Nevada Forest, Range & Watershed Action Plan

2020

NEVADA
DIVISION OF FORESTRY
Protecting your range, forest, and watershed.

NEVADA DEPARTMENT OF
CONSERVATION & NATURAL RESOURCES

“The nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased and not impaired in value.” - *President Theodore Roosevelt*

Acknowledgements

The contents of this Forest, Range, and Watershed Action Plan (FRWAP) are the sole responsibility of the Nevada Division of Forestry. However, the process leading to the document's final creation was a collaborative effort with many valuable contributions of time, energy and input from multiple entities in addition to our own excellent personnel. The Nevada Division of Forestry thanks the following entities for their participation and guidance in the production of this assessment:

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Executive Summary

Land managers in Nevada seek to create healthy and resilient landscapes through public and private partnerships in urban, rural and wildland areas across Nevada that sustain necessary water supplies, local economies, human health, and wildlife habitat for present and future generations of Nevadans. Nevada's forests, rangelands and watersheds are under threats and need protection through management actions. This Forest, Range, and Watershed Action Plan (FRWAP) provides the status of ecosystems in Nevada with the specific key issues and threats to those ecosystems. The plan contains a road map to help all stakeholders efficiently and effectively mitigate and manage threats through a set of comprehensive, long-term, and coordinated goals and strategies for investing resources to address landscape management priorities in Nevada. Providing a framework and analyses to establish priority landscapes, this FRWAP is intended to focus energy and investment in natural resource and wildland fire management projects, enhancing effective impact. As resource managers, we will know we are impactful when proactive measures to restore healthy ecosystem functions are prioritized and implemented, creating ecosystem conditions that naturally mitigate threats for the well-being of society.

Planning Process

This plan meets the requirements set forth in the 2008 Food, Conservation, and Energy Act (Farm Bill) and subsequent Farm Bills. This FRWAP reflects the required 10-year update of the original Forest Action Plan (Assessment and Strategies) completed in 2010. Changes in this update include the following:

1. Restructuring to increase utility and information flow
2. Expansion of coverage to non-forested or woodland ecosystems
3. Expansion from Non-federal landownership to all landownerships
4. Enhanced wildfire management, special status species information, analysis, and strategy
5. Updated examples of actions taken in Nevada that address the USFS State and Private Forestry Priorities and Objectives
6. Enhanced stakeholder and public review process

These changes reflect a shared commitment in Nevada to pursue an "all hands, all lands" approach through a collaborative natural resource and wildland fire management process that has been pursued since 2015. The Nevada Cohesive Strategy and the Nevada Shared Stewardship Agreement directives are being actively pursued by a variety of stakeholders. In keeping with this approach, this planning process was enhanced because of those collaborative efforts, as well as the engagement of those same stakeholders and public involved in the development process. The plan was guided by stakeholder and public comments, as well as independent investigation. Information and data from other plans were incorporated to make this plan more effective and comprehensive; plans consulted include, but are not limited to:

- Bureau of Land Management – Land Use Plans
- US Forest Service – National Forest Plans
- Programmatic Environmental Impact Statements
- Community Wildfire Protection Plans
- Species Habitat Conservation Plans
- Multi-jurisdictional fuel reduction plans
- Conservation Districts - Resource Needs Assessments
- Nevada Wildlife Action Plan
- Nevada Wildland Fire Cohesive Strategy Action Plan
- Nevada Shared Stewardship Agreement
- Non-point Source Pollution and Source Water Protection Plans

Plan Structure and Purpose

This plan contains five primary sections that address required and supplemental information in compliance with the national standards for State Forest Action Plans (Figure 1). Each section provides foundational information for people that need additional background information. The reader is encouraged to seek knowledge from this plan, utilizing it to coordinate better with others to implement well-guided natural resource management actions, at impactful scales, in the highest priority locations in the State. The FRWAP has been, and will be used for the following purposes:

- Educating the public and new natural resource management employees
- Informing local and regional natural resource assessments, climate adaptation plans, and other land use planning documents
- Informing and participating in agency and cooperator strategic planning to create shared priorities
- Guiding resource investments and actions to meet priorities
- Informing policy makers and evaluating the merits of policy and investment proposals
- Orienting collaborative natural resource management efforts toward addressing USFS State and Private Forestry's National Goals and Objectives
- Qualifying Nevada to receive funds through USFS State and Private Forestry programs, as well as the Cooperative Assistance Act of 1978

INTRODUCTION	• The introduction provides a broader historical and contextual setting of Nevada and its natural resources
ASSESSMENT	• The assessment section provides a description of the conditions, trends, benefits and uses of each major ecosystem
KEY ISSUES THREATS STRATEGIES	• The key issues, threats, and strategies section provides key threats and issues negatively impacting ecosystems and the goals and strategies used to address them • This section also provides a list of the contributing programs supporting implementation
PRIORITY LANDSCAPE AREAS	• The priority landscapes section provides a designation of priority landscape areas based on spatial analysis of ecosystem threats, values, and opportunities for collaboration • This section also provides a description of the current extent and status of natural resource threats and issues within each priority landscape
IMPLEMENTATION	• The implementation section provides approaches, capabilities, capacities, targets for key accomplishments, limitations and resources required for successful plan implementation, monitoring and tracking

Figure 1. Forest, Range and Watershed Action Plan structure and function.

