. James L. Jacobs, Uinta National Forest supervisor, began an effort in 1950 to reduce livestock permits in the forest. In 1954 he worked to expand the efforts of the Soil Conservation Service and local municipalities to participate in pilot projects under the new Watershed Protection and Flood Prevention Act. During the same year, a public land order transferred to the Uinta National Forest from the Wasatch National Forest 142,000 acres in the American Fork Canyon area. Additionally, the Pleasant Grove Ranger District was also created, and it included the area originally known as the American Fork Ranger District. Part of the new district also came from the Wasatch National Forest, and other land along the Wasatch Front was transferred from the Spanish Fork District" (Holzapfel 1999).

ii. "Under the direction of the new forest supervisor, Clarence S. Thornock, two new forest-ranger offices were built in Utah County at Spanish Fork and Pleasant Grove. In addition, several large and complex watershed rehabilitation projects were initiated in 1957, featuring contour trenching along the steep mountain slopes east of Utah Valley. Also, additional campsites were built and several existing sites were modernized during this period of aggressive activity by the National Forest Service in Utah County" (Holzapfel 1999).

iii. "Yet management of these lands became more complex. As pressure mounted from lumber companies, ranchers, and mining companies on one side, and recreationists and environmentalists on the other, the U.S. Forest Service (USFS) found itself in a crossfire. In the late 1950s the USFS urged Congress to pass the Multiple-Use Sustained Yield Act to officially acknowledge a wide variety of uses of national forest lands. Opposition arose from all sides, each worried about the effect of the law on its particular favored access and use. Finally, when adopted in 1960, the act mandated more environmentally responsible management of the national forests" (Holzapfel 1999).

4. *Policies*

a. Encourage timber harvesting to prevent fuel load and biomass buildup.
b. Utah County encourages federal and state agencies to adopt and maintain scientifically sound forest management policies based on high quality, recently acquired data and to pursue multiple use of public forest resources to provide sustainable and continuous yield of timber, forage, firewood, wildlife, fisheries, recreation, and water.
c. The county supports prescribed burns as a fuels reduction management tool for resource enhancement when used in conjunction with forest thinning and post treatment salvage or in areas that physically cannot be mechanically thinned when such burns comply with air quality regulations.

5. *Desired Management Practices*

a. Agencies should adopt policies that promote and facilitate early detection and control of insect infestations through the use of biological and chemical agents, including salvage of dead and dying forest stands.
b. Agencies should encourage and provide for the prompt salvage and replanting of forested areas and forest losses due to fire, insect infestation, or other events.
c. Fuel reduction in forests is managed through silviculture, timber harvesting, and livestock grazing.
d. Grazing and other public land utilization should be re-implemented at previous levels after recovery from a wildfire.

IRRIGATION

1. DEFINITION

a. Irrigation is the process in which water is supplied to plants at intervals for agriculture.

2. RELATED RESOURCES

a. Land Use, Agriculture, Water Quality & Hydrology, Wilderness, Water Rights, Forest Management, Predator Control, Noxious Weeds, Canal and Ditches

3. FINDINGS

a. Overview
   i. Irrigation is the practice of supplemental application of water to land (beyond that water which is directly received by the land from naturally occurring precipitation) for the purpose of increasing the agricultural output of cropland and to sustain additional vegetation growth throughout the landscape. Much of Utah's agriculture would not be possible if not for irrigation. Utah's arid climate provides limited and frequently unreliable annual rainfalls. Many of the canals and ditches remain open, but over time many have been lined or piped to improve operational efficiency (Bio-West 2016).
   ii. Dams, canals, and pipelines are constructed to take advantage of the topography of each watershed and redistribute water from rivers and streams outward to lower elevation lands, which are more suitable for crop production (Bio-West 2016).
   iii. The science and practice of irrigation is intrinsically connected to agriculture in Utah and is dependent on the extensive networks of canals, pipes, and ditches that make the usage of water rights possible. Irrigation also plays a significant role in affecting downstream water quality and hydrology available for subsequent users, whether the user is human, animal, or vegetation (Bio-West 2016).
   iv. It is often the case that those who manage the agricultural conveyance networks are the same individuals that are the irrigation managers; however, this is not always the case. This overlap between irrigation supply managers and irrigation water users regularly creates confusion as to whether one is speaking about conveyance (water delivery via ditches and canals) or irrigation (water use). It is beneficial to understand the distinction between conveyance managers and irrigation managers. Farmers and ranchers are the water users, or the irrigators. They may also be involved with managing the diversion from which they receive

their water, or they may simply be shareholders that are more comparable to customers subscribed to a service, much like residential water users connected to a municipal water line. Irrigation or canal company officials may never actually irrigate any farmland; their jobs may simply be to manage the conveyance system's water rights, diversions, canals, gates, etc. (Bio-West 2016).

v. In 2012, Utah County had 75,167 acres of irrigated land (USDA 2012).

vi. Primary irrigation water sources for the Mountainland Association of Governments (MAG) region are the Provo, Weber, and Spanish Fork River watersheds, with storage in a number of reservoirs. Water is also provided to the region via the Central Utah Project (CUP) (Bio-West 2016).

vii. "Utah County obtains irrigation water from Mona Reservoir in Juab County and Strawberry Reservoir in Wasatch County, and both irrigation and culinary water from Deer Creek Reservoir in Wasatch County. The Jordanelle Reservoir in Wasatch County also provides municipal and industrial water to northern Utah County. Utah Lake lies within the county boundary and some local landowners obtain irrigation water from the lake, however, much of the water is used by downstream owners. There are a few smaller sized impoundments and natural bodies of water that exist within Utah County which are important for local recreational use and water storage" (Utah County Commission 2014).

viii. Springs and wells from underground water supplies are heavily used for both culinary and irrigation use in Utah County (Utah County Commission 2014).

b. Control and Influence

i. Within each watershed, various entities or individuals have legal claims (i.e., water rights) to use the water for "beneficial use," and are permitted to divert waters from streams into the storage dams, canals, and pipelines. The distribution of water is governed by state law and is based largely on geographic proximity, available supply, and ownership of the water rights (Bio-West 2016).

ii. Canal and irrigation companies are outside of the county's control, but could be influenced by private shareholders.

c. Economic Considerations

i. Without irrigation, the agriculture in Utah County would be almost nonexistent.

d. Custom and Culture

i. To sustain the influx of pioneer settlers, canals and ditches were constructed throughout Utah, making agriculture possible despite the dry climate. Subsequent development of agriculture brought further expansion of ditches and canals (Bio-West 2016).

ii. "Two separate canals, the High Line and the Mapleton, eventually brought Strawberry water to a large area in southern Utah County. The eighteen-mile-long High Line Canal, which extended southwesterly from the powerhouse, passing Salem, Payson, Spring Lake, and Santaquin and then through Goshen

Pass, furnished water to 17,000 acres of farmland near Payson, Salem, Santaquin, and Genola. The 6.8-mile-long Mapleton Canal served the Springville and Mapleton area" (Holzapfel 1999).

iii. "Survey responses regarding the importance of water resources derived from public lands and used to irrigate crops and pastures were fairly uniform across Utah... few respondents in any area of the state considered irrigation water to be not important or only slightly important. In each of the county clusters, a large majority of respondents considered water resources for irrigation to be "very important," with the percentage of respondents selecting that response ranging from 63.5% in the Davis/Salt Lake/Utah/Weber county area to approximately 92% in the Piute/Sanpete/Sevier clusters" (Krannich 2008).

4. *Policies*

a. Water is managed so that growth is not inhibited by water resources.
b. The county values irrigated agriculture as part of the local economy.
c. The county supports agricultural efficiency to conserve irrigation water.
d. The county opposes any plans or policies on public land that might limit access to sources of irrigation water rights.

Land Access

1. Definition

a. Access to public and private lands.

2. Related Resources

a. Recreation and Tourism, Land Use, Livestock and Grazing, Energy, Law Enforcement, Fire Management

3. Findings

a. Overview
   i. In Utah County, 42 percent of the land is private, 40 percent is public (BLM and USFS), 14 percent is various state land, and 3 percent is wilderness (SITLA 2016). Access to lands is undoubtedly essential to their utilization.
   ii. Common land access issues are a result of:
      - Private land surrounded by or accessed through public lands
      - Public lands surrounded or accessed through private property
      - Private lands within designated wilderness
      - Utah SITLA lands within public lands
   iii. Access to land for motorized (motorcycles, 4-wheel drive, etc.) and non-motorized (mountain bikes, hiking, climbing, etc.) recreation is a major issue in the county.
b. Broadband Internet
   i. As high speed Internet connections become an increasingly critical asset for economic development, education, healthcare, public safety, and general quality of life, the tech industry and governments must work collaboratively to prepare for the growing need. Zoning laws, right-of-ways, preferred corridors and infrastructure requirements, and coordination with public land management agencies may need to be analyzed in the future to maximize this utility. (K. Cole, Governor's Office of Economic Development, unpublished report).
c. Control and Influence
   i. County governments play a role in facilitating land access regardless of ownership. This is accomplished by acquiring and maintaining rights-of-way or easements across property. Counties also acquire and enforce access by participating in planning processes of federal and state agencies and via litigation.
d. Economic Considerations

i. Utah County residents' quality of life is tied to accessing public lands for resource utilization and recreation. Physical access via roadways, especially for motorized vehicles, is required for the development and utilization of mineral, recreational, and other resources. Of special concern are small inholdings managed by the BLM within close proximity to urban areas.

e. Custom and Culture
   i. It is the custom and culture of Utah County to support and protect private property rights, including access to public and private lands. Utah County feels strongly that state and federal landscape and amenities should be accessible by multiple modes of transportation, be utilized by multiple user groups for varying purposes, be inclusive to all persons with disabilities, and follow relevant accessibility guidelines.

4. *Policies*

a. Work with federal agencies to increase the use of existing trails.
b. Identify all county roads and public rights-of-way to protect the county's resources and promote public health and safety (i.e., search and rescue, fire protection, resource conservation, law enforcement, emergency medical services).
c. Encourage existing and proposed pedestrian and bicycle trail systems to provide access to outlying trails on public lands. Form a team with county or federal agencies in the creation of such trails.
d. The county supports the concept of motorized vehicles being used only on designated roadways or routes in order to control erosion and other resource impacts.
e. Allow consideration of new roads and trails by working with the appropriate land management agency.
f. Lawfully acquire necessary rights-of-way to facilitate public access to National Forest System lands and to meet resource management objectives.
g. The county supports public lands management by federal agencies that provides opportunities for a range of motorized recreation experiences on public lands while protecting resources and minimizing conflicts among various users.
h. Any fire, military, emergency, or law enforcement vehicle being used for emergency or administrative purposes is exempt from OHV restrictions.
i. Cooperate with the Forest Service to upgrade certain Forest Service roads in preparation to improve those roads into Class B roads.
j. Continue to improve all roads on public lands within the county system.
k. Maintain structures such as bridges and cattle guards to be structurally sound and safe for use.
l. Permits for all public land users should be preserved to ensure permit-holders access to various resources for which they hold a permit. Federal agencies should promptly renew those permits for responsible public land users.

Law Enforcement

1. Definition

a. The designated personnel group who has federal, state, or local authority within a jurisdiction to enforce the law or respond to an emergency.

2. Related Resources

a. Recreation and Tourism, Land Use, Land Access, Fire Management, Water Rights

3. Findings

a. Overview
    i. Law enforcement in Utah County includes many jurisdictions.
    ii. Key law enforcement issues related to natural resources management and public lands are coordination among jurisdictions of various law enforcement personnel and funding issues such as funding for search and rescue operations.
    iii. An example of law enforcement coordination involving public lands is livestock theft. The Livestock Inspection Bureau at the Utah Department of Agriculture and Food deals with cases of livestock theft, in close coordination with county sheriff's offices. Cases of livestock theft are eventually prosecuted through the county attorney. Additionally, in situations of disease outbreak, the Livestock Inspection Bureau works with sheriff's offices to help enforce livestock quarantines (UDAF 2017).
    iv. State law enforcement includes:
        - Utah Highway Patrol
        - Utah Division of Wildlife Resources Conservation Officers
        - Utah Department of Agriculture and Food, Livestock Inspection Bureau
        - State Park Rangers
    v. In 2013, the Utah Association of Counties reported that there were 1,002 law enforcement employees for Utah County. There were 12,661 adult arrests and 0.62 violent crimes per 1,000 people in 2013 (Utah Association of Counties 2015).
b. Control andInfluence
    i. An appropriate level of service for law enforcement is essential for all levels of government to protect the health, safety, and welfare of the county, which will in turn positively impact the local industry. Benefits are direct and indirect.
c. Economic Considerations
    i. Annual operating costs for local law enforcement (county sheriff's departments) are influenced by public lands law enforcement activities, including coordination

activities with state and federal law enforcement agencies. Costs associated with search and rescue operations are increasing in many areas of the state, particularly with increased recreational use of remote lands. Utah counties have the option to charge people who are rescued and/or can receive reimbursement through the state's Search and Rescue Financial Assistance Program.

ii. The Utah Search and Rescue Assistance Card (USARA Card) offers expense-paid rescue to individuals (hunters, hikers, other backcountry enthusiasts) for an annual fee. Money raised by the program will support the State's Search and Rescue Financial Assistance Program. County Search and Rescue teams will receive reimbursement for equipment, training, and rentals from the program. Such expenses are often borne by the counties.

d. Custom and Culture
    i. Law enforcement has always been important to citizens in Utah County for the safety, protection, and security it provides.
    ii. A History of Utah County (1999) recounts when alcohol was being sold illegally in the 1920s, "Local police, aided for the first time by federal agents, made five raids in Lehi and Provo in one day in 1925. Arrests continued throughout the county." Before and after Prohibition era, residents supported law and order in the county, including those who enforced it.

4. *Policies*

a. The sheriff's office works cooperatively with state and federal law enforcement to protect the rights of people on public lands.
b. Federal and state law enforcement that needs to take place in the county should be coordinated through the county sheriff's office.
c. The sheriff of Utah County is the top law enforcement official in the county.

Livestock and Grazing

1. Definition

a. Livestock include domestic animals, such as goats, sheep, cattle, or horses, raised for private use or for profit. Grazing is to feed on grass, browse, and other forage.

2. Related Resources

a. Land use, Land Access, Agriculture, Water Quality & Hydrology, Wilderness, Water Rights, Forest Management, Predator Control, Noxious Weeds, Wildlife, Fisheries, Threatened, Endangered, & Sensitive Species, Economic Considerations

3. Findings

a. Overview
   i. According to the Utah Annual Statistical Bulletin (2016), livestock estimates for Utah County in 2016 were 61,000 cattle and calves, with 15,900 beef cows and 16,300 milk cows, and 13,300 sheep and lambs.
   ii. There are 31 BLM, 2 SITLA, and 43 USFS grazing allotments within Utah County (USDA and ARGC 2009). A significant amount of livestock grazing occurs on land administered by these agencies. Grazing also occurs on private lands.
   iii. "The decline in the sheep industry in Utah, which has been dramatic in Iron, Sanpete, and Utah counties, reflects the decline in demand for wool, consumer preference for lamb, more restrictive predator control policies, and difficulties in obtaining labor. In addition, most sheep are no longer trailed to and from seasonal ranges and the cost of trucking has likely played a role in the decline of the sheep industry by increasing production costs. The steady decline in sheep numbers has also resulted in many federal grazing permits being transferred from sheep to cattle. Although actual numbers of sheep and lamb losses to predators have declined from about 53,000 animals in 1987 to 29,300 in 2007, the apparent decline in predation losses is confounded by the declining number of sheep. The percentage of losses has remained 10 to 12 percent over the past 20 years. Approximately 80 percent of the annual loss is from loss of lambs, the primary sale product, with the remainder of the loss occurring in breeding herds. The decline in the sheep industry and other factors, such as fire control policies of the past 100 years, are thought by some to have contributed to the gradual increase in woody plant domination on Utah rangelands" (Utah State University 2009).
   iv. "It is apparent that some ranchers in counties, such as Utah, Sanpete, Summit, Carbon, Uintah, and Iron, as well as Box Elder (traditionally centers for sheep

production), switched to or reallocated their resources to include cattle production" (Utah State University 2009).

v. The following are general land use observations as described in the NRCS Utah County Resource Assessment (2005):

1. Grass / Pasture / Hay Lands
    a. Complications related to overgrazing include poor pasture condition, soil compaction and water quality issues.
    b. Control of noxious and invasive plants is an ever increasing problem.
    c. The small, part-time farms are less likely to adopt conservation due to cost and low farm income.
2. Rangeland
    a. Improper livestock grazing, drought, and other practices have caused a decline in the diversity of rangeland cover and vegetation.
    b. Continued increase and spread of sagebrush and other woody species has decreased the usefulness of some areas as grazing land.
    c. Brush and pest management will be necessary in many areas to control.

b. Control and Influence

i. The BLM also administers grazing allotments and public-lands grazing in Utah County. The western portion of Utah County is managed under the 1988 Proposed Pony Express Resource Management Plan and Final Environmental Impact Statement while allotments in eastern Utah County are guided by the 2008 Price Resource Management Plan.

ii. In large part, Utah County private property owners and farm operators control this resource where occurring on private property. Where grazing takes place on federal lands, federal land managers are responsible for the regulations and restrictions.

c. Economic Considerations

i. Animal agriculture in Utah represents the single largest sector of farm income in Utah. At a value of more than $1 billion, 25 of the state's 29 counties report livestock as the dominant agricultural sector (Utah Department of Agriculture and Food n.d.).

ii. The Livestock Grazing in Utah: History and Status (2008) report states, "Rangelands in Utah are primarily administered by the Bureau of Land Management (BLM) and Forest Service (FS). Data from the BLM indicate that use by domestic livestock has declined more than two-thirds over time. Most of this decline has been associated with the reduction of the sheep industry. Similar

data for the FS indicate that declines in the use of FS lands have not been as dramatic as on BLM lands, but usage of FS lands today is about half what it was 60 years ago" (Godfrey 2008).

iii. Economic trends are described in Rangeland Resources of Utah (USU 2009): "Utah agriculture is dominated by production of livestock, livestock products, and the production of feed crops utilized in the livestock industry. In nominal terms, agricultural receipts in Utah have increased from $588 million in 1984 to $1.3 billion in 2007, a 128 percent increase, while Utah livestock and livestock product receipts have also more than doubled in the same period. The implication is that livestock and livestock receipts have fairly consistently contributed from 71 to 78 percent of all agricultural product receipts over the last 24 years. Beef cattle, dairy cattle, swine, and sheep, in decreasing order, contribute the majority of Utah livestock receipts. In terms of receipts from live animal sales, the cattle and sheep industries' contributions vary from 68 to 79 percent, while the swine industry contributions vary from 20 to 30 percent."

iv. The ability to graze livestock on the forage available is important to operators in the county.

v. The USFS and BLM grazing fee for 2015 was $1.69 per head month (HM) or AUM (USFS 2015).

d. Custom and Culture

i. "Utah County, Utah Lake, and Utah Valley were named after the Native Americans (Utes) who lived in the area. Walker Flat, on the west side of Peteetneet Creek, was named after Chief Wakara. Wanrhodes Canyon was named after an Indian who raised cattle in the area" (Holzapfel 1999).

ii. In the first half of the 20th century, "the county livestock industry contributed to range overgrazing and erosion problems, however, which ultimately resulted in major flooding in the county in 1930 and 1952. Cooperation between ranching interests and the federal government eventually brought about several erosion-control projects and increased supervision of the public lands by the federal Government" (Holzapfel 1999).