Plan Summary

Within the Introduction of this plan we explore Nevada's unique character and describe the colorful history, ecosystems, natural resources, values, traditions, cultures and politics of the state. In the Assessment section we explore the interactions of people and natural resources over time that have shaped land ownership patterns, uses, impacts and societal values at all scales, including both national and international. Further, in the Strategy section we analyze these interactions and their outcomes on the conditions, trends, benefits, services, as well as wildlife populations and habitats within nine broad terrestrial ecosystems that include:

- High Elevation Forests
- Quaking Aspen Woodlands
- Mixed Conifer Forests
- Pinyon-Juniper Woodlands
- Riparian Wetlands
- Sagebrush Ecosystems
- Other Cold Desert Shrublands and Grasslands
- Warm and Hot Deserts
- Urban and Community Forests

Within the Key Issues, Threats and Strategies section, we summarize the eight key issues and threats that were found to be most impactful in varying numbers of these ecosystems. These key issues and threats were explored for influences and intersections with climate change, plant and animal habitats under pressure, landownership fragmentation, and invasive weeds. The resulting analysis of these key issues and threats was used to evaluate and establish their primary causes, values-at-risk, challenges associated with addressing them, as well as the development of goals and strategies to most effectively reduce, eliminate, mitigate or avoid negative impacts to ecosystems. In total, there are 30 goals that can be achieved through the implementation of 100 strategies as indicated below. Each strategy has an accompanying performance measure that will allow stakeholders to monitor progression of the strategy implementation and toward attainment of associated goals.

Table 1. Summary of the number of goals and strategies per key issue or threat.

Key Issue or Threat	No. of Goals	No. of Strategies
1. Forest and Woodland Health	4	11
2. Wildfire Hazards	5	21
3. Urban and Community Forests	5	18
4. Riparian-Wetland Systems	4	14
5. Sagebrush Ecosystems	3	6
6. Species Requiring Specialized Conservation	1	8
7. Water Quality and Quantity	4	10
8. Climate Change Mitigation	4	14

In an effort to focus attention and investment of time, energy and resources into geographic areas of the state, the Priority Landscapes section provides a comprehensive geospatial analysis using 29 available data sets selected for their ability to address threats to ecosystems, values at risk, and collaborative opportunities across the state. The resulting priority map was used to designate 22 Priority Landscapes with similar geography, hydrography, ecosystems and other characteristics that account for approximately 60 percent of the land area in Nevada. Each of these Priority Landscapes specific characteristics is further described, including geography, ecosystems, land uses, threats, values, resource management plans, stakeholders and resource management cooperators. Priority Landscapes are also directly related to the applicable goals and strategies in the Assessment section to empower cooperators and stakeholders to implement effective approaches within those landscapes. There are other Priority Areas designated with the Priority Landscapes section that are specific to the US Forest Service State and Private Forestry programs such as the Forest Legacy, Stewardship and Multi-State programs that provide financial and other forms of assistance to landowners through the State of Nevada.

The Implementation section of this plan provides the preferred and, in some cases, directed approaches that agency leaders are asking staff and cooperators to use to accomplish identified targets. It is recognized that leadership, strategy, and delivery are key components of realizing action and the outcomes desired to manage, protect, and enhance our natural resources and associated values at risk. Equally important is the unification of these components with partners and stakeholders to ensure collaborative and consensus-based processes that produce sustainable outcomes. Key elements of the capability assessment and development in the Implementation section includes process design, delivery systems, technological support, equipment inventories, plus skillset and work force capacity. An assessment of the current capability and capacity was performed in an attempt to contrast the current and targeted accomplishment levels. These accomplishment levels were identified by utilizing available accomplishment records from the primary land and natural resource management stakeholders and partners across the state and then incorporating targets established in the Nevada Agreement for Shared Stewardship and other sources. There were nine performance areas and 21 performance metrics identified in the table below that can be monitored for progression, gauging the overall impact of strategy implementation on natural resource and wildfire management, particularly as they relate to dependent values at risk.

Table 2. Performance areas and metrics to monitor implementation and progression

Performance Areas	Performance Metrics
Land Treatment	• Acres Treated or Restored (seeding, planting, prescribed fire, fuel reduction, weed treatments)
Planning/permitting	• New acres under treatment, stewardship or other plans (NEPA or otherwise approved) • Community wildfire protection plans updated
Public and stakeholder education/training	• Individuals educated in fire prevention or conservation education events
Safe and Effective Fire Response	• Early detection cameras/lookouts • Early detection post-lightning aerial/remote sensing reconnaissance • Average wildland fire initial attack success • Initial Attack Fire Response quantity
Urban Environments	• Communities assisted with urban forestry • Urban forest management plan updates
Natural resource related industry and economic health	• Agricultural Production Acres Improved • Mines in production • Renewable energy developments in production • Outdoor recreation jobs supported • Livestock/Wildlife Water Source Improvements
Recreational opportunities afforded	• Developed and maintained recreation sites • Developed trails (motorized and non-motorized) • Hunting and fishing licenses sold
Fish and wildlife protection and conservation	• Special status species listed • Special status species managed/assessed
Collaborative planning and management	• Local area or issue working groups assembled, facilitated, and functional