4. *Objectives*

a. All grazing management plans on public lands acknowledge and consider the cultural, ecological, environmental, and economic importance of the livestock industry to the county.

5. *Policies*

a. Encourage rangeland health, forage, and grazing stability on public lands. Promote the use of good science to establish data used in rangeland decision making.

b. The county values livestock grazing on public lands as part of the local ranching heritage and culture.
c. When livestock management practices on public lands are determined to not be compatible with meeting or making progress towards achievable habitat objectives following appropriate consultation, cooperation, and coordination with local stakeholders, support implementing changes in grazing management through grazing authorization modifications, or allotment management plan implementation. Potential modifications include, but are not limited to, changes in (not in priority order):
    i. Habitat objectives;
    ii. Season or timing of use;
    iii. Numbers of livestock;
    iv. Distribution of livestock use;
    v. Duration and/or level of use;
    vi. Kind of livestock (e.g., cattle, sheep, horses, or goats); and
    vii. Grazing schedules (including rest or deferment).
d. The county supports the ranching industry.

6. *Desired Management Practices*

a. Livestock grazing on public land should be managed and regulated by county, state, and federal agencies so as to maintain and enhance desired plant communities for the benefit of watershed, wildlife, water quality, recreation, and livestock grazing as required by the applicable land use plans. Such management should be developed specifically and individually for each public land grazing allotment in order to achieve the desired result throughout the county.
b. Encourage livestock use on public lands to be compatible with recreation use. Locate structural and design non-structural improvements to meet visual quality objectives.
c. Support the protection of regeneration from unacceptable livestock damage. Proper livestock management methods will be included in allotment management plans and annual operating plans to protect regeneration. Permittees should be held responsible for damages resulting from negligence.
d. Private property, including infrastructure, machinery, and livestock, on federal public lands should be protected from other users who may damage the private property of those who have permits or rights to utilize the land or resource.

Mineral Resources

1. *Definition*

a. Natural resources in the form of minerals (solid inorganic substances).

2. *Related Resources*

a. Water Rights, Land Use, Air Quality, Water Quality and Hydrology, Energy, Mining, Cultural, Historical, Geological, and Paleontological, Land Access, Economic Considerations

3. *Findings*

a. Overview
    i. Mineral resources are deposits or occurrences of inorganic materials with intrinsic economic value (such as ore, aggregate, oil, and gas) that may be extracted from the Earth's crust. Mineral resources are regulated and managed based on type, and are grouped into three categories: locatable, leasable, and saleable.
    ii. "Utah County has important mineral deposits of metals concentrated primarily in three sections of the county: American Fork Canyon, the East Tintic Mountains, and, to a lesser degree, at the head of Spanish Fork Canyon. Gold, silver, copper, zinc, lead, and a number of other minerals have been exploited by miners beginning in the nineteenth century" (Holzapfel 1999).
    iii. "Kennecott Exploration Company (KEC), through a joint venture with Chief Consolidated Mining Company, acquired a porphyry copper lithocap target near Big Hill in the center of the East Tintic district of Utah County" (Boden 2014).
    iv. The most common soil types in the county are Mollisols, Aridisols, and Entisols. Mollisols make up most of the east side of the county. Aridisols and Entisols are largely found west of Utah Lake (Utah State University 2009).
        1. Mollisols
            a. "Mollisols are characterized by a thick, dark, relatively fertile surface soil. They typically form under grassland vegetation, in semiarid to sub-humid shrub steppe, or in forested zones under aspen and where grasses and forbs are important components of the understory. Mollisols are rich in humus (dead and decayed plant matter contributed mainly by the fine root turnover by grasses, forbs, and shrubs) . . . They primarily occur on lake terraces, alluvial fans, foothills, mountains, high plateaus, and valley bottoms. Mollisols are among some of the most important

and productive agricultural soils. At higher elevations in Utah, they support rangeland, wildlife habitat, recreation, and timber, while at lower elevations, they support irrigated and non-irrigated cropland, rangeland, and wildlife habitat" (Utah State University 2009).

2. Aridisols
    a. "Aridisols occur where annual precipitation is less than 12 inches and the soil has experienced some development, such as subsoil accumulations of carbonates, clays, silica, salts, or gypsum. Long and dry summers contribute to the formation of this soil order. Aridisols have a light color because the arid climate typically limits plant biomass production and the accumulation of organic matter. They are moderately to very strongly alkaline, and they often have significant accumulations of calcium carbonate in the subsoil. Aridisols support drought resistant vegetation. Sagebrush species, saltbush species, and greasewood are the dominant vegetation types, but their presence and distribution are highly dependent on the soil depth, texture, salinity, and alkalinity" (Utah State University 2009).
3. Entisols
    a. "Entisols are soils of recent origin that do not have discernible horizons with the exception of some darkening of the surface. They occur on younger alluvial terraces and fans, along some valley bottoms, and on stream floodplains. Entisols also occur as shallow soils on bedrock uplands in arid regions. The color of Entisols varies from light to dark, depending on the parent material. Entisols are common in the Great Basin, Colorado Plateau, and Uinta Basin, and can occupy small areas on recent floodplains in any region" (Utah State University 2009).

v. Locatable Minerals
1. This category includes high-value minerals such as gold, silver, and copper (metallics and non-metallics) that are subject to the Mining Law of 1872 as amended by 30 USC 2. Under the Mining Law, mining claims can be filed for these minerals. The category also includes certain industrial minerals such as gypsum, chemical grade limestone, and chemical grade silica sand. Uncommon varieties of mineral materials such as pozzolan, pumice, decorative rock, and cinders may also be regulated as locatable minerals if demonstrated to have unique market value (Bio-West 2016).

vi. Leasable Minerals

1. This category includes gas, oil, oil shale, coal, oil sands, phosphate, and geothermal resources, and are subject to the Mineral Leasing Act of 1920, as amended and supplemented (30 USC 181, et. seq.), the Mineral Leasing Act for Acquired Lands as amended (30 USC 351-359), and the Geothermal Steam Act of 1970 (30 USC 1001-1025). Examples of leasable minerals include coal bed methane, oil and gas, tar sands, potash, and geothermal resources (Bio-West 2016).

vii. Saleable Minerals

1. This category includes more common mineral resources including sand, stone, gravel, pumice, clay, and petrified wood. Regulation of these minerals on public lands is authorized by 30 USC 601. State and private lands are regulated by state, county, and local jurisdiction and land use codes. Some saleable minerals are sand and gravel, clay, and stone. Current mining in the Mountainland Association of Government region is focused primarily on saleable minerals, especially sand, aggregate, clay, and stone production (Bio-West 2016).

b. Control and Influence

i. Mineral surveying and extraction on public land is regulated by the BLM and Forest Service.

c. Economic Considerations

i. Inconclusive

d. Custom and Culture

i. When residents of Weber, Davis, Salt Lake, and Utah counties were surveyed on whether public land managers should reduce or increase the extent to which mineral exploration and extraction activities occur on Utah's public lands, 34.1 percent of survey respondents stated that levels should "stay about the same" (Krannich 2008).

ii. It is apparent that the extraction and utilization of minerals has been practiced since pioneer settlement in the mid 1800s. "Some of the earliest mining in the county started in American Fork Canyon in 1868. In 1870 the area was organized into a mining district. The canyon boomed with the discovery of silver, lead, and some gold in the area of Mineral Basin and the establishment of the Miller Mine that same year. One year later, the Miller brothers sold this mine for $190,000 to General Lloyd Aspinwall and others, who built a narrow-gauge railroad from the town of Lehi to Tibble Fork in American Fork Canyon; it operated from 1872 to 1878" (Holzapfel 1999).

4. *Policies*

a. Encourage extractive industries to be in compliance with federal, state, and county laws and regulations, while protecting multiple-use concepts and rights to access on public lands.
b. Encourage managing agencies to ensure that all mineral development activities on public lands within the county are bonded to cover 100 percent of the reclamation costs.
c. Avoid or minimize significant and conflicting public or private investments near sites on public lands where mineral activities may occur within the foreseeable future.
d. It is the policy of Utah County to encourage responsible stewardship of the environment in conjunction with mineral exploration and development. The county supports mineral exploration and development on public lands that is:
    i. Conducted subject to permits issued by jurisdictional agencies;
    ii. Consistent with county ordinances;
    iii. Consistent with local history, customs, traditions, and culture;
    iv. Free from legally or scientifically invalid and unreasonable barriers;
    v. Considers resource potential data that is available from industry, Utah Geologic Survey, Department of the Interior, and Department of Agriculture; and
    vi. Consistent with sound economic and environmental practices.

5. *Desired Management Practices*

a. Lands shown to have reasonable mineral potential on public lands in the county should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
b. Allow mineral leasing on public lands where it has been determined that stipulated methods of mining will not affect the watershed values to any significant degree.

MINING

1. DEFINITION

a. The process or industry of obtaining or transporting minerals or aggregate from a mine or other extractive process.

2. RELATED RESOURCES

a. Water Rights, Land Use, Air Quality, Water Quality and Hydrology, Energy, Mining, Cultural, Historical, Geological, and Paleontological, Land Access, Economic Considerations

3. FINDINGS

a. Overview
    i. There is some mining in Utah County, most of which occurs near mountains.
b. Control and Influence
    i. The State of Utah has primacy on regulation and reclamation of mining activities on all lands within the state, and the Utah Legislature assigned responsibility for administration of mining to the Utah Division of Oil, Gas and Mining (DOGM).
c. Economic Considerations
    i. In 2015, mining contributed just over $3 billion directly to the gross domestic product (GDP) of Utah, making up about 2.3 percent of the state's total GDP (National Mining Association 2016).
    ii. Based on the number of permits issued by the DOGM, Utah County has 94 mineral mines (DOGM 2017).
d. Custom and Culture
    i. "Some of the earliest mining in the county started in American Fork Canyon in 1868. In 1870 the area was organized into a mining district. The canyon boomed with the discovery of silver, lead, and some gold in the area of Mineral Basin and the establishment of the Miller Mine that same year. One year later, the Miller brothers sold this mine for $190,000 to General Lloyd Aspinwall and others, who built a narrow-gauge railroad from the town of Lehi to Tibble Fork in American Fork Canyon; it operated from 1872 to 1878" (Holzapfel 1999).
    ii. Built in 1920 near Goshen, the Tintic Standard Reduction Mill operated for only 4 years. It processed copper, gold, silver, and lead. At its highest productivity, the mill processed 200 tons of ore annually (Holzapfel 1999). In 1978, the mine was listed on the National Register of Historic Places (National Parks Service 2016).
    iii. "Between 1892 and 1893, miners from the Duke-Onyx Company in Chicago mined Hansen's Cave, stripping it of some of the beautiful formations. Some of

the onyx there was reportedly used in the Salt Lake LDS Temple. Eventually, the federal government stepped in and prevented the further exploitation of the caves in that section of American Fork Canyon when it created Timpanogos Cave National Monument in 1922, invalidating all mining claims in the area" (Holzapfel 1999).

iv. Mining has a rich history in the region. During the late 1800s and early 1900s, the region produced precious metals, coal, and other hydrocarbons. Mineral resources were quickly exploited, and the region suffered from economic hardship for several decades afterwards. In modern times, mining is limited to aggregates, clay, and other stone products.

4. *Objectives*

a. All decision-making regarding where mineral extraction on public lands is permitted within the county involves active participation from the county.

5. *Policies*

a. The county values mining on public lands as part of the local custom and culture.
b. The county encourages responsible mineral extraction on public lands.

Noxious Weeds

1. Definition

a. Plants considered harmful to animals or the environment, typically (but not always) non-native species which spread at the expense of native vegetation, also called invasive plants.

2. Related Resources

a. Forest Management, Fire Management, Agriculture, Livestock & Grazing, Riparian Areas, Energy Resources, Mining, Recreation & Tourism, Economic Considerations

3. Findings

a. Overview

i. There are many species of exotic and invasive weeds in the Utah. Some species, however, have more potential to be "injurious to public health, crops, livestock, land, or other property." The Utah Noxious Weed Act of 2008 defined 28 noxious weed species in three prioritization categories. In 2015, the official State Noxious Weed List was updated to include 54 species and prioritization categories were modified.

ii. The Utah County Resource Assessment, completed by the NRCS in 2005, stated that "Control of noxious and invasive plants is an ever increasing problem" for grass/pasture/haylands and forests.

iii. "An increasing threat to rangeland biodiversity and health is the invasion by non-native plant species. Some of the most prevalent and problematic invasive plants include diffuse knapweed (*Centaurea diffusa*), spotted knapweed (*Centaurea maculosa*), yellow starthistle (*Centaurea solstitialis*), leafy spurge (*Euphorbia esula*), and cheatgrass (*Bromus tectorum*). The vast majority of invasive plants have been introduced from other continents. Cheatgrass, the most widespread and dominant invasive plant in the Intermountain West, was introduced during the mid- to late-1800s by means of imported grain from Eurasia. The first records of cheatgrass in the Great Basin came from Provo, Utah, in 1894; Elko, Nevada, in 1905; and Reno, Nevada, in 1906" (USU 2009).

iv. "Invasive plants can have a significant impact on an array of ecological facets. Invasive plants have reduced species richness, plant diversity, and community productivity. Wildlife habitat and forage have been degraded; soil erosion and stream sedimentation have increased; soil moisture and nutrient levels have been depleted; and fire regimes have been altered. As cheatgrass has become a common component of sagebrush steppe vegetation communities, the

nutritional quality of forage has been reduced, the intensity and frequency of fires have changed, and water cycles have been altered. Although many factors are involved, several native animals, such as sage grouse, may have declined as a result of these changes" (USU 2009).

v. According to the Noxious Weeds Field Guide of Utah, "Noxious weeds are currently spreading at a rate of more than 4,600 acres per day on federal lands in the United States" (USU 2009).

vi. As described in the Noxious Weeds Field Guide of Utah, "Prevention, preserving and protecting lands not presently infested, is the first line of defense against aggressive noxious weeds. Prevention requires awareness and action by land managers as well as the general public, to recognize, report, and control new infestations before they have a chance to expand and spread" (USU 2009).

vii. "Attempts to manage and eradicate invasive plant species have been made utilizing various control methods. Historically, mechanical and chemical control techniques were the predominant invasive plant management methods; however, biological and cultural control techniques have been implemented and integrated with other practices. Mechanical control techniques include hand-pulling, hoeing, mowing, tilling, chaining, and bulldozing. Hand-pulling and hoeing are effective in controlling small infestations of shallow-rooted weeds in loose, moist soils. Mowing is commonly used to control invasive range annuals and some perennials; however, the success of mowing is highly dependent on timing. Annuals and some perennials can be suppressed and controlled if mowing occurs before viable seeds form. If not properly timed, mowing can promote the spread of invasive plants by encouraging the spread of seeds and stimulating the production of new stems from vegetative buds. Tilling practices can control annual species, but they rarely provide control of perennial species… More expensive mechanical control techniques, such as chaining and bulldozing, are effective in controlling invasive shrub and tree species. Although these methods require gentler terrain and are becoming increasingly expensive, they are effective in controlling shrubs and trees that do not readily resprout from root systems" (USU 2009).

viii. "The implementation of one control method is rarely effective in achieving the desired results for curtailing the spread of invasive plants. Successful long-term and cost effective management programs should integrate a variety of mechanical, chemical, biological, and cultural control techniques. Integrated management involves the deliberate selection, combination, and implementation of effective invasive plant management strategies with due consideration of economic, ecological, and sociological consequences… Presently, there are several examples of integrated strategies used to manage invasive plants and improve rangeland communities. Much attention has been

focused on the integration of targeted or prescription grazing with other control methods, as the incorporation of grazing management is an essential component in successfully addressing invasive plant problems" (USU 2009).

b. Control and Influence
    i. Cooperative weed management areas (CWMAs) can be an effective resource in the prevention, detection, and suppression of noxious and invasive weeds. Coordinated mechanical, chemical, and biological control over large areas by multiple stakeholders has proven successful for a variety of weed species. These areas replace jurisdictional boundaries in favor of natural boundaries that facilitate cooperation, coordination, and implementation of effective integrated weed management programs for listed noxious weeds (Utah Weed Control Association 2017). The Utah County CWMA provides these services for stakeholders in the area.
    ii. The Utah Noxious Weed Act (Title 4, Chapter 17, Rule R68-09) provides for the control and management of noxious weeds in Utah. Private property owners, municipalities, and state agencies are all subject to the provisions of the Utah Noxious Weed Act. Federal agencies are subject to the provisions of the Federal Noxious Weed Act of 1974 (P.L. 93-629) as amended in 1990 (Section 15, Management of Undesirable Plants on Federal Lands). Under the 1990 amendment to the Federal Noxious Weed Act, federal agencies are directed to enter into agreements with appropriate state and local agencies to coordinate the management of noxious weeds.
    iii. State land managers, local governments, and property owners are responsible for controlling weed species found on the state's noxious weeds list, and local weed species of concern, if necessary. Weed control responsibilities extend to lands under local management (roads, rights-of-way, parks, etc.), as well as enforcing provisions of the Utah Noxious Weed Act on private lands. If landowners are unwilling or unable to address weed problems on their own land, state law provides county weed managers the right to treat weeds on private lands (assuming proper notice is provided) and subsequently seek reimbursement or apply liens for the work. Utah County's weed control division is responsible for enforcing the Utah state weed laws.
    iv. The USDA is a primary leader involved in preventing the introduction of invasive species, largely through the Animal and Plant Health Inspection Service (APHIS). The Natural Resource Conservation Service (NRCS) also contributes to preventative measures and education on plants that may pose a risk to cropland, rangeland, or wildlands.

c. Economic Considerations
    i. According to the Noxious Weeds Field Guide of Utah, "Devastation caused by noxious weeds is enormous. Economic losses from weeds exceed $20 billion

annually in the United States, and the cost continues to grow. Weeds often reduce crop yields, and can damage watersheds, increase soil erosion, negatively impact wildland plant and animal communities, and adversely affect outdoor recreation. Ecological damage from uncontrolled noxious weed infestations can be permanent, leaving lands unable to return naturally to their pre-invasion condition" (Bellison 2009).

ii. "The invasion of non-native plant species not only produces various ecological modifications, but also results in substantial socioeconomic impacts, particularly to the livestock industry and land management agencies responsible for fire suppression. Invasive plant species cause more economic loss on rangeland than all other pests combined. Invasive plants reduce the carrying capacity for livestock by lowering the forage yield. Consequently, the costs of managing and producing livestock increase" (USU 2009).

iii. "The importance of herbicides in modern weed management is underscored by estimates that losses in the agricultural sector would increase about 500% from $4.1 billion to $20 billion per year without the use of herbicides" (Whitesides 2004).

iv. Other cost considerations involve restoration projects, such as the ongoing removal of phragmites along the shores of Utah Lake. This multi-year project cost at least $215,000 and involved significant manpower. In this light, proper management, including preventative measures to control weeds, could be more efficient over the long term (Utah Lake Commission 2009).

d. Custom and Culture

i. The introduction and early causes of noxious weeds was described in A History of Utah County (Holzapfel 1999): "The inroads of settlement of the last 150 years displaced many indigenous plants through agriculture and the building of roads, cities, and towns. Crop and row agriculture also impacted the native fauna. The indigenous vegetation was eliminated from large areas in the county and replaced by cultivated plants and numerous noxious weeds. The introduction of livestock—cattle, sheep, and horses—led to the overgrazing and eventual loss of native grasses and to the increase of sagebrush and other desert shrub invaders. Farming and the introduction of domestic livestock fostered the growth of less desirable weedy plants such as cheatgrass (in Provo by 1894) from the steppes of central Eurasia and Russian thistle (tumbleweed, which quickly spread throughout the West after 1873). In the urban and cultivated segments of the county, the native vegetation has largely been destroyed or replaced; however, some areas in the region still contain the native vegetation."

ii. Because ranching and farming is a custom and part of the culture of the county, it is important to maintain ecological integrity in order to support and protect agricultural industries (Whitesides 2004).

4. *Policies*

a. Control noxious weeds and poisonous plants on public lands in cooperation with forest users and state and local agencies.
b. Encourage pack stock and riding stock users on public lands to use certified weed-free feed.
c. The county supports efforts to secure the agricultural commodities and aesthetic beauty of the county against weed infestations on public lands.

5. *Desired Management Practices*

a. Federal agencies protect public lands bordering private lands from predatory animals, rodents, noxious weeds, and vectors.
b. Treat areas that contain cheatgrass and other invasive or noxious species on public lands to minimize competition and favor establishment of desired species.

Predator Control

1. Definition

a. The strategies and practices to control the actions of or reduce the number of predator animals.

2. Related Resources

a. Agriculture, Livestock and Grazing, Threatened, Endangered, and Sensitive Species, Wildlife, Land Use

3. Findings

a. Overview
    i. Predators in Utah include raptors, mountain lions, bears, wolves, coyotes, foxes, weasels, and snakes.
    ii. The USDA established a program in 1895 called Wildlife Services (WS) to assist land managers in predator control activities for the protection of livestock. "Currently, WS operational activities include conducting rabies control and eradication efforts, managing invasive species, completing wildlife disease surveillance, reducing the impact of predation on livestock, preventing wildlife strikes at airports, protecting transportation infrastructure, and protecting threatened/endangered species, rare habitats, and ecosystems" (APHIS 2009).
    iii. One primary focus of predator control in Utah is protecting livestock from coyotes, black bear, and mountain lion, and mule deer from coyotes.
    iv. The Utah Division of Wildlife Resources (UDWR) predator-control program provides incentives for hunters to remove coyotes. The primary goal of the program is to remove coyotes from areas where they may prey on mule deer. Participants receive $50 for each properly documented coyote that they kill in Utah (UDWR 2014).
    v. In Utah County, the Wasatch Mountains and associated canyons are inside of the recommended coyote removal zone (UDWR n.d.).
b. Control and Influence
    i. The UDWR is primarily responsible for predator control strategies and enforcement. Most of UDWR's revenue is generated from the sale of hunting and fishing licenses and permits. These funds are restricted for use by the UDWR only. All license dollars collected stay with the UDWR to execute the division's mission to protect and conserve wildlife and habitat in Utah.
c. Economic Considerations

i. Losses due to predation can be significant. In 2014 in Utah, 5,200 sheep and 12,100 lambs were killed by predators, for a total value loss of nearly $3 million (U.S. Department of Agriculture 2015).
    1. Coyotes were by far the largest contributor to predation deaths (2,800 sheep deaths and 8,500 lambs deaths); bears were second (1,100 sheep deaths and 1,700 lambs deaths); and mountain lions third (700 sheep deaths and 900 lambs deaths).
ii. Utah cattle are also killed by predators, though not in as many numbers. In 2010 in Utah, 300 head of cattle and 2,300 calves were killed by predators for a total value loss of $1.1 million (U.S. Department of Agriculture 2011).
    1. Coyotes are responsible for the majority of cattle predation, including 58 percent of calf losses and 44 percent of cows.
    2. Bears were responsible for 43 percent of the cow losses.

d. Custom and Culture
    i. "The mountains in Utah County act as a wildlife shelter. Big-game animals in the region—elk, mountain sheep, mule deer, antelope, and bear—were hunted by Native Americans for meat and fur" (Holzapfel 1999).

4. *Objectives*

a. Predators on public lands are managed to be balanced with native plants and animals, along with private property rights and economic needs in the county.

5. *Policies*

a. The county supports Utah Division of Wildlife Resources and supports finding local solutions to predator concerns on public lands.

6. *Desired Management Practices*

a. Improve wildlife management to protect agricultural profitability and minimize depredation on public lands.

Recreation and Tourism

1. Definition

a. Recreation is an activity done for enjoyment. Tourism is the social, cultural, and economic phenomenon of visiting places for pleasure.

2. Related Resources

a. Land access, Land Use, Cultural Historical Geological Paleontological, Wilderness

3. Findings

a. Overview
    i. "Utah County, Utah's second most populated county with over half a million residents, had a 10% leisure and hospitality share of total private jobs in 2015, ranking 26th statewide. Utah County . . . is home to parks, museums, restaurants, a convention center (Utah Valley Convention Center), specialty retailers, special events, family-friendly amusement centers, including Seven Peaks, Classic Fun Center and Provo Beach, and colleges, such as Brigham Young University. Utah County is also home to Sundance, a four season resort owned by Robert Redford that offers skiing, mountain biking, theater, lodging, and fine dining. Timpanogos Cave National Monument, located in Utah County's American Fork Canyon, offers guided tours of its three-cave system every hour throughout the day. Other outdoor recreation attractions in Utah County are fishing on the Provo River, boating on Utah Lake, and strolling through the Thanksgiving Point Gardens" (Kem C. Gardner Policy Institute 2016).
    ii. "The tourists that are drawn to these mountains for their beauty and recreation aspects bring important out-of-county dollars into the county's economy annually" (Utah County Commission 2014).
b. Control and Influence
    i. The following agencies all contribute to recreation and tourism policy and management in Utah: Utah Office of Tourism, Utah Office of Outdoor Recreation, Utah Division of State Parks and Recreation, Utah Division of Wildlife Resources, State of Utah School and Institutional Trust Lands Administration, U.S. Bureau of Land Management, U.S. Forest Service.
    ii. The county can influence recreation by providing adequate recreation infrastructure (showers, campsites, trails, etc) and advertising recreation resources. The county cannot control consumers nor influence competing destinations.
c. Economic Considerations

i. Recreation and tourism is a significant economic consideration for counties in Utah. In 2015, visitors from within the United States and abroad made more than 7.5 million visits to Utah's BLM-managed federal lands, supported 4,447 Utah jobs, and contributed $460 million in economic activity to the state. A comparison of the first 8 months of 2013 to those same months in 2014 shows that travel exports increased by nearly 6 percent. This increase was 84 percent faster than other U.S. export growth. In 2013, the tourism industry was Utah's second largest export, with nonresident spending at $6.4 billion (Bureau of Land Management 2016).

ii. In 2015, the county saw $11,610,938 in travel related sales tax revenue, a 13.7 percent increase over 2014. Leisure and hospitality jobs were estimated at 17,969. Timpanogos Cave alone saw 104,023 visitors in 2015, an 8.7 percent increase over 2014 (Kem C. Gardner Policy Institute 2016).

d. Custom and Culture

i. "One of the largest areas of growth in Utah County during the 1980s and 1990s was in the travel and tourism sector. Throughout the state of Utah, tourism in 1994 was a $3.35 billion business, outstripping agriculture and mining combined" (Holzapfel 1999).

ii. "Another recreational activity also had its start in Provo Canyon when Raymond R. Stewart began a small ski resort named Timp Haven in the winter of 1944-45. This first attempt largely failed, but things went better during the next ski season. Expansion continued when two old cabins were brought in—one housed the rope-tow equipment and the other was used for a lunch stand" (Holzapfel 1999).

4. *Objectives*

a. The health and quality of wildlife, land, air, and water are the foundations of a sound recreational infrastructure.

5. *Policies*

a. Outdoor recreation takes many forms on public land. Opportunities and appropriate places should be provided for the full spectrum of recreational activities, interests, and abilities, including those that involve little or no cost to enjoy. Utah County supports responsible access to our recreational amenities.

b. Participate as an active partner with public land management agencies to ensure that public land recreational resources are managed in ways that contribute to the protection of resources, the overall quality of life, and the recreational experience of county residents and visitors.

c. Responsible recreation on public lands is promoted and encouraged via effective education and enforcement.

d. Work with the public lands agencies to develop mountain biking opportunities on public lands in the county.
e. Work closely with the public lands agencies to develop off road trails on public lands for ATV use.

6. *Desired Management Practices*

a. Develop appropriate facilities on public lands where the present facilities are not meeting the demand and where it meets the highest net public benefit.

Riparian Areas

1. Definition

a. Riparian areas are zones where terrestrial and aquatic ecosystems directly interact with each other. They occur around numerous types of waterbodies including rivers, lakes, and springs, and are dominated by hydrophilic vegetation.

2. Related Resources

a. Livestock & Grazing, Wild & Scenic Rivers, Canals & Ditches, Irrigation, Agriculture, Water Rights, Water Quality & Hydrology, Wetlands, Floodplains & River Terraces, Wildlife, Noxious Weeds, Fisheries, Recreation & Tourism, Fire Management, Land Use

3. Findings

a. Overview
    i. Riparian zones are important in ecology, environmental management, and civil engineering because of their role in soil conservation, their habitat biodiversity, and the influence they have on fauna and aquatic ecosystems, including grasslands, woodlands, wetlands, or even non-vegetative areas.
    ii. According to the Utah Wildlife Action Plan (2015), "riparian areas are the richest habitat type in terms of species diversity and wildlife abundance." These areas provide habitat to a range of wildlife including amphibians, birds, mammals, fish, and insects. Riparian areas also play a significant role in the erosion processes by slowing water, trapping sediment, and stabilizing banks. Finally, riparian areas provide quality forage for livestock and are valued within grazing allotments (Bio-West 2016).
    iii. Riparian areas should be managed to protect vegetation characteristics. Conservation efforts include preserving existing riparian areas as well as restoring damaged ones. Preservation should also include the dedication of sufficient water and groundwater to support vegetation. Limiting the removal of water from the system is essential in maintaining the integrity of the riparian area. Restoration efforts must consider factors like hydrology, floodplain, and adjacent land use. Restoration design of riparian areas should follow a protocol that accounts for stream hydrology, soil characteristics, vegetation, adjacent land use, recreation, and other influences. Stream or river modifications may require permits.
    iv. The health of riparian areas is influenced by many factors including hydrology, topography, climate, invasive species, and land use. Because riparian areas are

highly sensitive to human disturbances, it is important to manage them appropriately.

v. The Utah County Resource Assessment (NRCS 2005) includes the following observations related to riparian areas and streams:
    1. There is considerable stream bank instability and erosion due to overgrazing of riparian areas and loss of vegetation to hold banks in place.
    2. Residue and nutrient management are needed to maintain healthy streams and riparian areas.

vi. The Utah Comprehensive Wildlife Conservation Strategy (Sutter et al. 2005) prioritizes habitat categories based on several habitat criteria important to the species of greatest conservation need. The top key habitat statewide is lowland riparian (characterized by riparian areas below 5,500 feet in elevation; principal vegetation: Fremont cottonwood and willow), while the third most key habitat is mountain riparian (characterized by riparian areas over 5,500 feet in elevation; principal vegetation: narrowleaf cottonwood, willow, alder, birch and dogwood).

b. Control and Influence
    i. Federal agencies manage riparian areas and floodplains under Executive Orders 11988 and 11990, Sections 303 and 404 of the Clean Water Act, and the Endangered Species Act. Riparian areas are also managed under individual resource management plans and other agency policies and guidelines, such as the BLM's Riparian Area Management Policy.
    ii. The Utah Division of Water Rights processes stream alteration permits in conjunction with the U.S. Army Corps of Engineers.

c. Economic Considerations
    i. Economic benefits of riparian areas are difficult to quantify. They are intertwined with nonmarket ecosystem services like clean water and wildlife habitat. Engineered water treatment plants are extremely expensive. (USFS 2008, Utah Division of Water Quality 2013)
    ii. Other cost considerations involve restoration projects, such as the ongoing removal of phragmites along the shores of Utah Lake. This multi-year project cost at least $215,000 and involved significant manpower. In this light, proper management, including preventative measures to control weeds, could be more efficient over the long term (Utah Lake Commission 2014).

d. Custom and Culture
    i. "Survey participants' opinions about the importance of various public land resources to the quality of life in their communities highlighted several key issues. Respondents generally considered water resources used for agriculture, homes, and businesses, and that provide fish and wildlife habitat, areas with trees and vegetation that provide wildlife habitat, and areas that attract

recreational uses and tourism to be most important for local quality of life" (Krannich 2008).

ii. "Across the 11 multi-county clusters, there were virtually no respondents who consider such resource use to be "not at all important." At the same time, between two-thirds and four-fifths of respondents indicated that they consider such use to be "very important" to local quality of life" (Krannich 2008).

iii. In the Davis/Salt Lake/Utah/Weber County area, 66.9 percent of survey respondents felt that water resources that provide important habitat for fish and wildlife were very important to the overall quality of life for people living in their community (Krannich 2008).

4. Objectives

a. Private property rights are balanced with the need to preserve and care for riparian areas on public lands.

5. Policies

a. Support projects and land uses on public lands that protect the riparian corridors and stream ecology.
b. Support the use of good science by federal and state agencies to ensure that riparian areas are functioning on public lands.
c. The county values riparian areas for their ecological and aesthetic values.

6. Desired Management Practices

a. Minimize significant soil compaction and disturbance in riparian ecosystems. Allow use of heavy construction equipment during period when the soil is less susceptible to compaction or rutting.

THREATENED, ENDANGERED, & SENSITIVE SPECIES

1. *DEFINITION*

a. Species of plants, animals, and other living organisms which are, to some degree, threatened by extinction.

2. *RELATED RESOURCES*

a. Wildlife, Land Use, Fisheries, Livestock and Grazing, Noxious Weeds, Fire Management

3. *FINDINGS*

a. Overview
   i. The Endangered Species Act (ESA) directs all federal agencies to work to conserve endangered and threatened species and to use their authorities to further the purposes of the ESA. Animal or plant species are classified as endangered, threatened, candidate, or proposed.
   ii. The State of Utah sensitive species list is prepared pursuant to Utah Administrative Code R657-48. By rule, wildlife and plant species that are federally listed candidates for federal listing, or for which a conservation agreement is in place, automatically qualify for the list. The additional species on the Utah sensitive species list—wildlife and plant species of concern—are those species for which there is credible scientific evidence to substantiate a threat to continued population viability. It is anticipated that wildlife and plant species of concern that are designated will act as an "early warning" system to identify species for which conservation actions are needed. Species on the state sensitive species list are not protected by any special state regulations.
   iii. In 1997, as part of the state water tax, the Utah Legislature created the Endangered Species Mitigation Fund (ESMF), which significantly expanded the funding base for conservation of wildlife and plant species which are designated as Utah sensitive species or are ESA-listed. The purpose of this fund is to avoid, reduce, and/or mitigate impacts of ESA listings on the people of Utah (Utah Division of Wildlife Resources 2015).
   iv. "There has been a large increase in the designation of wildlife that requires special management over the past several decades . . . The Utah Division of Wildlife Resources indicated that species of concern increased from 64 in 1976 to 90 in 1998, and decreased to 74 in 2003 due to new criteria. In 2009, the UDWR identified 71 species of concern. The UDWR has also identified 90 conservation concern wildlife species, which require additional attention" (Utah State University 2009).

v. "The Utah Division of Wildlife Resources has developed a Comprehensive Wildlife Conservation Strategy (CWCS), also known as the Utah Wildlife Action Plan. The CWCS is a proactive plan to restore and enhance populations and habitats of specially designated wildlife species. Emphasis is on preventing the wildlife from becoming endangered and requiring additional protection under the Endangered Species Act (ESA)" (Utah State University 2009).

vi. As of March 2017, Utah County has a number of of endangered, threatened, and sensitive species. These can change from year to year, so researchers should consult with individual agencies (Utah Division of Wildlife Resources 2015).

vii. "Utah is home to at least 600 rare vascular native plant species (and subspecies/varieties) including some 25 species that are federally listed as endangered or threatened under the Endangered Species Act of 1973. The 600 taxa represent almost 19% of our currently known flora" (Utah Native Plant Society n.d.).

b. Control and Influence

i. The BLM and the USFS both maintain their own lists of sensitive species for the lands they administer, using their own criteria. These agencies have their own policies and objectives for managing wildlife and plant populations.

c. Economic Considerations

i. Much of the funding for conservation activities comes from hunter and angler license fees and habitat stamps, as well as federal excise taxes on shooting, boating, and fishing equipment. These sources may indirectly benefit some "non-game" species, but in general funding is harder to come by for these species (Utah Division of Wildlife Resources 2015).

ii. The ESA prohibits consideration of economic impacts when determining whether to list a species, but it does require consideration of economic impacts when designating critical habitat.

iii. In 2013, the USFWS and the National Marine Fisheries Service issued a final rule regarding how and when these agencies evaluate the economic impacts of critical habitat designation.

d. Custom and Culture

i. Species extinctions in the late 19th century and early 20th century triggered national awareness and response in the form of active wildlife and plant management.