In many cases the re-focusing, or expansion of existing resources is required to achieve targets in this plan. Of the 21 metrics, only six of them target *no change*, suggesting performance is at a desirable level, while the other 15 require modest to significant increases in accomplishments. Increased accomplishments will require additional resources where re-focusing and prioritization cannot overcome the gap between present and targeted performance. Limitations identified in this plan are qualitative, not quantitative; including capacity for supporting legal, financial, planning, implementation, monitoring, coordination and collaboration. Such limitations are almost always tied to constraints in funding, technology, and science. It will depend on every partner, at every level, to determine and communicate the needs and limitations when they engage a strategy or performance area. This process will be critical to the development of support requests from the broader coalition of partners engaged, helping fill gaps as they are identified. Finally, monitoring will be essential for all partners to perform, so quality data can be used to determine strategy effectiveness and impact of investments on desired outcomes.

We hope this Forest, Range and Watershed Action Plan provides a toolset for all stakeholders in Nevada to become more impactful in actions conserving Nevada's natural resources, making the state a more prosperous place to live, work, and recreate.

Introduction to Nevada's Natural Resources

Introduction to Nevada's Natural Resources

Nevadans, past and present, have overcome the hardships that arid valley and steep mountain environments can impose on human enterprise. To the casual observer, a vast majority of the state may appear vacant, wide-open, and wild. A closer look reveals that the land and all it bears has long been put to productive and recreational uses. Land here is grazed by livestock; irrigated and farmed; logged for wood products and fuel; mined for gold, silver, copper, and other metals; drilled for oil and geothermal energy; developed for rural and urban communities, industry, and transportation; and, enjoyed by a wide variety of outdoor recreationists. However, the dry climate and rugged landscape leave little margin for excessive use or neglectful management of the soil, water, vegetation, and wildlife. Decisions about resource utilization, especially water, greatly impact ecosystem health and the socioeconomic well-being of communities. Sustaining resources harvested and extracted for food, fiber, energy, and minerals depends upon careful and vigilant stewardship of the environment by all individuals and institutions.

Nevada is diverse, with habitats varying from low deserts to alpine communities across an elevation change of nearly 13,000 feet. The primary goal of this plan is to help guide stakeholders and partners in their pursuit to restore and sustain healthy forests, rangelands, watersheds and habitat which encompass a great diversity of ecosystems and land uses throughout the state. This section describes important historical, political, and physical features to help readers understand the broader context of the challenges and opportunities in managing Nevada's natural resources. There was extensive research in these subjects that provided the information presented, including the use of geographic information systems (GIS) and the associated data to visualize and provide interpretations of data collected, developed and distributed by many cooperators.

Nevada's Land and Natural Resources

Land Ownership

Nevada's borders enclose about 70,722,108 acres, making it the seventh largest state in the United States. The federal government controls approximately 61,283,130 acres or 87 percent of the land. Of the remaining 13 percent (or 9,129,387,331 acres), 12.7 percent is privately owned, two percent is tribal, 0.1 percent local government, 0.2 percent is state government, and 0. 4 percent is unclassified lakes and reservoirs (Table 3 and Figure 2). On a percentage basis, Nevada has more federal land than any other state. Tribal land is not federally owned but is held in trust by the federal government for the tribes. At least 90 percent of the land in Esmeralda, Lander, Lincoln, Nye, and White Pine counties is federally managed. Fifty percent or more of the land in every Nevada county is federally managed, except the two smallest (Storey and Carson City). The state's size and diversity among landowners presents many challenges and opportunities in managing the forest and natural resources of the state.

Today, there are approximately 8,934,817 acres of private land in Nevada, an area almost the same size as the state of New Hampshire. Given the geographical size difference between Nevada—the seventh largest state—and New Hampshire—the 44th largest or conversely the sixth smallest state—a quick comparison demonstrates how public land ownership spatially affects Nevada residents. Assuming that all Nevada residents live on private lands, Nevada's population density is 217 persons per square mile while New Hampshire's is 137 persons per square mile. These data indicate how clustered Nevada's human populations are and are largely surrounded and separated by large swaths of public lands, emphasizing how properly managing the Wildland Urban Interface (WUI) in Nevada is essential to the health of wild lands in the state.

Table 3. Lands owned and managed by category and associated acreages in Nevada.

Landowner (as of 2019)	Acres	% of Total Land Area
Bureau of Indian Affairs	1,321,876	1. 9%
Bureau of Land Management	47,242,025	67. 1%
Bureau of Land Reclamation	473,612	0. 7%
Department of Defense	3,332,041	4. 7%
Department of Energy	880,081	1. 2%
Fish and Wildlife Service	1,503,392	2. 1%
Forest Service	5,756,381	8. 2%
Local & Municipal	78,646	0. 1%
National Park Service	773,722	1. 1%
Nevada State Lands	115,924	0. 2%
Private Lands	8,934,817	12. 7%
Major Waterbodies	309,591	n/a
Totals	**70,722,108**	**100. 0%**