4. *Policies*

a. Support policies that help ensure that the greater sage-grouse (*Centrocercus urophasianus*) remains under the management of UDWR and does not become listed as threatened or endangered.

b. The county opposes listing any new species as threatened or endangered without proper scientific evidence.
c. The county supports finding local, especially state-level, solutions to protect sensitive species to prevent federal listing.

5. *Desired Management Practices*

a. No land, landscape, habitat, or other area on public lands should be managed for only one species. Federal agencies should consider all impacts to ecological, economic, and human or urban development systems when managing for listed species.

Water Quality and Hydrology

1. Definition

a. Water quality is the condition of water based on physical, chemical, and biological properties with respect to a specific purpose or use. Hydrology is the science of the properties, distribution, and effects of water.

2. Related Resources

a. Land Use, Fire Management, Wild & Scenic Rivers, Wetlands, Water Rights, Canals & Ditches, Irrigation, Livestock & Grazing, Riparian Areas, Recreation & Tourism, Fisheries, Threatened, Endangered, & Sensitive Species, Agriculture

3. Findings

a. Overview
   i. "Land within the boundary of Utah County is comprised approximately of 60% federal, state, county and city ownership, including the area of Utah Lake, and 40% in private ownership. Much of the federal and state land is located in the higher elevations of the mountains which provides the needed watershed for the expanding city populations and for irrigation of farm land" (Utah County Commission 2014).
   ii. "The most fundamental land use in the arid west is watershed use which provides the essential water for agriculture, residential and all other land uses. Any damage to watershed areas should be rehabilitated, and the critical mountain areas should be managed for flood and fire protection, water conservation and erosion prevention. Valley infiltration areas that recharge the ground water supplies should also be protected from development, pollution, excavation, and surface covering that would reduce infiltration. Development patterns and policies should be consistent with adopted regulations protecting watershed, water sources, and water source protection zone areas" (Alpine and Timp-Nebo Conservation Districts 2013).
   iii. "Since the valley floor areas contribute to the water table, the disposal of human and industrial waste into the soil should be minimized by the utilization of sewage treatment facilities whenever possible. Storm water runoff from development should be required to be disposed of on-site to increase the water table recharge, unless a storm drain or surface drain that is controlled by an agency or jurisdiction is available that would allow for the increase of water runoff to an acceptable body of water or sump" (Utah County Commission 2014). "At an elevation of 4,492 feet, Utah County receives 16.82 inches of rainfall and

41.23 inches of snowfall annually" (Alpine and Timp-Nebo Conservation Districts 2013).

b. Hydrology

i. The hydrologic cycle describes movement of water on earth. Some of the processes by which water moves include: precipitation, infiltration (soil moisture and groundwater), and streamflow. In order to account for the distribution of water within a specific area, it is necessary to consider these processes. One of the units used to quantify and analyze water and its effects at a specific location is the watershed. A watershed, or drainage basin, is an area of land in which all water within drains to the same outlet.

ii. "Two major concerns of water in Utah County are sufficiency and quality. The county was settled and developed because it is located at one of the few sites in the arid west where supplies of water are sufficient for agriculture and development. The county has a number of streams that originate in the local mountains, and these are supplemented by water from the Provo River, Current Creek, and Thistle Creek, which originate outside of the county boundary. The local water supply is also augmented by inter-basin transfers from the Weber River and tributaries of the Colorado River" (Utah County Commission 2014).

iii. "Utah County obtains irrigation water from Mona Reservoir in Juab County and Strawberry Reservoir in Wasatch County, and both irrigation and culinary water from Deer Creek Reservoir in Wasatch County. The Jordanelle Reservoir in Wasatch County also provides municipal and industrial water to northern Utah County. Utah Lake lies within the county boundary and some local land owners obtain irrigation water from the lake, however, much of the water is used by downstream owners. There are a few smaller sized impoundments and natural bodies of water that exist within Utah County which are important for local recreational use and water storage" (Utah County Commission 2014).

iv. "Springs and wells from underground water supplies are heavily used for both culinary and irrigation in Utah County. The higher quality of the water and the lack of pumping expenses make springs the preferred source of drinking water systems whenever they are available. Most of the larger springs located in the canyon bottoms and foothill areas of the Wasatch Mountains are currently utilized for culinary water supply. Wells are also used by cities to supply water for culinary use and fire suppression with some cities utilizing wells to supply the water needed beyond the amount that can be supplied by springs. Population growth in Utah County will be dependant on additional wells from underground aquifers since little additional water can be obtained from existing captured spring flows" (Utah County Commission 2014).

v. "Mountain watershed areas also provide the runoff that feed the streams and rivers that flow into Utah Lake and the Great Salt Lake. This stream and river

water is used for wildlife, irrigation and recreation. It has been the ability to capture and utilize water that has led to the development of Utah County from its early pioneer farming heritage to its current urban and intensive farming development. Preservation of both quantity and quality are necessary" (Utah County Commission 2014).

c. Water Quality
    i. In Utah, water quality is regulated by the state based on the source of pollutants entering waterways, defined as either "point source" or "nonpoint source" pollution. Point sources (PS) discharge pollutants directly into a waterbody, usually through pipes or ditches originating from industries or waste treatment plants. Nonpoint sources (NPS) are pollution sources that do not originate from distinct locations and tend to vary in time and space. Nonpoint source pollution occurs when runoff from rainfall or snowmelt pick up pollutants from the human and natural landscape and transport them indirectly to a waterbody (Bio-West 2016).
    ii. Threats to water quality include:
        1. "Stream-bank erosion: Sediment is probably one of the most easily recognized water quality issues. Turbid water decreases light penetration, interferes with plant growth, and decreases species diversity. Sediment also decreases the storage capacity of lakes and reservoirs. Solutions include stream fencing, proper grazing management, stream restoration, bank stabilization, and riparian vegetation establishment" (Alpine and Timp-Nebo Conservation Districts 2013).
        2. "Nutrients: Increases of phosphorus and nitrogen into receiving waters results in an increase of plant and algae growth, which can led to increased eutrophication rates. Highly enriched conditions result in changes in taste, color, and odor of drinking water and a significant decrease in organism diversity. Solutions include stream fencing, proper grazing management, berms, stream restoration, and riparian vegetation establishment" (Alpine and Timp-Nebo Conservation Districts 2013).
    iii. Utah Lake
        1. "Utah Lake is a rather shallow body of fresh water, with an average depth of only 9.2 feet. It dominates the valley by occupying 25 percent of its floor. The lake, which covers approximately 93,000 acres, contains about 900,000 acre-feet of water and is about twenty-three miles in length from north to south and slightly more than half that in width. Utah Lake receives much of its water from the Provo River, Spanish Fork River, Hobble Creek, American Fork River, Dry Fork Creek, and Currant Creek. The latter drains Goshen Valley on the south. However, 20

percent of the lake's water derives from springs. The Provo River originates in the southwestern edge of the Uinta Mountains and drains portions of present-day Wasatch, Summit, and Utah counties. The Jordan River, which flows northward from Utah Valley, bisects the Traverse Mountains through a channel known as the Jordan Narrows and eventually flows into the Great Salt Lake" (Holzapfel 1999).

2. "The lake is commonly perceived as being polluted and undesirable for water recreation due to human-caused pollutants, such as agricultural uses around the lake, steel mill effluent, nutrients from sewage treatment facilities, and overgrazing in the watershed" (Alpine and Timp-Nebo Conservation Districts 2013).
3. "An evaluation of the current data obtained by the Division of Water Quality indicates the water quality of Utah Lake is fairly good. It is considered to be very hard, with a hardness concentration value of approximately 399 mg/L (CaCO3)" (Alpine and Timp-Nebo Conservation Districts 2013).

iv. Big East Lake

1. "Big East Lake is located south of Utah Valley, between Loafer Mountain and Mount Nebo. With a volume of 670 acre-feet of water, it is considered to be the largest of the Payson Lakes, a group of about six lakes in the Payson Canyon Drainage. Some of these lakes, including Big East, have been regulated with dams in order to use their water for agricultural purposes. Big East has a large, staffed campground and other developed facilities, making it a popular summer recreational area for Utah Valley residents. The lake has a very small watershed of only 500 acres, with most of that being unmodified by direct human activity" (Alpine and Timp-Nebo Conservation Districts 2013).
2. "The water quality of Big East Reservoir (Payson Lake) is good. It is considered soft, with a hardness concentration of approximately 69 mg/L. The water quality constituents analyzed that exceeded established state water quality standards for the reservoir were phosphorus, temperature, dissolved oxygen, and iron" (Alpine and Timp-Nebo Conservation Districts 2013).

v. Tibble Fork Reservoir

1. "Tibble Fork Reservoir is a small reservoir of only 259 acre-feet of water north of Mount Timpanogos in the Wasatch Front. The reservoir was created in 1966 by the construction of an earth-fill dam, and the water is used primarily for irrigation; however, a 166 acre-foot conservation pool is maintained throughout the year using the water, as well. The inflow and outflow is the American Fork River, with Mill Canyon Creek also

contributing. Silver Lake Flat is just upstream and is an upstream impoundment of Tibble Fork" (Alpine and Timp-Nebo Conservation Districts 2013).

2. "The water quality of Tibble Fork Reservoir is excellent. It is considered to be hard, with a hardness concentration value of approximately 165 mg/L" (Alpine and Timp-Nebo Conservation Districts 2013).
3. Tibble Fork Dam was recently rehabilitated by the NRCS to meet current NRCS and Utah dam safety criteria (National Resource Conservation Service n.d.).

vi. Salem Pond

1. "Salem Pond, consisting of 158 acre-feet of water, is one of the many natural ponds in the south end of Utah Valley. These are small, spring-fed bodies of water at the base of the mountains. The town of Salem was built around the pond, making it one of the few natural lakes in the state that has been surrounded by a residential area. The pond was created by the construction of an earthfill dam in 1851, and the water is used for irrigating 900 acres of land lower in the valley" (Alpine and Timp-Nebo Conservation Districts 2013).
2. "The water quality of Salem Pond is conserved very good [sic]. It is considered to be hard, with a hardness concentration value of approximately 261 mg/L. The parameters that have exceeded water quality standards for the state for beneficial uses include total phosphorus (TP) and dissolved oxygen" (Alpine and Timp-Nebo Conservation Districts 2013).

d. Control and Influence

i. Point source pollutants are highly regulated under the Clean Water Act of 1972 and Water Quality Act of 1987 through the issuance of permits and possible fines if permit requirements are not met. The U.S. Environmental Protection Agency (EPA) issues discharge permits within the National Pollutant Discharge Elimination System (NPDES). In Utah, the State of Utah was granted primacy by EPA to manage the NPDES permitting program as the Utah Pollution Discharge and Elimination System (UPDES) and is operated by the Utah Department of Environmental Quality (DEQ) Division of Water Quality (DWQ).

e. Economic Considerations

i. It is much more cost effective to protect the water at its source and prevent contamination than to treat it in a wastewater treatment plant. "Nationwide, every $1 spent on source water protection saves an average of $27 in wastewater treatment costs" (Utah Division of Water Quality 2013).

ii. Prepare60, a center established by four water conservancy districts in Utah, published a 2014 report illustrating that $17.9 billion spent on water

infrastructure maintenance alone enables $5.4 trillion in ongoing economic activity. An investment in water resources of $15 billion would create 930,000 new jobs, $93 billion in incremental economic output, and $71 billion in additional personal income (Aguero 2014).

f. Custom and Culture
    i. All people who have inhabited the Utah Valley have depended on clean water in order to sustain life and civilization, as well as the natural environments. This precious resource has been, and always will be, the lifeblood of the county.

4. *Policies*

a. Support projects and policies on public lands that maintain and improve soil conditions and vegetative cover in uplands.
b. Utah County will participate in the management of watersheds on public and private lands to optimize quality and quantity of water.
c. Maintain and improve our fresh water supplies and watersheds on public lands, and increase our watershed production capabilities.
d. Maintain water storage capacity of reservoirs on public lands by reducing sediment loading and seeking additional storage.
e. Manage municipal watersheds on public lands for multiple uses with mitigation measures to protect the water supply for intended purposes. Allow projects when the proposed mitigation measures provide adequate protection.
f. The county supports finding local solutions to water quality and hydrological concerns on public lands including future dams.

Water Rights

1. Definition

a. The legal right to make use of water from a stream, lake, canal, impoundment, or groundwater.

2. Related Resources

a. Water Quality & Hydrology, Canals & Ditches, Irrigation, Land Access, Agriculture, Livestock & Grazing, Wildlife, Fisheries, Mining, Wild & Scenic Rivers

3. Findings

a. Overview
   i. Water is a renewable but finite natural resource, and because annual supplies of water vary, its availability is subject to competition between stakeholders. The demand to supply water to Utah's various interests is expected to always be a complex issue for stakeholders to coordinate. Water is a resource taken from a natural system resulting from a fluctuating cycle of precipitation and subsequent absorption into the earth and/or the drainage of water from high elevations to lower elevations. The network of flowing water, both above and below the earth's surface, extends beyond obvious topographic or political boundaries (Bio-West 2016).
   ii. "All waters in Utah are public property. A 'water right' is a right to divert (remove from its natural source) and beneficially use water. The defining elements of a typical water right will include:
      1. A defined nature and extent of beneficial use;
      2. A priority date;
      3. A defined quantity of water allowed for diversion by flow rate (cfs) and/or by volume (acre-feet);
      4. A specified point of diversion and source of water;
      5. A specified place of beneficial use" (Utah Division of Water Rights 2011).
   iii. "Rights for water diversion and use established prior to 1903 for surface water or prior to 1935 for ground water can be established by filing a 'diligence claim' with the Division. Such claims are subject to public notice and judicial review and may be barred by court decree in some areas of the state" (Utah Division of Water Rights 2011).
   iv. "All other rights to the use of water in the State of Utah must be established through the appropriation process administered by the Division of Water Rights. The steps to this process for an 'Application to Appropriate Water' are as follows:

1. An Application to Appropriate Water is filed with the Division.
2. The application is advertised and protests may be received and a hearing may be held.
3. The State Engineer renders a decision on the application based upon principles established in statute and by prior court decisions.
4. If the application is approved, the applicant is allowed a set period of time within which to develop the proposed diversion and use water. When the diversion and use are fully developed, the applicant retains the services of a professional engineer or land surveyor who files 'proof' documentation with the Division showing the details of the development.
5. Upon verification of acceptably complete proof documentation, the State Engineer issues a Certificate of Appropriation, thus 'perfecting' the water right" (Utah Division of Water Rights 2011).

v. "Many areas of the state are administratively 'closed' to new appropriations of water. In those areas, new diversions and uses of water are established by the modification of existing water rights. Such modifications are accomplished by the filing of 'change applications.' These applications are filed and processed in a manner very similar to that described above for Applications to Appropriate Water" (Utah Division of Water Rights 2011).

vi. As water supplies fluctuate from year to year, any water right is subject to available supply. The State of Utah follows the Prior Appropriation System, which grants priority to water rights based upon that water right's chronologic seniority.

vii. "The State Engineer has adopted procedures for enforcing water rights violations. Under the new enforcement procedure, an action is initiated by the Division of Water Rights (DWR) after a violation has been observed by an official working in the DWR or another capacity for the state, or after a complaint is received from a water user, government agency, or other interested party. Private water users can report violations" (Donaldson, F. J. 2007).

viii. "Utah County relies heavily on the Utah State Engineer to control the water rights assigned to properties, and the Utah County Health Department to monitor water systems and septic facilities, in making their recommendations concerning land use development in the unincorporated area of Utah County" (Utah County Commission 2014).

b. Control and Influence

i. The appropriation of water from Utah rivers, lakes, and wells is regulated by the Utah Division of Water Rights and is subject to both state and federal laws.

c. Economic Considerations

i. Although water rights are the right to use appropriated water within the requirements of a given beneficial use, water rights are classified as "real property" in the State of Utah and are bought and sold much like real estate (Utah Division of Water Rights 2011).

d. Custom and Culture
   i. "The Utah pioneers, in the late 1840's, were the first Anglo-Saxons to practice irrigation on an extensive scale in the United States. Being a desert, Utah contained much more cultivable land than could be watered from the incoming mountain streams. The principle was established that those who first made beneficial use of water should be entitled to continued use in preference to those who came later. This fundamental principle was later sanctioned in law, and is known as the Doctrine of Prior Appropriation. This means those holding water rights with the earliest priority dates, and who have continued beneficial use of the water, have the right to water from a certain source before others with water rights having later priority dates" (Utah Division of Water Rights 2011).
   ii. "In the early territorial days, rights to the use of public streams of water were acquired by physical diversion and application of water to beneficial use, or by legislative grant. A 'county courts' water allocation system was enacted in 1852 and was in effect until 1880 when it was replaced by a statute providing for county water commissioners" (Utah Division of Water Rights 2011).
   iii. Water availability and water rights are so important to residents of the county that they were the impetus for the establishment of a whole city. According to A History of Utah County (Holzapfel 1999), "For some time, farmers east of Springville had worked to obtain their own irrigation system and water rights from Spanish Fork Canyon. In 1900 they organized the Mapleton Canal, Road and Irrigation Company to divert water from Spanish Fork Canyon to their farms. Frustrated by the lack of support from the community of Springville, Mapleton farmers petitioned the county commission to allow them to establish their own community. In 1901 their petition was granted."

4. *Policies*

a. Utah County supports projects on public lands that benefit in-stream uses and protect current water right holders.
b. The county opposes federal policies on public lands that infringe on private water rights.
c. The county encourages water conservation on public lands to intelligently use the water that is available in this arid county.
d. The county values water rights as a necessary protection for growth and survival in the county.

e. The county opposes federal law that would marginalize the State of Utah's protection and management of water rights, including Waters of the United States (WOTUS).

WETLANDS

1. *DEFINITION*

a. Lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living therein or on.

2. *RELATED RESOURCES*

a. Livestock & Grazing, Land Use, Noxious Weeds, Wildlife, Water Quality & Hydrology, Wetlands, Wild & Scenic Rivers, Canals & Ditches, Irrigation, Riparian Areas, Recreation & Tourism, Agriculture, Water Rights

3. *FINDINGS*

a. Overview
   i. Wetlands have been defined in different ways by numerous entities and agencies. However, the U.S. Army Corps of Engineers (Corps) and the U.S. Environmental Protection Agency (EPA) jointly define wetlands as: "Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that do under normal circumstances support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." This definition of wetlands is perhaps the most relevant to local land managers and planners because the Corps and the EPA are the agencies that have legal jurisdiction over wetlands, including those wetlands on private property. Wetlands provide numerous benefits including wildlife habitat, aquifer recharge, and water quality improvements.
   ii. Utah County has approximately 125,991 acres of wetlands (U.S. Fish & Wildlife Service 2016).
   iii. According to the Utah Wetland Information Center, 1 percent of Utah's landscape is wetlands (Utah Geological Survey. n.d.). Wetlands are among the most productive ecosystems in the world, comparable to rainforests (EPA 2015). The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristic vegetation of aquatic plants, adapted to the unique hydric soil. Wetlands have the ability to improve water quality by acting as filters. In addition, wetlands can lessen the effects of flooding by containing stormwater

and releasing it gradually. Because these critically productive systems are a scarcity in the region, special emphasis is necessary for their management.

b. Control and Influence
    i. The Corps and the EPA have strict guidelines for any activities occurring on or near a wetland. Under Section 404 of the Clean Water Act (CWA), activities that involve excavation or placement of fill in jurisdictional waters or wetlands require a permit issued by the Corps and may be reviewed by EPA. The extent of jurisdiction is determined on a project-by-project basis in consultation with the Corps. Impacts to or near wetlands can require permits from federal, state, and local agencies.
c. Economic Considerations
    i. Wetlands provide recreational value as well as ecological, social, or economic value. Possibly the most significant economic and social benefit of wetlands is flood control, but wetlands also provide essential functions in filtering water/improving water quality, soil conservation, and providing habitat for waterfowl and other wildlife (World Wildlife Fund 2004). Wetlands also recharge aquifers, securing future water supplies.
d. Custom and Culture
    i. Human life depends on water, and settlements have historically occurred near rivers, bodies of water, and wetlands.

4. *Policies*

a. Utah County supports projects, land uses, and water allocation policy on public lands that protect wetlands.

5. *Desired Management Practices*

a. Establish trail design standards on public lands that minimize impacts on sensitive riparian corridors.
b. Manage, maintain, protect, and restore riparian and wetland areas on public lands to the proper functioning condition and achieve an advanced riparian obligate vegetation community.
c. Encourage the UDWR to identify wetlands and riparian areas with significant wildlife values on public lands to aid in their protection. Best management practices should be used to protect and enhance wetlands and riparian areas.

Wild and Scenic Rivers

1. Definition

a. An administrative designation created under the National Wild and Scenic Rivers Act of 1968, applied to preserve certain free-flowing rivers that possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values.

2. Related Resources

a. Recreation & Tourism, Land Use, Livestock & Grazing, Irrigation, Canals & Ditches, Water Rights, Water Quality & Hydrology, Wetlands, Floodplains & River Terraces, Riparian Area, Fisheries, Wildlife, Threatened Endangered Sensitive Species

3. Findings

a. Overview
    i. The Wild and Scenic Rivers Act is notable for preserving the special character of rivers, while also recognizing the potential for their appropriate use and development. It encourages river management that crosses political boundaries and promotes public participation in developing goals for river protection (BLM 2012).
    ii. Under the Wild and Scenic Rivers Act, rivers are classified into three categories:
        1. Wild rivers represent "vestiges of primitive America" in that they are free-flowing segments of rivers with undeveloped shorelines that typically can only be accessed via trail.
        2. Scenic rivers are dam-free river segments with undeveloped shorelines but accessible in places by roads.
        3. Recreational rivers are more developed than wild or scenic river segments and can be accessed by roads.
    iii. Section 5(d)(1) of the Wild and Scenic Rivers Act directs federal agencies to identify potential additions to the National Wild and Scenic Rivers System through federal agency plans. Under these provisions, federal agencies study the suitability of river sections they manage for designation under the Wild and Scenic Rivers Act. Sections that are determined to be suitable can be managed to preserve their suitability by an agency land management plan while awaiting congressional designation (National Wild and Scenic Rivers System 2016).
    iv. Designating river segments as wild, scenic, or recreational would restrict many activities related to the stream and other uses within 0.25 mile of it, and in some cases, these designations could be detrimental to users' ability to develop and

manage water resources necessary to meet future growth needs. The ability to obtain approval for water right change applications on, or upstream of, designated streams by existing water users may also be limited. Similarly, federal permits cannot be issued for uses on a stream segment that would be in conflict with the wild and scenic designation.

v. Designation of wild and scenic rivers may result in non-use, restricted use, or environmental impacts on public and private lands. These restrictions may prohibit future uses that are necessary to continue to assure economic prosperity or may adversely affect the operation, management, and maintenance of existing facilities.

vi. There are no designated segments within Utah County.

b. Control and Influence

i. Wild and scenic rivers are designated by Congress, but are managed by the USFS and the BLM.

c. Economic Considerations

i. At present, the economic implications of wild and scenic river designation are not totally understood, nor quantifiable. The tradeoff between increases in recreation and tourism sectors and the potential economic loss of future river development should be considered. An analysis of wild and scenic river designation conducted by Utah State University made the following observations: primary impacts of designation relate to a reduction in the grazing in riparian areas; and other impacts include further regulations on adjacent public and private land uses (Keith et al. 2008).

d. Custom and Culture

i. Where citizens of Utah County are not responsible for the designation or management of wild and scenic rivers, and as there is only a short history (since 1968) of this designation in the U.S., no custom or culture can be associated with the federal designation of wild and scenic rivers at this time; however, county residents maintain that rivers in general are an integral element of sustaining and improving the health of the regional economy and ecosystem. Citizens of Utah County have always prized rivers first for the life they give to the human species, and second for their aesthetic, ecological, recreational, and hydropower value. Managing rivers for multiple uses has historically been, and continues to be, a tradition based on facilitating many values.

ii. In the Davis/Salt Lake/Utah/Weber County area, 32.9 percent of respondents said they believe designation of wild and scenic rivers on Utah's public lands should be increased. Data from the same survey states that 42.9 percent of respondents from the same area determined that public land managers should moderately or majorly increase the extent to which designation of wild and scenic rivers occurs on Utah's public lands (Krannich 2008).

4. Objectives

a. River segments that have been designated as wild, scenic, or recreational are adequately protected and functioning.

5. Policies

a. The county values wild and scenic rivers as contributors to the ecology and beauty of the county.
b. The county opposes river management that exceeds the statutory authority of the Wild and Scenic Rivers Act.

6. Desired Management Practices

a. Federal agencies should work with the state, local and tribal governments, and the agencies involved, to coordinate its decision making on wild and scenic river issues and to achieve consistency wherever possible.
b. Regarding wild and scenic rivers designations, federal agencies should work with affected local, state, federal, and tribal partners to identify in-stream flows necessary to meet critical resource needs, including values related to the subject segments. Such quantifications will be included in any recommendation for designation.

Wilderness Areas

1. Definition

a. According to the Wilderness Act of 1964, federal lands must have specific characteristics to be considered by Congress for wilderness preservation:
   i. They must be in a generally natural condition.
   ii. They must have outstanding opportunities for solitude or a primitive and unconfined type of recreation.
   iii. They must be at least 5,000 acres or large enough to preserve and use as wilderness.
   iv. They may also contain ecological, geological, or other features of scientific, scenic, or historical value.

2. Related Resources

a. Recreation and Tourism, Land Use, Livestock and Grazing, Fire Management, Noxious Weeds, Water Quality and Hydrology, Forest Management

3. Findings

a. Overview
   i. Many people use “wilderness” to describe any remote, rugged, and undeveloped land. The term “wilderness” is a legal definition created under the Wilderness Act of 1964, applied to specific parcels of public lands with certain characteristics. Wilderness designation enables preservation and protection of “Federal lands retaining primeval character and influence” and as such, limits consumptive, motorized, and mechanized uses.
   i. Other public lands not officially designated as wilderness may be managed under similarly restrictive objectives. These include lands recommended for wilderness designation by the U.S. Forest Service (USFS) as Recommended Wilderness Areas and the Bureau of Land Management (BLM) as Wilderness Study Areas (WSA). These lands are managed to protect their wilderness character until Congress can act. Other non-wilderness designations which have restrictive management objectives include USFS Roadless Areas and BLM Lands with Wilderness Characteristics (LWC).
   ii. To qualify for wilderness designation, lands must be at least 5,000 acres of contiguous roadless area, or of sufficient size as to make practicable its preservation and use in an unimpaired condition, primarily natural in character with human impacts substantially unnoticeable, provide opportunities for solitude, and after the first three criteria are met, may contain other

supplemental values such as ecological, educational, geological, historical, scenic, or scientific values (Bureau of Land Management n.d.; Wilderness Act of 1964).

iii. There is a 20,777-acre designated wilderness area to the east of the Traverse Mountains in the Wasatch Range above Alpine City. Wilderness also encompasses Mount Timpanogos between American Fork Canyon and Provo Canyon; this area is 10,447 acres in size . Another designated wilderness area is 7,338 acres east of Mona at the most southwestern corner of Utah County, west of Nebo Loop Road. All three wilderness areas are managed by the Uinta-Wasatch-Cache National Forest (Rural Community Consultants 2016).

b. Control and Influence

i. Federal wilderness designation is a legislative action by Congress that sometimes follows a recommendation made by a comprehensive National Environmental Policy Act (NEPA) land management planning process, though wilderness designations may be citizen or legislator driven.

ii. In general terms, wilderness designation begins with the adoption of agency planning documents. For the Mountainland Association of Governments (MAG) region, this includes resource management plans from one BLM field office and the Uinta-Wasatch-Cache and Ashley National Forests.

iii. As part of each plan, management agencies inventory lands to identify areas which have wilderness characteristics. These areas are then recommended as wilderness, but are not officially set aside as wilderness until designated by Congress. Wilderness areas are managed by federal entities (e.g. BLM, USFS).

iv. According to the BLM, the best way for counties to influence future wilderness designation is to enter into a memorandum of understanding with the agency. Counties cannot influence current wilderness study areas except by contacting their congressional representative (P. Jarnecke, Bureau of Land Management, personal communication).

c. Economic Considerations

i. The economic effect of wilderness designation is the subject of ongoing debate. For example, when several proposals were made in the early 1990s to increase acres of wilderness in Utah, a 1992 Government Accountability Office (GAO) study investigated a claim that designating 3.2 million acres of land as wilderness in Utah would cost the state $9.2 billion annually in future earnings. The debate over the economic impact of designating wilderness areas continues in Utah. An unpublished report from Utah State University in 2010 investigated contradictory claims about the economic impact of designating wilderness areas in Utah (Yonk et al. 2010).

ii. Economic considerations of wilderness designation should include:

1. Mineral and energy development potential
2. Logging and forest products

3. Grazing restrictions (grazing is allowed in wilderness areas but must meet wilderness guidelines)
4. Private and state land inholdings
5. Land transfers
6. Motorized recreational uses (Bio-West 2016).

iii. Wilderness designation on public lands has positive effects on:

1. Non-motorized recreation
2. Wildlife habitat
3. Drinking water source protection
4. Watershed protection (Bio-West 2016).

d. Custom and Culture

i. Part of Utah County's culture is outdoor-oriented, with residents and visitors recreating in a variety of ways; this includes the use of motorized all-terrain vehicles where appropriate. Managing lands and providing adequate access for multiple uses has historically been, and continues to be, a tradition based on accommodating a range of local values.

4. *Policies*

a. Support and encourage accurate, on-the-ground mapping of roads, fences, rangeland improvements, and any other anthropogenic influence on lands under consideration for LWCs or WSA designations.
b. The county supports management of existing wilderness according to federal law.
c. The county favors management that maximizes the public's enjoyment of existing wilderness, including access.
d. The county opposes the designation of new wilderness areas.

5. *Desired Management Practices*

a. Special land use designations should only be used when they are consistent with surrounding management and contribute to the sound policy of multiple use, economic viability, and community stability.

WILDLIFE

1. *DEFINITION*

a. Undomesticated animals usually living in a natural environment, including both game and nongame species.

2. *RELATED RESOURCES*

a. Threatened, Endangered, or Sensitive Species, Predator Control, Agriculture, Livestock and Grazing, Land Use, Fisheries, Forest Management, Recreation and Tourism

3. *FINDINGS*

a. Overview
   i. Utah County's size, urban interface, and biological diversity increase the importance of wildlife issues and the impact of management decisions.
   ii. "A variety of animals and fowl live in the habitats of Utah County. Like vegetation, animal and fowl habitat is a result of the surrounding environmental conditions of soil and climate. Mule deer and elk are the most numerous big game animals in the county, and both are avidly pursued by local and out-of-state sportsmen. For both of these species, the size of the population is limited by the quantity and quality of food that can be found in the areas where they winter. Residential development has encroached into these critical deer and elk winter areas resulting in a loss of population as they are driven from their normal winter habitat" (Utah County Commission 2014).
   iii. "Mountain goat, moose, cougar, bear, and many species of smaller mammals are also found in Utah County. Valley varieties of birds, game birds, raptors, and mountain birds and fowl can be found in Utah County. Golden and Bald Eagle winter nesting sites are plentiful in areas near the shores of Utah Lake. A variety of fish are found in Utah Lake and most all streams, lakes and ponds have native and planted trout. Stretches of the Provo River, through Utah County, are designated as a blue ribbon trout fishery" (Utah County Commission 2014).
   iv. "Populations of many species of wildlife have declined over the past 30 years due to a variety of manmade and natural factors. Unless adequate measures are taken to recover and conserve species populations and habitats, some of these species may become federally listed in the future" (Sutter et al. 2005).
   v. Species management plans provide guidance and direction for a number of species in Utah. These plans are taken through a public process to gather input from interested constituents and then presented to the Utah Wildlife Board for approval. Species covered by statewide plans include wild turkey, chukar, greater

sage-grouse, mule deer, elk, moose, pronghorn, mountain goat, bighorn sheep, Utah prairie dog, beaver, northern river otter, black bear, cougar, bobcat, and wolf.

vi. Black Bear

1. "The black bear has been a protected species in Utah since 1967, when a group of sportsmen petitioned the Utah State Legislature to protect both cougar (*Puma concolor*) and bear" (Utah Division of Wildlife Resources 2011).
2. The management goal in Utah is to "Maintain a healthy bear population in existing occupied habitat and expand distribution while considering human safety, economic concerns, and other wildlife species. A 'healthy' bear population is one that has a proportion of breeding age animals that will maintain population levels consistent with habitat, and that maintains genetic variability" (Utah Division of Wildlife Resources 2011).
3. The "Black Bear Guidebook" (2016) distributed by UDWR details the rules, boundaries, and licenses required for hunting.

vii. Moose

1. "In addition to organized transplants, moose that wander out of the mountains and into populated areas are also relocated. Most nuisance moose situations occur along the Wasatch Front in the spring and summer months when younger moose are dispersing. Additionally, depending on winter severity, moose may wander into towns during the winter months while they are searching for areas with less snow. Some of those moose have been moved to areas throughout Utah to help bolster previously transplanted populations or to start new populations. Still others have been simply been [*sic*] relocated to suitable habitat within nearby units away from cities and towns" (Utah Division of Wildlife Resources n.d.).

viii. Elk

1. The general management goals for elk in Utah are stated in the associated management plan. "Manage for a population of healthy animals capable of providing a broad range of recreational opportunities including hunting and viewing. Consider impacts of the elk herd on other land uses and public interests including private property rights, agricultural crops and local economies. Maintain the population at a level that is within the long-term capability of the available habitat." These goals are included along with more specific acreage and population targets (Utah Division of Wildlife Resources 2012).

ix. Deer

1. “The winter range within the Heber Valley and Spanish Fork Canyon areas... appear suitable to support planned deer population objectives. Suitable winter range on the Bonneville Shoreline is more limited due primarily to development and poor quality habitat. Deer will likely be forced to winter in an urban setting during more severe winters in this area. The abundance and increase of bulbous bluegrass is a concern in all of the areas of the subunit because this perennial species can form dense mats of cover that may compete with other more desirable herbaceous species and with seedlings and young shrubs, which potentially limits establishment of new plants into the population. The abundance of cheatgrass in the Heber Valley and Bonneville Shoreline areas of the unit is a concern because this annual species can increase fuel loads and increases the chance of a catastrophic fire event” (Utah Division of Wildlife Resources 2016).

x. Another tool for wildlife management is a cooperative wildlife management unit (CWMU). They can be created by the state as contiguous areas of land open for “hunting small game, waterfowl, cougar, turkey, or big game which is registered in accordance with...the Wildlife Board.” CWMUs can span over private, public, and state land, in an effort to manage based on an animal’s range, rather than man-made borders. These small management areas rely on local knowledge and stakeholder involvement to conserve wildlife and associated habitat. There are three CWMUs entirely inside of Utah County, and an additional three that share land in Carbon or Wasatch Counties (Utah Division of Wildlife Resources n.d.).

b. Control and Influence
   i. The Utah Division of Wildlife Resources (UDWR) is the wildlife authority for the state. It is the UDWR’s responsibility to protect, propagate, manage, conserve, and distribute protected wildlife throughout the state (Utah Code, Title 23). “Wildlife” means vertebrate animals living in nature, with the exception of the following: feral animals, coyote, field mouse, gopher, ground squirrel, jack rabbit, muskrat, and raccoon.
   ii. The BLM and USFS manage wildlife habitat on their respective lands.
c. Economic Considerations
   i. The U.S. Fish and Wildlife Service found that Utah residents and non-residents spent over $1.5 billion dollars in 2011 in Utah on recreation activities associated with wildlife (U.S. Department of the Interior et al. 2011).
d. Custom and Culture
   i. Around the area now known as Sundance Resort, “Robert Redford and his family announced early in 1998 a conservation easement for more than 860 acres of critical wildlife habitat, vital watershed, and undisturbed alpine meadows they had purchased from the Chipman family” (Holzapfel 1999).

ii. "The mountains in Utah County act as a wildlife shelter. Big-game animals in the region—elk, mountain sheep, mule deer, antelope, and bear—were hunted by Native Americans for meat and fur" (Holzapfel 1999).