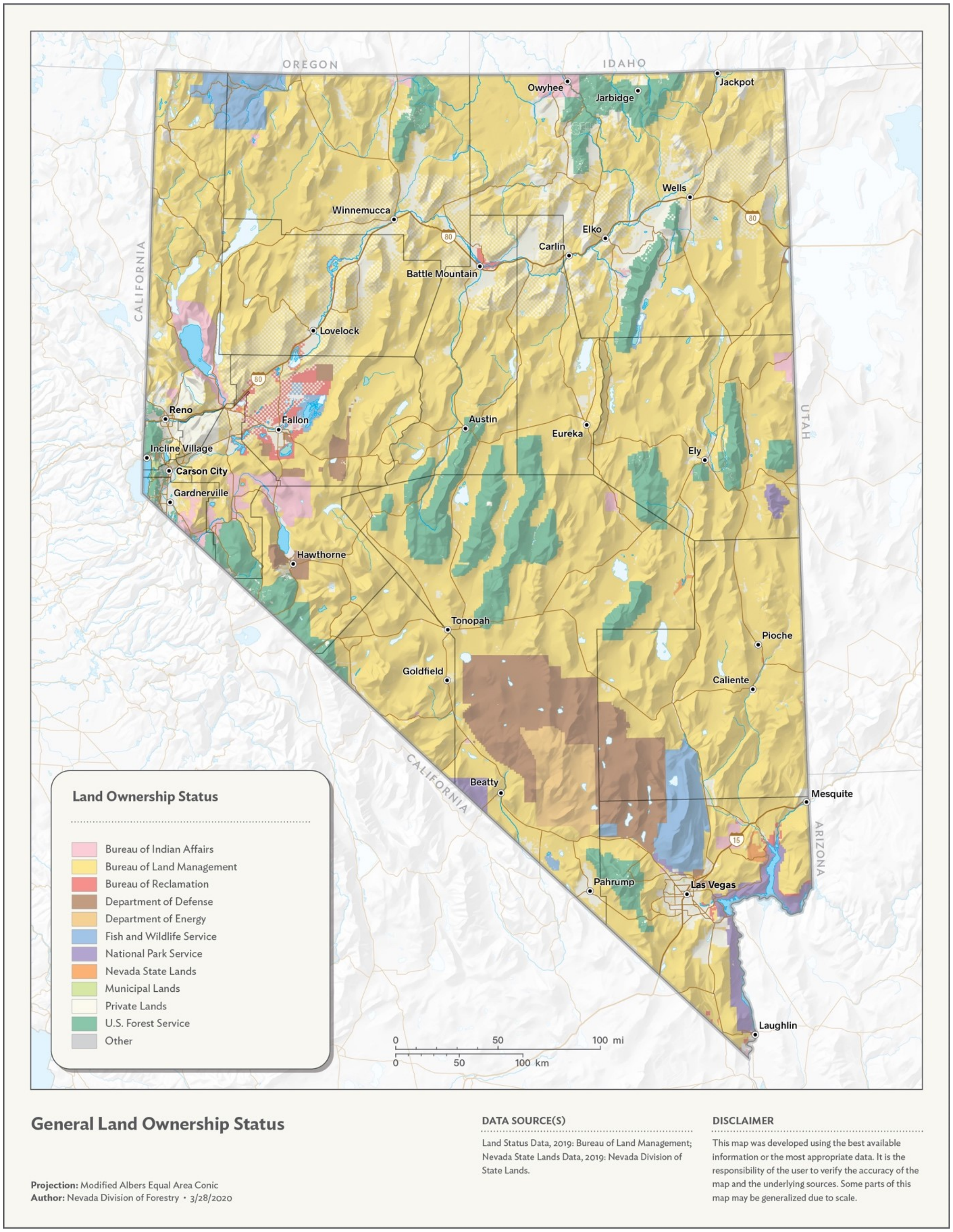

Figure 2. Map of land ownership in Nevada.

Ownership Patterns

At the time of statehood in 1864, Nevada was granted 3.9 million acres, consisting of the 16th and 36th sections of each township. Under the Exchange Act of 1880, Congress agreed to let Nevada exchange its 3.9 million acres for 2 million acres selected by the state. Thus, Nevada relinquished about half of the state grant land in order to select surveyed land and more desirable locations. The selected land generally was located near existing settlements, mines and reliable surface water resources. Almost all state grant lands were patented to private landowners.

Additional private land for Nevada was obtained in the 1860's when the federal government granted the Central Pacific Railroad Company the odd numbered legal sections of land (each about one square mile) in a corridor extending twenty miles on each side of the railroad. This public land transfer totaled 5,086,683 acres, making this the primary source of private land in Nevada. The "checkerboard pattern" is evident on land status maps as a 40-mile wide corridor of alternating private and public sections of land that meanders from the eastern to the western borders of the state. The corridor straddles the Humboldt and Truckee rivers, and generally follows present day Interstate Highway 80. The checkerboard pattern of public and private land complicates land development and natural resource management. Development has been somewhat limited due to the rural nature of the lands and suitability for livestock grazing and farming. Several productive farm districts lie within the checkerboard lands.

As populations grow and communities are developed in areas that are restricted by federal landownership, local and federal agencies are introducing land bills to Congress to initiate land exchanges in pursuit of mutual objectives.

Land Exchanges and Protected Lands

With 86.5 percent of land in Nevada being held under federal and State ownership, there may be a perception that those lands are protected. Depending on the designation of the land under these governmental entities, the lands can be protected or unprotected from conversion to other ownerships and land uses. Land exchanges and transfers are not uncommon with State and Federal governments, though they are mostly sold for conversion to private and commercial interests or acquired to be placed in wilderness or state park status. Most of Nevada's state owned and administered lands today were purchased by the state from private landowners or donated by private landowners to the State to create State Parks or other cultural and environmental protection measures. While wilderness areas could be considered protected from conversion to development with exception of certain authorized mining activities. It is important to recognize that land development and fragmentation are only two threats to native ecosystems identified in the Strategy Section of this plan and the balance of the threats and issues, like wildfire and invasive weeds, identified can impact lands that are placed in protected status as much or more than lands where protections allow for mitigating and responsive management actions to be taken.

Today, land transactions are focused mainly on consolidating or exchanging private and public lands to more effectively and prudently conserve, manage, and develop land and water resources. The level of activity involving public and private land sales and exchanges has intensified in recent years, primarily in and around cities and urbanizing towns.

Two of the most significant single land ownership changes involve Federal government transactions. In 1989, approximately 660,000 acres was transferred from the U. S. Bureau of Land Management (BLM) to the USFS under the Nevada National Forest and BLM Enhancement Act. In 1985, the Navy added 177,000 acres to the Fallon Naval Air Station land base to accommodate an expanded military mission. The Fallon Naval Air Station is also proposing an expansion that would withdraw over 600,000 acres of BLM administered land as well as purchase 62,587 acres of private lands and place them under the control of the US Navy for aerial warfighter training.

The BLM, through the normal land disposal process (authorized by the federal Recreation and Public Purposes Act) and through a special process provided for in the Southern Nevada Public Land Management Act (SNPLMA) of 1998, has undertaken the most land transactions of any federal agency. In addition to the disposal (land sale and transfer to a non-federal owner) of public land for development in Las Vegas Valley, the SNPLMA process involves federal acquisition of environmentally sensitive private parcels throughout the state. This program has authorized over 100,000 acres of land sales in Clark County and provided over $3 billion in revenue to the Federal government.

Other federal agencies participating in the SNPLMA land acquisition process are the USFS, National Park Service (NPS), and U.S. Fish and Wildlife Service (USFWS). State and local governments are participating by advising the federal agencies during the SNPLMA process on areas where lands can be sold and where funding can be applied to improvement projects. The Federal Land Transaction Facilitation Act of 2000 is also expected to increase the amount of federal agency disposals and acquisitions in Nevada.

More recent land transfers and designations have occurred as a result of the Lincoln County Conservation, Recreation and Development Act of 2004 and White Pine County Conservation, Recreation and Development Act of 2006 both authorized the sale of rights of way for utilities and 45,000 acres of land for private and commercial interests. The Acts changed the designation of 1,308,000 acres of federal land to Wilderness. There are additional counties in Nevada that are working on similar land bills, so these trends are likely to continue in the future assuming they continue to find favor in Congress.

Lands can be protected in Nevada through various means, though the most significant are conservation easements for non-federal lands as well as a variety of federal land designations that afford protections for lands. Table 4 and Figure 3 show the acreages of each protective federal designation that exists in Nevada. Approximately 8,733,214 acres or 12.4 percent of the state is within one of these designations. There is no comprehensive accounting of conservation easement acreages or locations within the State of Nevada.

Table 4. Federally designated lands for protection and associated acreages in Nevada.

Protected Lands	Acres*
BLM Wilderness Areas	2,083,988
NPS Wilderness Areas	229,788
USFS Wilderness Areas	1,127,929
Wilderness Study Areas	2,347,017
National Monuments	2,093,759
Areas of Critical Environmental Concern	1,268,670
National Parks	187,171
National Recreation Areas	565,824