4. *Policies*

a. Increase partnerships with private, federal, state, local, and wildlife interest groups.
b. The county supports wildlife management that seeks an optimal balance between wildlife populations and human needs.
c. The county opposes any federal land management that infringes on state jurisdiction over wildlife.
d. The county values wildlife as in important part of the ecosystem and beauty of the county.
e. Support agencies to ensure adequate amount of forage for wildlife and domestic livestock on public lands.
f. Support responsible wildlife management; ensure that wildlife interests are considered in all public land use and resource development decisions.
g. Encourage partnerships among county residents, the county, and federal and state agencies to improve wildlife and fish habitat.

5. *Desired Management Practices*

a. New roads are planned and sited in areas where there are limited impacts to wildlife. When existing roads are maintained, barriers to wildlife movement are altered to allow for movement.
b. Agencies should coordinate with the county before eliminating, introducing, or re-introducing any species onto public lands and address potential impacts of such an action on private lands, customary use, and private property interests in the public land, and the local economy.

Appendix A- Works Cited

Aguero, J. 2014. Utah's water dependent economy. Prepare60. <http://prepare60.com/Content/EconomicsWater.pdf>. Accessed 5 Jan 2017.

Alpine and Timp-Nebo Conservation Districts. 2013. Utah county resource assessment. <http://media.wix.com/ugd/9bdf1b_75a87ff734cc4e0fb4a3c64df643daa3.pdf>. Access 14 Jan 2017.

Anderson, L. R., J. R. Keaton, and S. N. Eldredge. 1994. Liquefaction. Utah Geological Survey. <http://files.geology.utah.gov/online/pdf/pi-28.pdf>. Accessed 14 Jan 2017.

Animal and Plant Health Inspection Service [APHIS]. 2009. Partnerships and progress. U.S. Department of Agriculture. <https://www.aphis.usda.gov/wildlife_damage/downloads/partnerships%20in%20progress.pdf>. Accessed 5 Jan 2017.

Bellison, N., R. Whitesides, S. Dewey, J. Merritt, S. Burningham. 2009. Noxious weed field guide for Utah. Utah State University Cooperative Extension. <http://extension.usu.edu/files/publications/publication/pub8746541.pdf>. Accessed 9 Jan 2017

Berry, J., D. Hurlbut, R. Simon, J. Moore, and R. Blackett. 2009. Utah renewable energy zones task force phase I report. Utah Geological Survey Miscellaneous publication 09-1. <https://energy.utah.gov/wp-content/uploads/UREZ-Phase-I.pdf>. Accessed 15 Jan 2017.

Bio-West. 2016. MAG natural and other resources. <http://gis.bio-west.com/magresources/>. Accessed 20 Jan 2017.

Boden, T., K. Krahulec, D. Tabet, A. Rupke, and M. Vanden Berg. 2014. Utah's extractive resource industries. Utah Geological Society Circular 120. <http://files.geology.utah.gov/online/c/c-120.pdf>. Accessed 3 Nov 2016.

Bureau of Land Management. n.d. What to know about lands with wilderness characteristics in the planning process. <https://www.blm.gov/style/medialib/blm/mt/blm_programs/inventories/lwc.Par.62320.File.dat/LWC%20Fact%20Sheet.pdf>. Accessed 13 Jan 2017.

Bureau of Land Management. 2001. The federal land policy and management act of 1976 as amended. U.S. Department of the Interior. <https://www.blm.gov/or/regulations/files/FLPMA.pdf>. Accessed 20 Jan 2017.

Bureau of Land Management [BLM]. 2012. Manual Transmittal Sheet 6400 – Wild and Scenic Rivers – Policy and Program Direction for Identification, Evaluation, Planning, and Management (Public). U.S. Department of the Interior. <https://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.76771.File.dat/M6400_WildScenicRivers_Final%20071312.pdf>. Accessed 30 Oct 2016.

Bureau of Land Management [BLM]. 2016. Connecting with Utah communities; BLM-Utah's recreation and visitor services strategy 2016-2020. U.S. Department of the Interior. <https://www.blm.gov/style/medialib/blm/ut/natural_resources/recreation/frontpagephotos.Par.73300.File.dat/CWUCstrat2016.pdf>. Accessed 18 Jan 2017.

Donaldson, F. J. 2007. Farmer beware: water rights enforcement in Utah. Journal of Land, Resources, and Environmental Law 27:367-385. <http://www.epubs.utah.edu/index.php/jlrel/article/viewFile/56/49>. Accessed 30 Oct 2016.

Economic Profile System. 2017. A profile of agriculture. Headwaters Economics. <https://headwaterseconomics.org/tools/economic-profile-system/>. Accessed 17 Jan 2017.

Godfrey, B. E. 2008. Livestock grazing in Utah: history and status. Utah State University, Logan, Utah.

Governor's Office of Energy Development. 2015. Energy and energy-related mining in Utah. <https://energy.utah.gov/wp-content/uploads/UtahsEnergyEconomy_EconomicImpactAssessment.2015.compressed.pdf>. Accessed 9 Jan 2017.

Governor's Office of Energy Development. 2017. Energy overview. <http://energy.utah.gov/resource-areas/energy-information/>. Accessed 9 Jan 2017.

Headwaters Economics. 2016. County payments: history, context, and policy. <https://headwaterseconomics.org/dataviz/county-payments/>. Accessed 9 Jan 2017.

Holzapfel, R. S. 1999. A history of Utah County. Utah State Historical Society. Utah County Commission. <http://digitallibrary.utah.gov/awweb/awarchive?item=34354>. Accessed 10 Dec 2017.

Hylland M. D., and W. E. Mulvey. 2003. Geologic hazards of Moab-Spanish Valley, Grand County, Utah. Special Study 107. Utah Geological Survey. <http://www.riversimulator.org/Resources/farcountry/Geology/GeoHaz/SS-107.pdf>. Accessed 15 Oct 2016.

Jakus, P. M., R. A. Ward, L. Coulibaly. 2013. The economic contribution of agriculture to the economy of Utah in 2011. Center for Society, Economy and the Environment. Paper #2013-01.<http://www.ag.utah.gov/documents/EconomicContributionOfAgriculture2011.pdf> Accessed 17 Jan 2017.

Leaver, J. 2016. The state of Utah's travel and tourism industry, 2015. Kem C. Gardner Policy Institute. University of Utah. <http://gardner.utah.edu/wp-content/uploads/2016/05/TourismReport-v7.pdf>. Accessed 17 Jan 2017.

Keith J., P. Jakus, J. Larsen, S. Burr, D. Reiter, and J. Zeitlin. 2008. Impacts of wild and scenic rivers designation. Utah State University. <http://digitallibrary.utah.gov/awweb/awarchive?type=file&item=27530> . Accessed 15 Oct 2016.

Kem C. Gardner Policy Institute. 2016. Utah County profile. University of Utah. <http://gardner.utah.edu/wp-content/uploads/2016/10/utah_49049_profile.pdf>. Accessed 18 Jan 2017.

Kim, M., and P. M. Jakus. 2013. The economic contribution and benefits of Utah's blue ribbon fisheries. Utah State University. <http://csee.usu.edu/files/uploads/CSEE_RR_4_Kim_and_Jakus_Feb_2013.pdf>. Accessed 15 Oct 2016.

Klauk, R. H. 1984. Summary of low-temperature geothermal studies conducted by the Utah Geological and Mineral Survey from July 1, 1977 to December 31, 1984. Utah Geological and Mineral Survey. <http://digitallibrary.utah.gov/awweb/awarchive?type=file&item=32102>. Accessed 25 Jan 2017.

Krannich, R. S. 2008. Public lands and Utah communities: a statewide survey of Utah residents. Utah State University. <http://apecextension.usu.edu/files/uploads/Environment%20and%20Natural%20Resources/Public%20Lands/General%20Population%20Final%20Report.pdf>. Accessed 25 Jan 2017.

Krannich, R. S., Lilieholm, R. J., and Unger J. 2012. Utah angler survey. Utah State University. <https://csee.usu.edu/files/uploads/CSEE_RR_1_Krannich_et_al_Nov_2012.pdf>. Accessed 15 Jan 2017.

May, W., R. Brain, and E. Stafford. 2013. Wind power in Utah. Utah State University Extension Sustainability. <http://extension.usu.edu/files/publications/publication/sustainability_2012-16pr.pdf>. Accessed 3 Jan 2017.

McAvoy, D., M. Kuhns, and J. Black. 2012. Utah forest types: an introduction to Utah forests. Utah State University Cooperative Extension. <http://extension.usu.edu/files/publications/publication/NR_FF_011.pdf>. Accessed 25 Jan 2017.

Milligan, M. 2005. Geosights: thistle landslide revisited, Utah County, Utah. Utah Geological Survey. Survey Notes 37(2). <http://geology.utah.gov/map-pub/survey-notes/geosights/thistle-landslide/>. Accessed 25 Jan 2017.

National Agricultural Statistics Service. 2016. Utah annual statistics bulletin. Utah Field Office. <https://www.nass.usda.gov/Statistics_by_State/Utah/Publications/Annual_Statistical_Bulletin/Pdf/ab16/pg67%20CE%20cattle.pdf>. Accessed 17 Jan 2017.

National Interagency Fire Center. 2015. Federal firefighting costs (suppression only). U.S. Department of the Interior. <https://www.nifc.gov/fireInfo/fireInfo_documents/SuppCosts.pdf>. Accessed 18 Jan 2017.

National Mining Association. 2016. The economic contributions of U.S. mining (2015 update). <http://nma.org/wp-content/uploads/2016/09/Economic-Contributions-of-Mining-in-2015-Update-final.pdf>. Accessed 3 Apr 2017.

National Oceanic and Atmospheric Administration [NOAA]. 2009. State of the science fact sheet: air quality. <https://esrl.noaa.gov/csd/factsheets/airqualitysos.pdf>. Accessed 27 Feb 2017.

National Parks Service. n.d. Timpanogos cave. <https://www.nps.gov/tica/index.htm>. Accessed 17 Jan 2017.

National Parks Service. 2016. National register of historic places program. <https://www.nps.gov/nr/nrlist.htm>. Accessed 17 Jan 2017.

National Resource Conservation Service [NRCS]. n.d. Tibble fork dam rehabilitation begins in Utah county. U.S. Department of Agriculture. <https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ut/newsroom/releases/?cid=NRCSEPRD1137831>. Accessed 17 Jan 2017.

National Resource Conservation Service [NRCS]. 2005. Utah County resource assessment. U.S. Department of Agriculture. <https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs141p2_032207.pdf>. Accessed 3 Nov 2016.

National Weather Service. n.d. Flooding in Utah. National Oceanic and Atmospheric Administration. <http://www.floodsafety.noaa.gov/states/ut-flood.shtml>. Accessed 17 Jan 2017.

National Wild and Scenic Rivers System. 2017. A compendium of questions and answers relating to wild & scenic rivers. <https://www.rivers.gov/documents/q-a.pdf>. Accessed 17 Jan 2017.

Office of Outdoor Recreation. 2013. The state of Utah outdoor recreation vision. <https://www.utah.gov/governor/docs/OutdoorRecreationVision.pdf>. Accessed 22 Jan 2017.

PacifiCorp. 2017. Spanish Fork wind park 2. <http://www.pacificorp.com/es/re/sf.html>. Accessed 25 Jan 2017.

Pope, C. A., J. Schwartz, and M. R. Ransom. 1992. Daily mortality and PM_{10} pollution in Utah Valley. Archives of Environmental Health: A International Journal 47(3).

Powell, A. K., editor. 1994. Utah history encyclopedia. Wildlife management in Utah. The University of Utah Press. Salt Lake City.

Rocky Mountain Power. 2017. Quick facts. PacifiCorp. <https://www.rockymountainpower.net/about/cf/qf.html>. Accessed 25 Jan 2017.

Rural Community Consultants. 2016. Utah County resource management plan map. GIS Data. <https://www.arcgis.com/home/item.html?id=77c50444092844d0850679c608e342e0>. Accessed 17 Jan 2017.

Southwick Associates. 2013. The economic contributions of outdoor recreation. Outdoor Industry Association. <https://outdoorindustry.org/images/ore_reports/oia-state-recreation-economy-technical-report-2013.pdf>. Accessed 10 Nov 2017.

Sutter, J. V., M. E. Andersen, K. D. Bunnell, M. F. Canning, A. G. Clark, D. E. Dolsen, and F. P. Howe. 2005. Utah comprehensive wildlife conservation strategy (CWCS). Utah Division of Wildlife Resources Publication Number 05-19. <http://iwjv.org/sites/default/files/utah_strategic_wildlife_action_plan.pdf>. Accessed 7 Jan 2017.

University of Utah, Bureau of Economic and Business Research. 2014. An analysis of a transfer of federal lands to the state of Utah. <http://publiclands.utah.gov/wp-content/uploads/2014/11/1.%20Land%20Transfer%20Analysis%20Final%20Report.pdf> Accessed Jan 18 2017.

U.S. Department of Agriculture [USDA] and Utah Automated Geographic Reference Center [AGRC]. 2009. Grazing improvement and allotment areas. <https://gis.utah.gov/data/farming/grazing-improvements/>. Accessed 28 Mar 2017.

U.S. Department of Agriculture [USDA]. 2011. Cattle and calves nonpredator death loss in the United States, 2010. USDA–APHIS–VS–CEAH. Fort Collins, CO. #631.1111. <https://www.aphis.usda.gov/animal_health/nahms/general/downloads/cattle_calves_nonpred_2010.pdf>. Accessed 5 Jan 2017.

U.S. Department of Agriculture [USDA]. 2012. Utah County profile. Census of Agriculture. <https://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/Utah/cp49049.pdf>. Accessed 1 Jan 2017.

U.S. Department of Agriculture [USDA]. 2015. Sheep and lamb predator and nonpredator death loss in the United States. USDA–APHIS–VS–CEAH–NAHMS Fort Collins, CO. #721.0915.. <https://www.aphis.usda.gov/animal_health/nahms/sheep/downloads/sheepdeath/SheepDeathLoss2015.pdf>. Accessed 7 Jan 2017.

U.S. Department of Agriculture [USDA]. 2016. November 2016 crop acreage data. Farm Service Agency. <https://www.fsa.usda.gov/news-room/efoia/electronic-reading-room/frequently-requested-information/crop-acreage-data/index>. Accessed 29 Nov 2016.

U.S. Department of the Interior. 1988. Proposed pony express resource management plan and final environmental impact statement. <https://www.blm.gov/style/medialib/blm/ut/natural_resources/planning/existing_lups6.Par.40049.File.dat/PONYFEIS.PDF>. Accessed 1 Jan 2017.

U.S. Department of the Interior. 2008. Record of decision and approved resource management plan. Price Field Office. <https://www.blm.gov/style/medialib/blm/ut/price_fo/Planning/rod_approved_rmp.Par.58259.File.dat/Price%20Final%20Plan.pdf>. Accessed 1 Jan 2017.

U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau. 2011. National survey of fishing, hunting, and wildlife-associated recreation. <https://www.census.gov/prod/2012pubs/fhw11-nat.pdf>. Accessed 18 Jan 2017.

U.S. Department of the Interior. 2017. Payment in lieu of taxes. <https://www.doi.gov/pilt>. Accessed 17 Jan 2017.

U.S. Environmental Protection Agency. 2015. What are wetland functions? <https://www.epa.gov/wetlands/what-are-wetland-functions>. Accessed 21 Oct 2016.

U.S. Fish & Wildlife Service. 2015. Endangered species act: overview. U.S. Department of the Interior. <https://www.fws.gov/endangered/laws-policies/>. Accessed 7 Jan 2017.

U.S. Fish & Wildlife Service. 2016. National wetlands inventory. U.S. Department of the Interior. <https://www.fws.gov/wetlands/data/Mapper.html>. Accessed 12 Oct 2016.

U.S. Forest Service [USFS]. 1997. Forest resource statistics for Northern Utah, 1993. <http://digitalcommons.usu.edu/govdocs_forest/72/>. Accessed 1 Jan 2017.

U.S. Forest Service [USFS]. 2003. Final eligibility determination of wild & scenic rivers. <https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsm9_002951.pdf>. Accessed 18 Jan 2017.

U.S. Forest Service [USFS]. 2003. Revised forest plan Wasatch-Cache National Forest. <https://www.fs.usda.gov/detail/uwcnf/landmanagement?cid=stelprdb5076923>. Accessed 18 Jan 2017.

U.S. Forest Service. 2008. Social and economic value of riparian environments. <https://www.fs.fed.us/rm/pubs_other/rmrs_2008_jones_g003.pdf>. Accessed 18 Jan 2017.

U.S. Forest Service [USFS]. 2015. Forest service and BLM announce 2015 grazing fee. <https://www.fs.fed.us/news/releases/forest-service-and-blm-announce-2015-grazing-fee >. Accessed 18 Jan 2017.

U.S. Forest Service [USFS]. 2016. Wildland fire touches every part of the nation. <http://www.fs.fed.us/fire/management/index.html>. Accessed 12 Oct 2016.

U.S. General Accounting Office. 1992. Wilderness: effect of designation on economy and grazing in Utah. <http://www.gao.gov/assets/220/217154.pdf>. Accessed 18 Jan 2017.

Utah Association of Counties. 2015. 2015 Utah counties fact book. <http://uacnet.org/wp-content/uploads/2014/08/2015-Utah-Counties-Fact-Book.pdf>. Accessed 17 Jan 2017.