**Acreages are highly overlapping between categories.*

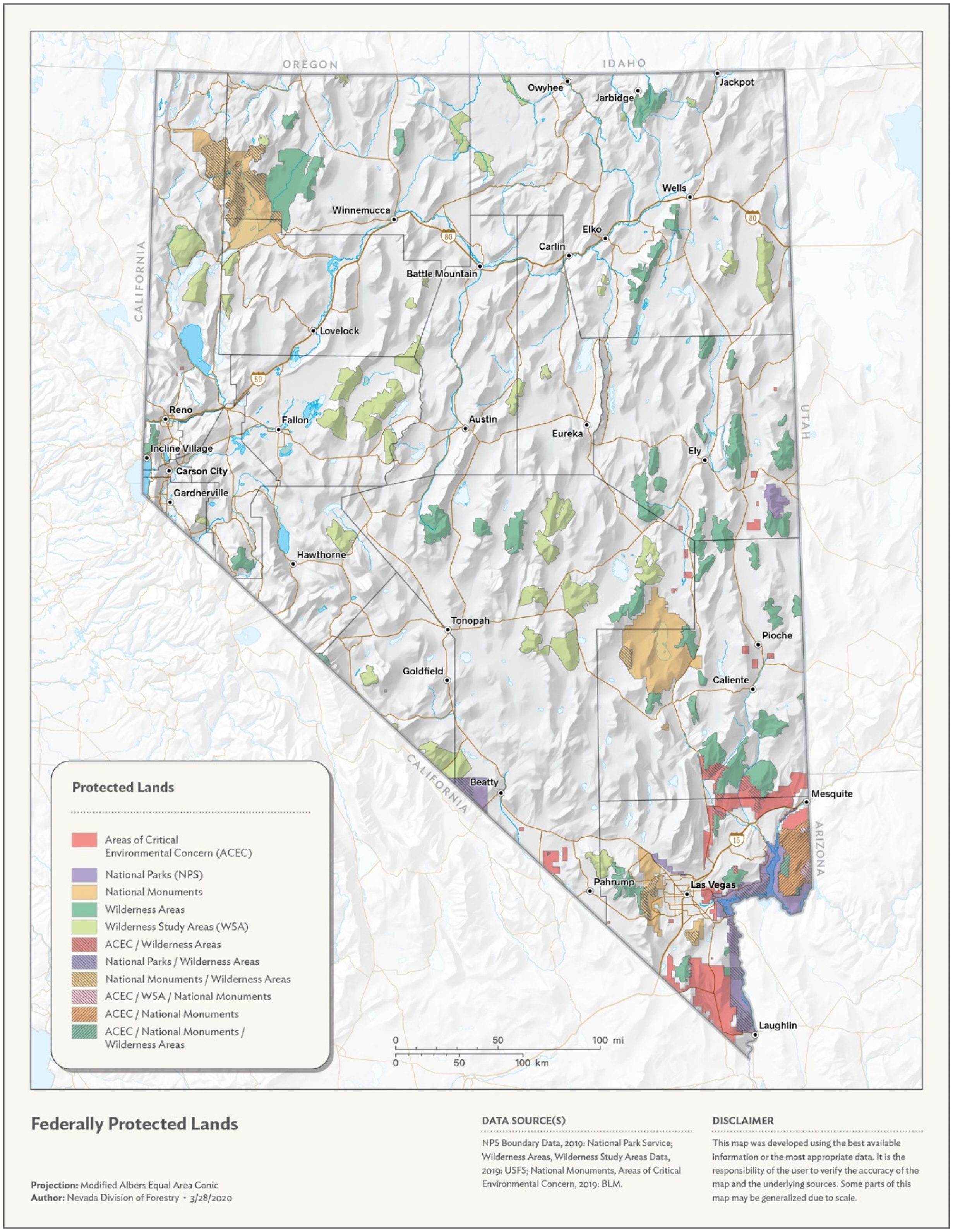

Figure 3. Map of federally protected lands in Nevada.

Major Terrestrial Ecosystems

Nine major vegetated, non-production agricultural terrestrial ecosystems were identified to assess the conditions, set regional priorities for investment and action, and develop applicable strategies to improve conditions and trends. These nine major ecosystems represent the most dominant landcover categories represented across the state with unique values and needs with respect to active management and conservation activities. Table 5 and Figure 4 show the abundance and distribution of the major ecosystems across the state, based on the vegetation classifications (Landfire 2014) and biophysical factors that define major ecosystems.

Table 5. Acres of major terrestrial ecosystems in Nevada by jurisdiction.

Ecosystems	Private & Local Acres	State Lands Acres	Tribal Acres	Federal Acres (w/o BIA)	Total Acres	% of Total Area
Cold Desert Grass and Shrublands	3,164,267	73,998	528,545	11,037,646	14,804,456	20. 93%
High Elevation Forests	17,670	5,715	987	531,977	556,349	0. 79%
Mixed Conifer Forests	91,841	6,057	16,249	611,477	725,623	1. 03%
Pinyon-Juniper Woodlands	376,336	11,912	61,574	8,078,068	8,527,889	12. 06%
Riparian and Floodplain Areas	99,419	3,784	8,924	645,553	757,680	1. 07%
Sagebrush Ecosystems	2,911,523	34,591	413,059	21,584,888	24,944,060	35. 27%
Upland Quaking Aspen	94,798	1,873	9,268	575,389	681,328	0. 96%
Urban and Community Forests	237,754	1,531	5,261	34,263	278,809	0. 39%
Warm and Hot Desert	631,900	88,928	90,779	14,536,486	15,348,093	21. 70%
Other*	1,407,363	78,860	187,208	2,424,387	4,097,819	5. 79%

**Playas, Water, Hardscapes (Developed Areas), Perennial Snow, Agricultural Croplands.*

Nevada, known for its iconic American West cowboy culture, is dominated by sagebrush ecosystems which host rangeland habitats vital for economic and wildlife needs. Forests and woodlands cover nearly 12 million acres of Nevada, 16.5 percent of the state's total land area. Most wooded acres are classified as pinyon-juniper woodlands equaling five times the land area of all other forest types combined. The state's only true timberlands (with harvestable stocks) occur in mixed conifer forests and cover less than two percent of Nevada's land mass. Forests are distributed throughout the state, with the greatest abundance along the Sierra front on the western border with California. However, at high elevations mixed conifer forests are found within every ecoregion in the state: Mojave, Great Basin, Columbia Plateau, and Sierra Nevada.

More than 92 percent of Nevada's forested land is public land—managed primarily by the USFS and the BLM, leaving approximately 750,000 acres in private ownership (NV Natural Resource Status Report, 2002). This distribution is relatively proportional to the 86.5 percent of the state that is Federally owned. The southern portion of the state, the Mojave region, is a hot mountainous desert with drastic elevation changes, containing a wide variety of habitats and diverse ecosystems.

Nevada's wild lands experience a variety of stressors, including but not limited to direct impacts from human encroachment (expanding development), water usage and resulting water table drawdowns, insect pest and disease outbreaks, soil and water quality degradation, changing climatic conditions and increased susceptibility to wildfire from invasive species and human presence. Impacts that negatively affect the health and resiliency of Nevada's natural resources point to the need for considerate, intentional, and intensified conservation and land management efforts.

Agencies must optimize the implementation of our natural resource and fire management programs by identifying and prioritizing areas of need and goals to accomplish. Once needs and goals are outlined the broader land and fire management agencies will leverage their capacity through partnerships with landowners and advocates throughout the state to have a tangible impact on Nevada's natural resources. This plan describes the state of Nevada's important natural resources, defines priority regions where agencies focuses human and capital resources, and outlines goals and strategies for protecting and improving natural resource conditions, benefits, and services across the state.

Figure 4. Map of major terrestrial ecosystems in Nevada.

Human Population

Many rural communities are spread throughout the state's valleys and mountains. Even the state's four "urban" counties (Carson City, Clark, Douglas, and Washoe) contain large rural areas. Towns are widely spaced, connected to land and water resources suitable for recreation, farming, ranching, mining, and military installations. Rural county growth rates fluctuate, often a response to national or global economic factors that depress precious metals production. Rural communities with a strong agricultural base are more resistant, although the recent droughts have taken a toll on some farmers. The majority of rural counties experienced population growth from 2000 to 2018. Supplies of high-quality water are limited. Increasingly, rural area resources will be sought to meet urban area needs for water supply, energy production, waste disposal sites, outdoor recreation, and industries with large water consumption or pollutant discharges.

Figure 5. Rural valleys with abundant water typically support multiple ranches, often owned and operated by descendants of the pioneer homesteaders.

Nevada's population continues to grow. Population increased from approximately two million in the year 2000 to just over three million in 2018 (Nevada State Department of Taxation, 2018). Migration has contributed significantly to the population growth in Nevada, and neighboring states are growing rapidly. The collective population of Nevada and neighboring states increased from 48 million in 2000 to nearly 57 million in 2014. Our population is currently 3.14 million and expected to reach 3.36 million in 2030. Nevada maintained a seven percent population increase from 2000 to 2010 and is the sixth-fastest growing state in the nation. The pace and scale of population growth experienced by Nevada and its regional neighbors has led to increased pressure on natural resources and natural resource management capacity.

Nevada's population is highly urbanized, meaning most people live within a few metropolitan areas. The average population density of the entire state is 25.9 persons per square mile, but 88 percent reside in major population centers within Clark (73 percent) and Washoe (15 percent) counties (Figure 6). Of the five largest cities, three are in Clark County (Las Vegas, Henderson, and North Las Vegas) and the others are in Washoe County (Reno and Sparks). In western and southern Nevada, regional-scale urbanization has emerged. The urbanizing western region encompasses southern Washoe, Carson City, Douglas, Lyon, and Storey counties, with a combined population of 625,142 in 2018. In the south, the regional scope of urbanization encompasses Clark County and southern Nye and Lincoln counties. Population exceeds 2.3 million in the southern region. In the urban regions, and some rural areas, more residential, commercial, industrial, and public service developments are being built outside "urban" boundaries. The type of growth Nevada has experienced has increased development in the Wildland Urban Interface (WUI), adding to environmental pressures, including urban and community forests, and placing more demands on state resource management and fire suppression agencies.