Utah Automated Geographic Reference Center. 2016. National wetlands inventory - version 2 - surface waters and wetlands inventory. GIS Data. <http://www.fws.gov/wetlands/data/Data-Download.html>. Accessed 17 Oct 2016.

Utah County Bureau of Air Quality. 2011. Utah County environmental health. <http://www.utahcountyonline.org/dept/healthenvirair/index.asp>. Accessed 31 Jan 2017.

Utah County Planning Commission. 2014. Utah County general plan. County Legislative Body of Utah County, Utah. <http://www.utahcounty.gov/Dept/comdev/2014GeneralPlanUpdatedJan2015.pdf>. Accessed 17 Jan 2017.

Utah Department of Agriculture and Food [UDAF]. n.d. Animal agriculture. <http://ag.utah.gov/animal.html>. Accessed 3 Nov 2016.

Utah Department of Agriculture and Food [UDAF]. n.d. Century Farm registration. <http://ag.utah.gov/licenses-registrations/41-licenses-regulations-and-registration/201-century-farm-registration.html>. Accessed 4 Jan 2017.

Utah Department of Agriculture and Food [UDAF]. 2012. Planning for agriculture. Utah Agriculture Sustainability Task Force. <http://ag.utah.gov/documents/Agtaskforce.pdf>. Accessed 4 Jan 2017.

Utah Department of Agriculture and Food [UDAF]. 2015. Annual report. <http://ag.utah.gov/documents/annualreport2015web.pdf>. Accessed 3 Nov 2016.

Utah Department of Agriculture and Food [UDAF]. 2017. Brand inspection & registration. <http://ag.utah.gov/animal/animal-identification.html>. Accessed 4 Jan 2017.

Utah Department of Environmental Quality [UDEQ]. n.d. Water quality assessment program. <http://deq.utah.gov/ProgramsServices/programs/water/wqmanagement/assessment/PreviousIR.htm>. Accessed 17 Jan 2017.

Utah Department of Transportation. n.d. West Davis corridor wetlands fact sheet. <http://www.udot.utah.gov/westdavis/uploads/doc_pdf/Documentation_EIS_WetlandsFactSheet.pdf>. Accessed 17 Jan 2017.

Utah Division of Air Quality [UDAQ]. 2012. It's up to all of us (Video File). <https://www.youtube.com/watch?v=Vi9WF1FptG4>. Accessed 27 Feb 2017.

Utah Division of Air Quality. 2015. Annual report. Utah Department of Environmental Quality. <http://www.deq.utah.gov/Divisions/daq/info/annualreports/docs/2015/02Feb/Final_Annual_Report_2015.pdf>. Accessed 17 Jan 2017.

Utah Division of Oil, Gas, and Mining [DOGM]. 2017. Live data statistics. Utah Department of Natural Resources. <http://www.oilgas.ogm.utah.gov/Statistics/Statistics.cfm>. Accessed 17 Jan 2017.

Utah Division of Oil, Gas, and Mining [DOGM]. 2017. Utah minerals program. <http://linux3.ogm.utah.gov/WebStuff/wwwroot/minerals/mineralsfilesbypermitinfo.php>. Accessed 17 Jan 2017.

Utah Division of Forestry, Fire, & State Lands. 2013. Master cooperative wildland fire management and Stafford Act response agreement. Utah Department of Natural Resources. <https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5409791.pdf>. Accessed 18 Jan 2017.

Utah Division of Forestry, Fire & State Lands. 2014. Utah forest health highlights. Utah Department of Natural Resources. <http://www.ffsl.utah.gov/images/forestry/health/StateHighlights2014.pdf>. Accessed 18 Jan 2017.

Utah Division of Forestry, Fire & State Lands. 2016. Utah forest action plan. Utah Department of Natural Resources. <http://www.ffsl.utah.gov/images/forestry/stateassessment/UtahFAP-2016-LowRes.pdf>. Accessed 18 Jan 2017.

Utah Division of Water Rights [UDWRi]. 2011. Water right information. Utah Department of Natural Resources. <http://www.waterrights.utah.gov/wrinfo/>. Accessed 15 Oct 2016.

Utah Division of Water Rights [UDWRi]. 2014. Canal companies and contact information. Utah Department of Natural Resources. <https://www.waterrights.utah.gov/canalinfo/canal_owners.asp>. Accessed 15 Jan 2017.

Utah Division of Water Quality [UDWQ]. 2013. Nutrient pollution in Utah. Utah Department of Environmental Quality. <http://www.deq.utah.gov/Topics/FactSheets/docs/handouts/nutrients.pdf>. Accessed Jan 9 2017.

Utah Division of Wildlife Resources [UDWR]. n.d. Participating CWMU properties. Utah Department of Natural Resources. <https://wildlife.utah.gov/maps/public/list_cwmus.php>. Accessed 18 Jan 2017.

Utah Division of Wildlife Resources [UDWR]. n.d. Utah moose statewide management plan. <https://wildlife.utah.gov/hunting/biggame/pdf/moose_plan.pdf>. Accessed 22 Jan 2017.

Utah Division of Wildlife Resources [UDWR]. n.d. Utah's predator control program map. <https://wildlife.utah.gov/pdf/predator_program_map.pdf>. Accessed 22 Jan 2017.

Utah Division of Wildlife Resources [UDWR]. 2009. Utah aquatic invasive species management plan. Utah Department of Natural Resources Publication No. 08-34.. <https://wildlife.utah.gov/pdf/AIS_plans_2010/AIS_mgt_plan_full.pdf>. Accessed 15 Oct 2016.

Utah Division of Wildlife Resources [UDWR]. 2011. Utah black bear management plan v. 2.0 2011-2023. Utah Department of Natural Resources. <https://wildlife.utah.gov/bear/pdf/2011_bear_plan.pdf>. Accessed 7 Jan 2017.

Utah Division of Wildlife Resources [UDWR]. 2012. Elk herd unit management plan. <https://wildlife.utah.gov/public_meetings/info/2012-05_elkplans.pdf>. Accessed 7 Jan 2017.

Utah Division of Wildlife Resources [UDWR]. 2014. Utah's predator control program summary: Program activities and data from July 1, 2013 through June 30, 2014. Utah Department of Natural Resources. <https://wildlife.utah.gov/pdf/predator_program_summary_2014.pdf>. Accessed 7 Jan 2017.

Utah Division of Wildlife Resources [UDWR]. 2015. Blue ribbon: Lower Provo River. <https://wildlife.utah.gov/hotspots/brwaterbody.php?id=31>. Accessed 18 Jan 2017.

Utah Division of Wildlife Resources [UDWR]. 2015. Utah wildlife action plan; 2015-2025. Utah Department of Natural Resources. DWR publication 15-14. <https://wildlife.utah.gov/wap/Utah_WAP.pdf>. Accessed 3 Nov 2016.

Utah Division of Wildlife Resources [UDWR]. 2015. Utah's state listed species by county. <http://dwrcdc.nr.utah.gov/ucdc/ViewReports/sscounty.pdf>. Accessed 7 Jan 2017.

Utah Division of Wildlife Resources [UDWR]. 2016. 2016 Utah black bear guidebook. <https://wildlife.utah.gov/guidebooks/2016_pdfs/2016_bear_low.pdf>. Accessed 7 Jan 2017.

Utah Division of Wildlife Resources [UDWR]. 2016. Deer herd unit #17. Deer Herd Unit Management Plan. <https://wildlife.utah.gov/hunting/plans/deer_17.pdf>. Accessed 7 Jan 2017.

Utah Economic Council. 2014. Utah economic outlook. <http://www2.eccles.utah.edu/sites/default/files/media/outlook.pdf>. Accessed 27 Feb 2017.

Utah Geological Survey. n.d. Liquefaction information & county liquefaction maps. <http://geology.utah.gov/hazards/earthquakes-faults/liquefaction/>. Accessed 17 Jan 2017.

Utah Geological Survey. n.d. Wetland information center. Utah Department of Natural Resources. <http://geology.utah.gov/resources/wetlands/>. Accessed 12 Oct 2016.

Utah Geological Survey. 2010. Geologic investigations of the Wasatch fault zone in Salt Lake City. <http://files.geology.utah.gov/online/pdf/wasatchfaultstudy_slc.pdf>. Accessed 15 Jan 2017.

Utah Heritage Foundation. 2013. Profits through preservation: executive summary. <http://www.utahheritagefoundation.com/preservation-resources/econstudy#.WH7MV1UrKpo>. Accessed 3 Jan 2017.

Utah Lake Commission. 2009. Procedures of sovereign land management. Utah Lake Master Plan. <http://www.ffsl.utah.gov/images/statelands/utahlake/ProceduresOfSovereignLandMgmt. pdf>. Accessed 3 Jan 2017.

Utah Lake Commission. 2014. Phragmites removal 2014. <http://utahlake.gov/phragmites-removal-2014/>. Accessed 3 Jan 2017.

Utah Native Plant Society. n.d. Rare plants introduction. <http://www.unps.org/index.html?PAGES/rare.html>. Accessed 10 Jan 2017.

Utah Petroleum Association. n.d. Petroleum refining. <http://www.utahpetroleum.org/refining.php>. Accessed 3 Jan 2017.

Utah School and Institutional Trust Lands Administration [SITLA]. n.d. What are trust lands? <https://trustlands.utah.gov/our-agency/what-are-trust-lands/>. Accessed 17 Jan 2017.

Utah School and Institutional Trust Lands Administration [SITLA]. 2016. Land ownership GIS data obtained July 28, 2016. <https://gis.utah.gov/data/sgid-cadastre/land-ownership/>. Accessed 25 Jan 2017.

Utah Seismic Safety Commission. 2008. Putting down roots in earthquake country. Utah Geological Survey. <https://www.utah.gov/beready/documents/roots_earthquake_low.pdf>. Accessed 3 Jan 2017.

Utah State Parks. n.d. Land and water conservation fund state-side grant program. Utah Department of Natural Resources. <http://stateparks.utah.gov/resources/grants/land-and-water-conservation-fund/>. Accessed 3 Jan 2017.

Utah State Parks. 2017. Park visitation data. Utah Department of Natural Resources. <http://stateparks.utah.gov/resources/park-visitation-data/>. Accessed 3 Jan 2017.

Utah State University [USU]. 2009. Rangeland resources of Utah. USU Cooperative Extension Service.<https://extension.usu.edu/utahrangelands/files/uploads/RRU_Final.pdf>. Accessed 3 Nov 2016.

Utah Weed Control Association. 2017. Cooperative weed management areas. <http://www.utahweed.org/cwma.htm>. Accessed 4 Apr 2017.

Van Hooser, D. D., and A. W. Green. 1983. Utah's forest resources, 1978. U.S. Forest Service. <https://svinet2.fs.fed.us/rm/ogden/pdfs/historic_pubs/utah_1978.pdf>. Accessed 17 Jan 2017.

Ward, R. A. and K. Salisbury. 2016. The economic contribution of agriculture to the Utah economy in 2014. Utah State University. Economic Research Institute Report #2016-01. <http://www.ag.utah.gov/documents/Economic%20Contribution%20of%20Agriclture%20to%20the%20Utah%20Economy%202014.pdf>. Accessed 27 Jan 2017.

Western Forestry Leadership Coalition. 2009. The true cost of wildfire in the Western US. Lakewood, Colorado. <https://www.blm.gov/or/districts/roseburg/plans/collab_forestry/files/TrueCostOfWilfire.pd f>. Accessed 18 Jan 2017.

Whitesides, R. E. 2004. The Utah strategic plan for managing noxious and invasive weeds. Utah Weed Advisory Council and The Utah Weed Control Association. <http://www.utahweed.org/PDF/strategic_plan.pdf>. Accessed 31 Jan 2017.

Wikipedia contributors. 2016. Lake side power station. Wikipedia, The Free Encyclopedia. <https://en.wikipedia.org/w/index.php?title=Lake_Side_Power_Station&oldid=738739910>. Accessed 22 Feb 2017.

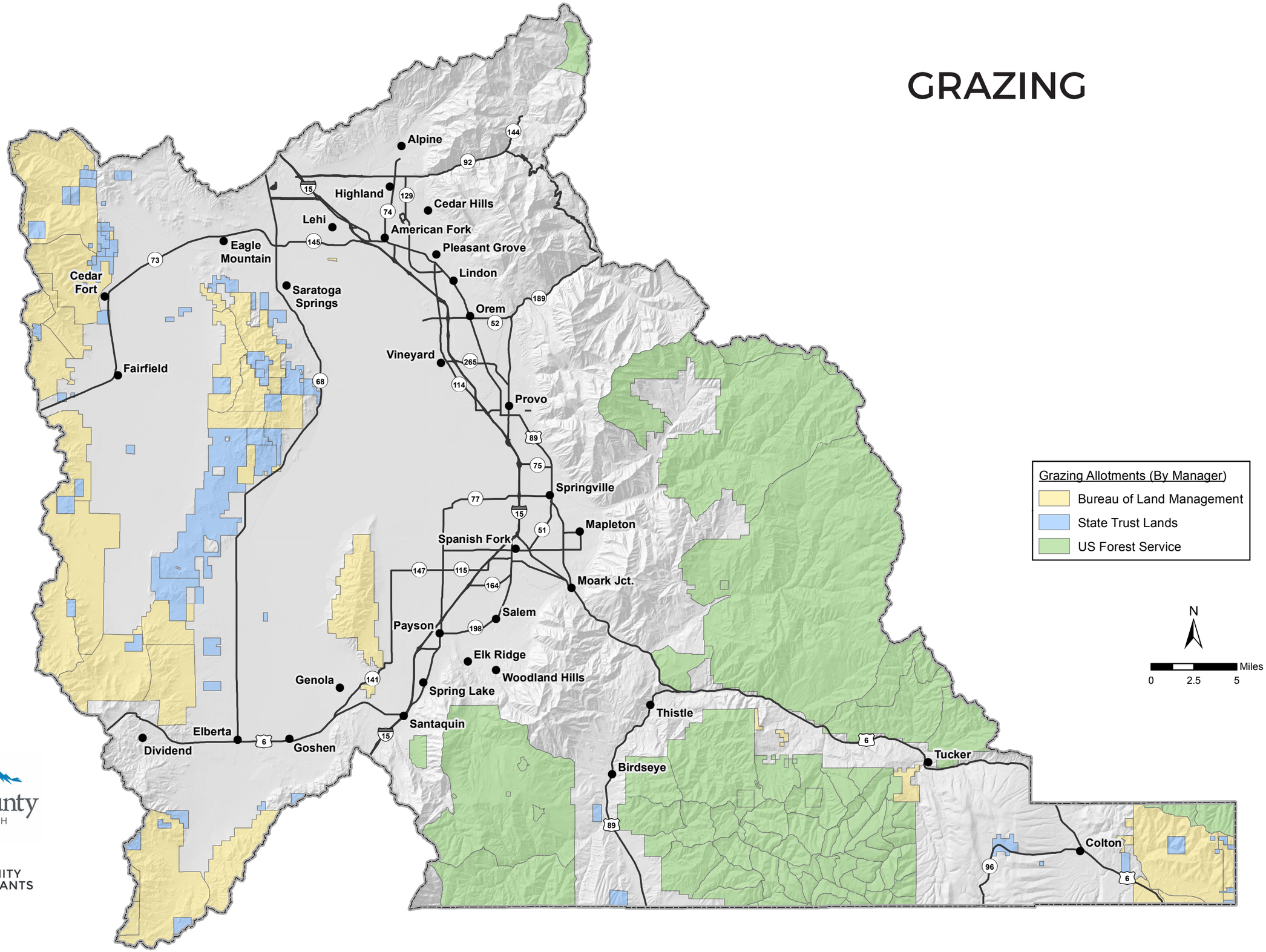
World Health Organization. 2014. Ambient (outdoor) air quality and health: fact sheet N°313. <http://who.int/mediacentre/factsheets/fs313/en/>. Accessed 25 Feb 2016.

Yonk, R., B. C. Steed, and R. Simmons. 2010. The local impact of wilderness: an overtime analysis of wilderness designation. Utah State University. <http://www.usu.edu/ipe/wp-content/uploads/ipePublications/Local-Impact-of-Wilderness.m;lf>. Accessed 30 Oct 2016.

Appendix B- Maps

1. Grazing
2. Land Access
3. Landownership
4. Recreation
5. Vegetation
6. Water Resources

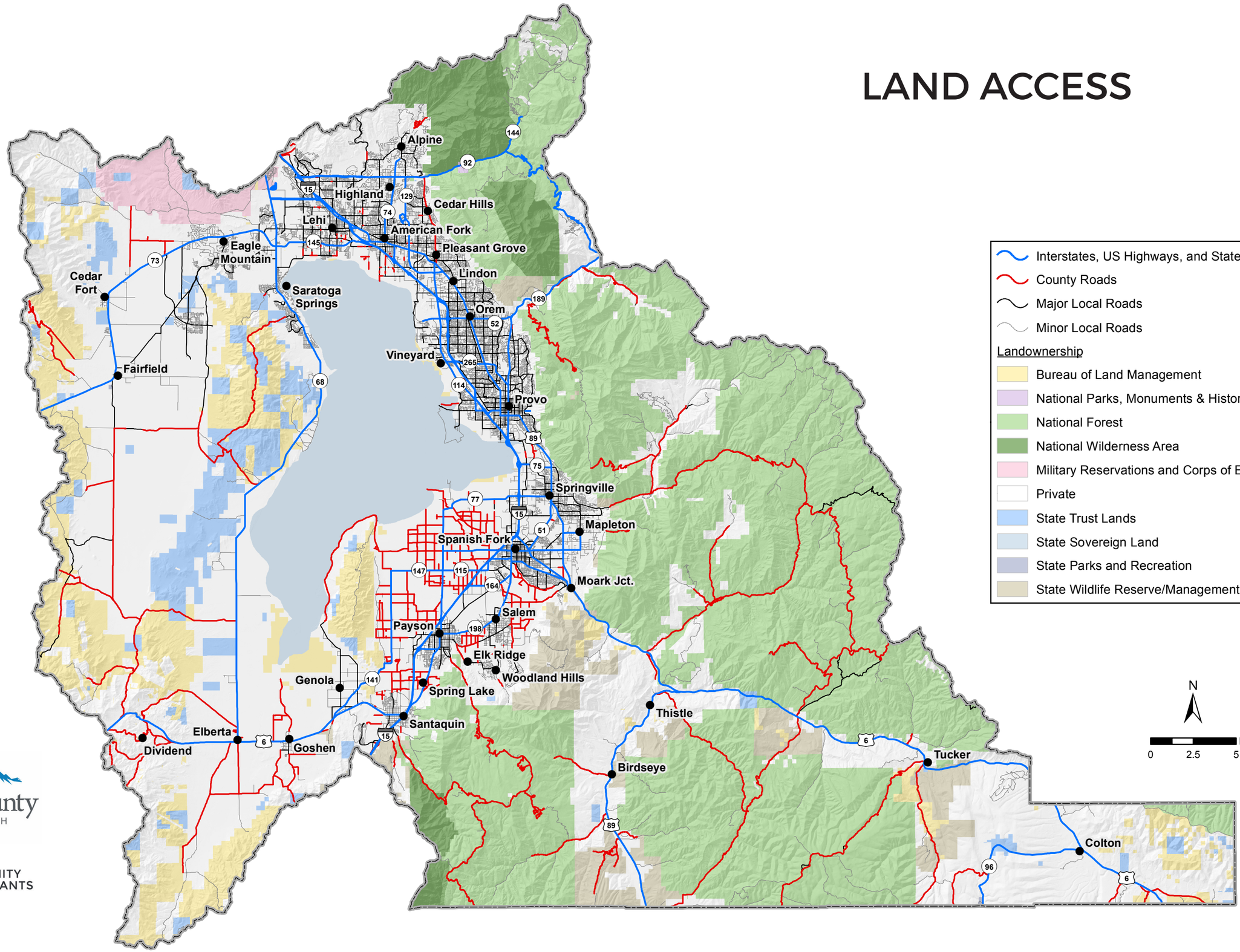
GRAZING



Utah County
HEART of UTAH

RURAL COMMUNITY CONSULTANTS

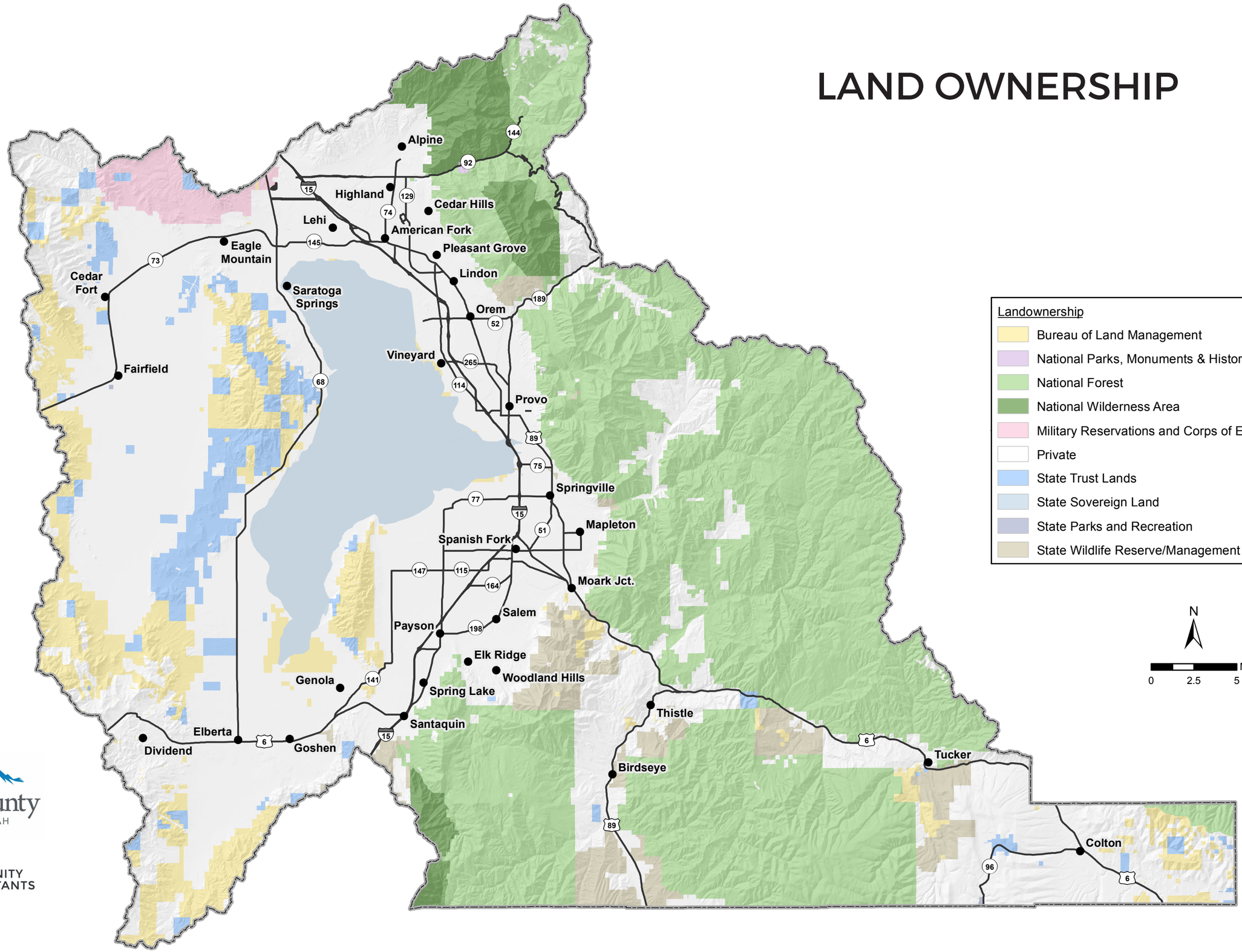
LAND ACCESS



Utah County
HEART of UTAH

RURAL COMMUNITY CONSULTANTS

LAND OWNERSHIP



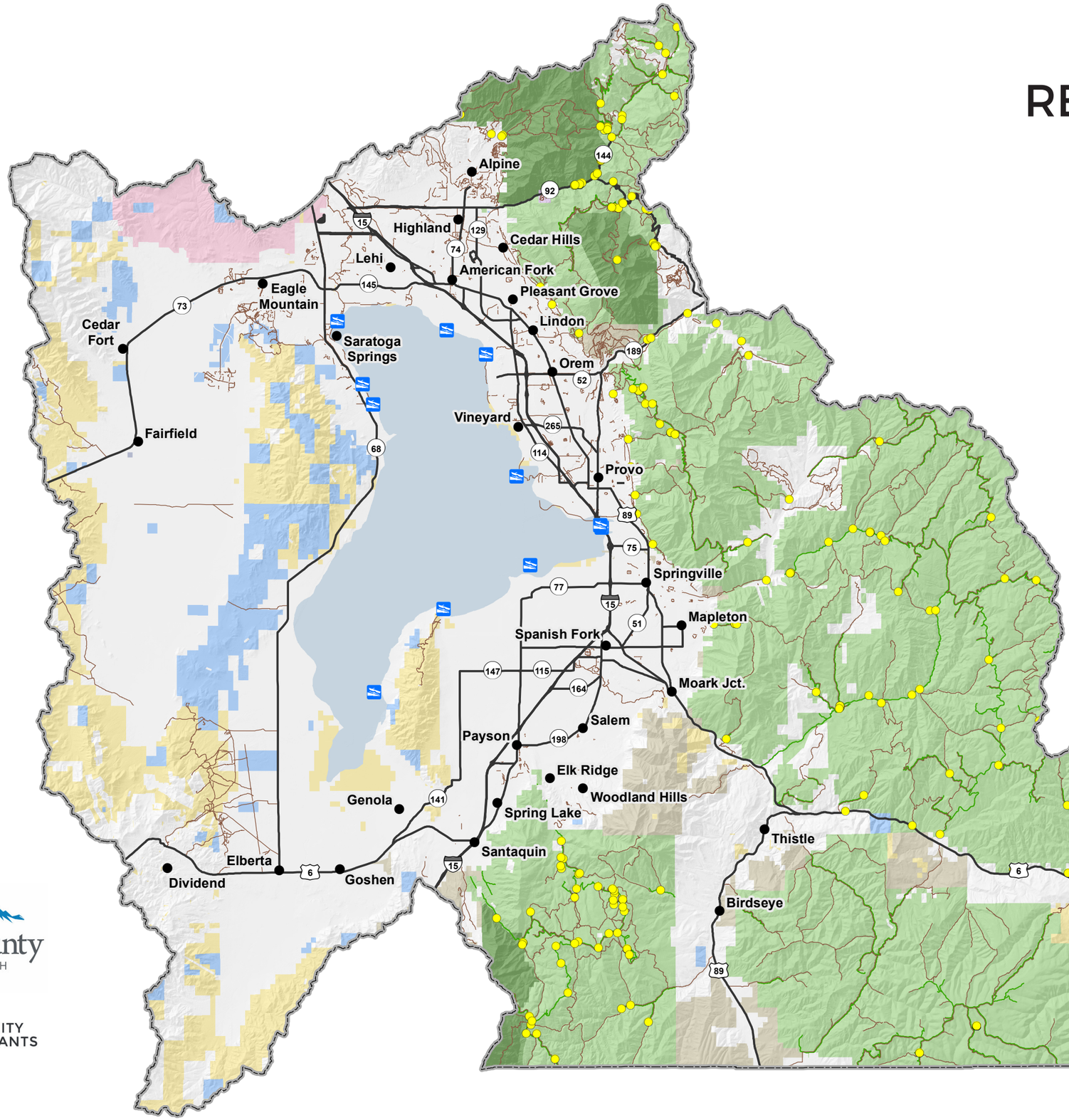
Landownership

- Bureau of Land Management
- National Parks, Monuments & Historic Sites
- National Forest
- National Wilderness Area
- Military Reservations and Corps of Engineers
- Private
- State Trust Lands
- State Sovereign Land
- State Parks and Recreation
- State Wildlife Reserve/Management Area

Utah County
HEART of UTAH

RURAL COMMUNITY CONSULTANTS

RECREATION



- US Forest Service Recreation Sites
- Boat Ramps
- Trails
- US Forest Service Roads (MVUM)

Landownership

- Bureau of Land Management
- National Parks, Monuments & Historic Sites
- National Forest
- National Wilderness Area
- Military Reservations and Corps of Engineers
- Private
- State Trust Lands
- State Sovereign Land
- State Parks and Recreation
- State Wildlife Reserve/Management Area

N

0 2.5 5 Miles

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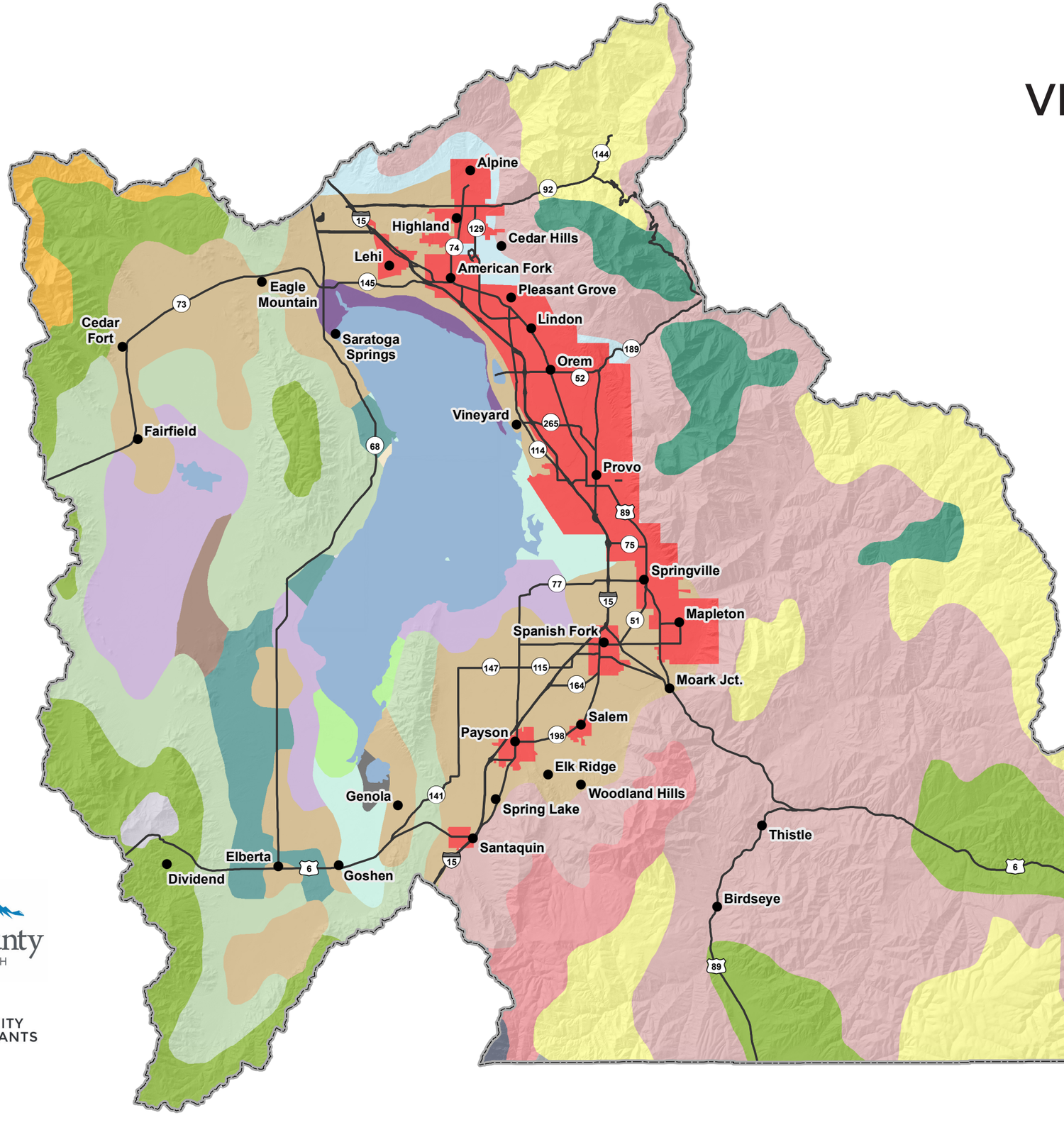
VEGETATION



Dominant Vegetation

- Alkali
- Aspen
- Bitterbrush
- Bluegrass
- Cheatgrass
- Cities
- Cultivated Land
- Douglas Fir
- Dropseed
- Greasewood
- Maple
- Mt. Mahogany
- Oak
- Ponderosa Pine
- Sagebrush
- Saltgrass
- Sedges
- Serviceberry
- Shadscale
- Tamerisk
- Utah Juniper
- Wheatgrass
- White Fir
- Water

N

0 2.5 5 Miles

Utah County
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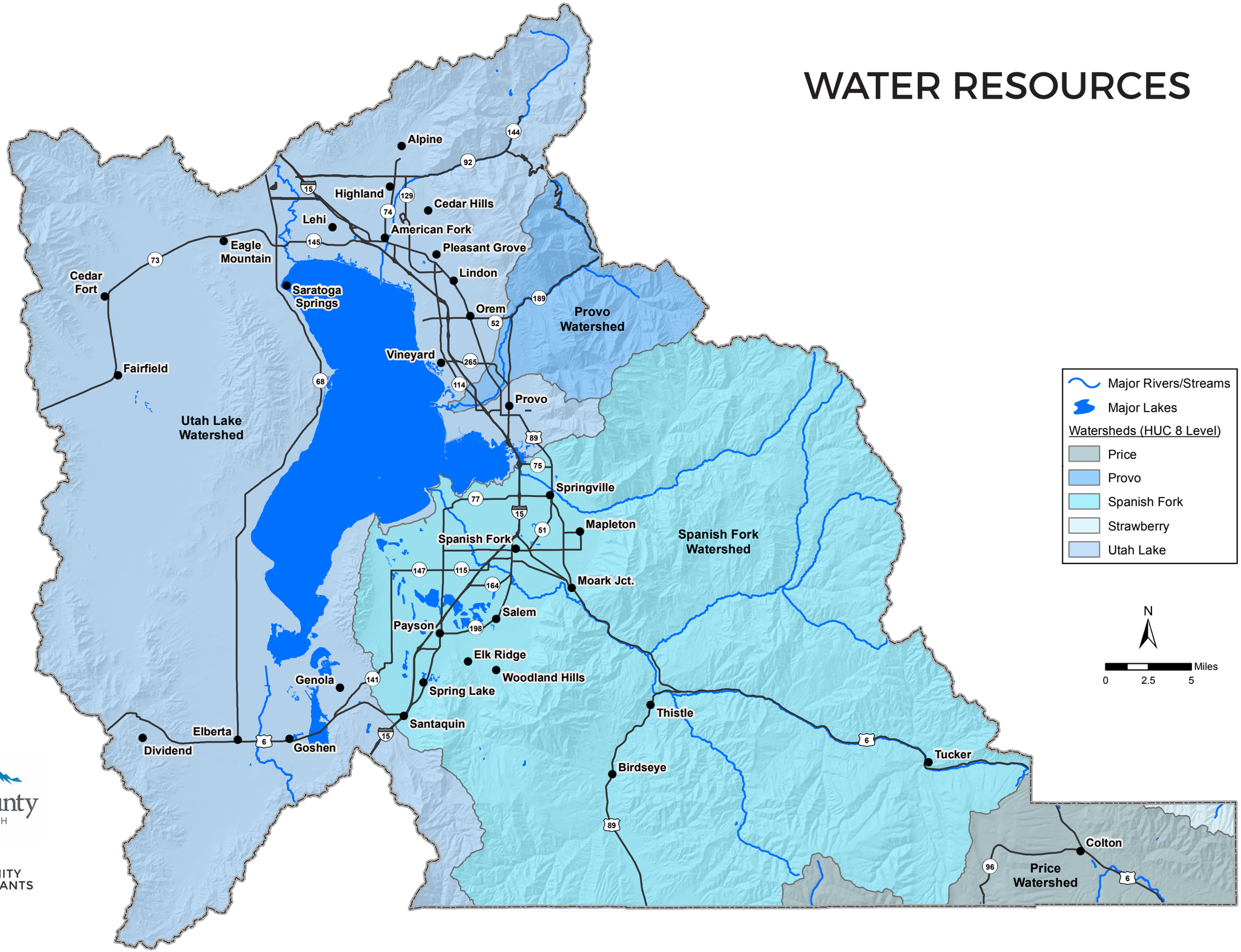
WATER RESOURCES



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