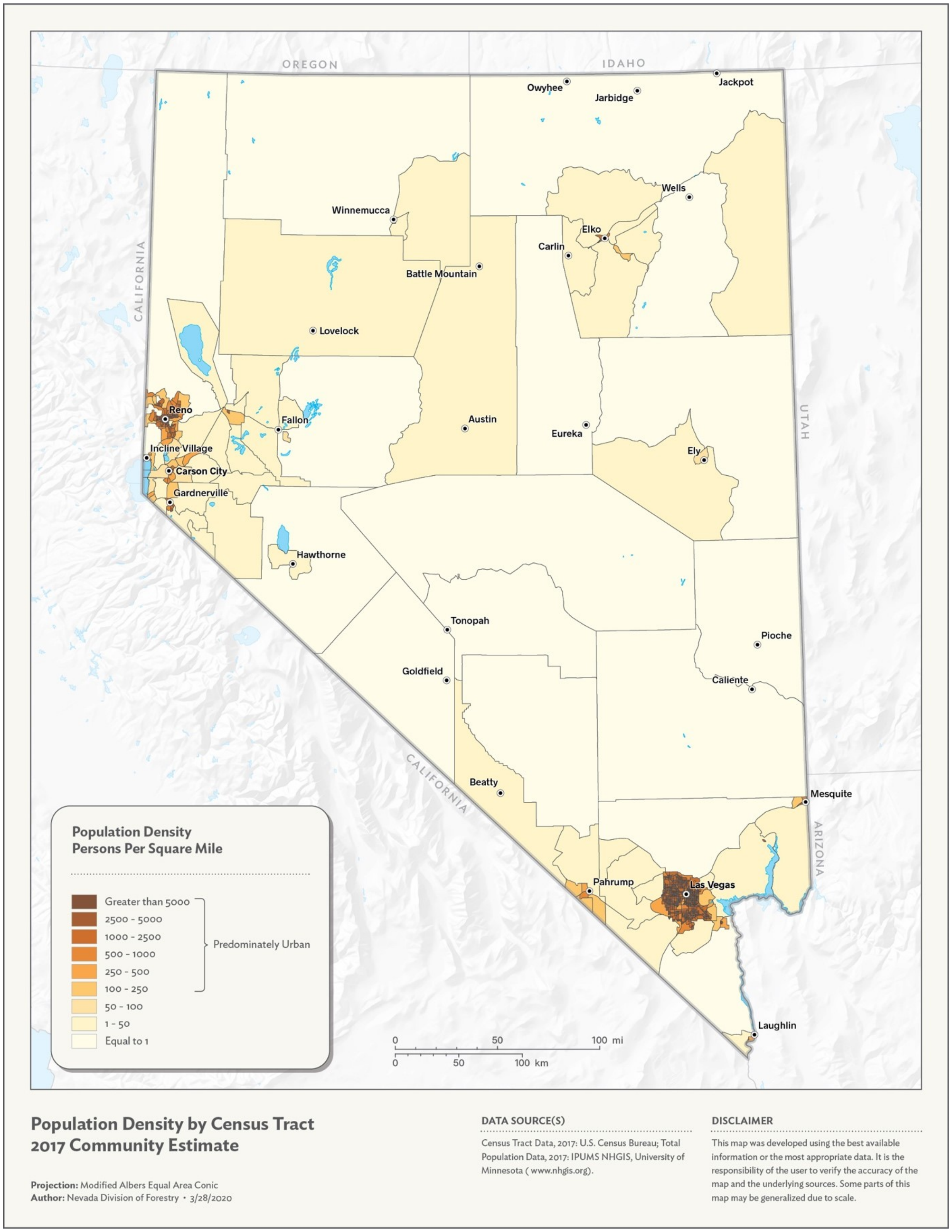

Figure 6. Map of Population distribution and density in Nevada.

Urban (or suburban) sprawl is difficult to quantify. It can be described as a development cycle that starts with subdivisions built outside urban boundaries and ends with a blanket of residential and commercial buildings. In fast growing areas, consideration of systematically conserving open space for important ecological functions and socioeconomic values may be an afterthought. Eventually floodplain, wildlife habitat, or forest patches may be retained, often as parks, but a piecemeal approach relinquishes many of the natural values and ecological functions. From a long-run socioeconomic viewpoint, sprawl is an inefficient consumption of land and raises costs of municipal and utility services. Negative consequences of sprawl place greater demand on state and local agencies to mitigate additional issues, such as air and water quality deterioration; wildfire threats at the urban/wildland interface; fragmentation of wildlife habitat; threats to vulnerable plant and animal species; over-development of floodplains; loss of wetlands and riparian resources; and loss of public land access. More urban and suburban communities are taking interest in retaining and improving management of open space and prime agricultural land, indicating the realization of the importance of open space values socially, economically and ecologically in Nevada.

Region-wide urbanization will challenge local governments and resource management agencies to coordinate their individual efforts to assess and mitigate the variety of ways growth can impact limited and valuable resources.

Cultural Resources

In order to execute natural resources field projects using federal funding, agency staff must adhere to Section 106 of the National Historic Preservation Act. In addition to that requirement, agencies seek to be responsible stewards of the cultural resources and values while accomplishing the agency's natural resource and fire management mission. Field staff are trained by the State Historical Preservation Office (SHPO) in Nevada to conduct cultural resource surveys and coordinate with SHPO on determining impact mitigation and avoidance tactics. This section highlights Nevada's prehistory, early recorded history and the kind of sites and artifacts are encountered across the state.

Figure 7. A waterwheel found on a site surveyed by NDF prior to a hazardous fuels reduction project. The wheel generated electricity for a pioneer home.

The prehistory of Nevada dates back some 11,500 years to the Late Pleistocene. Human populations of Asian origin reached Nevada and other parts of the Great Basin between 10,000 to 12,000 yrs. ago. Besides migration of people to the area, twenty-two species of mammals also entered the area including mammoth, caribou, bison, grizzly bears, wolves and lions. The environment at that time was primarily tundra. These early migrants hunted big mammals, perhaps hastening the extinction of some megafauna species. Nevada has three major biogeographic divisions that have existed since the Late Pleistocene: Sierra Nevada Mountains, Great Basin and Mojave Desert. Within the expanse of the Great Basin were the Pleistocene lakes Bonneville and Lahontan that covered large portions of Nevada and Utah. Evidence of Late Pleistocene habitation most often consist of surface lithic artifacts (e. g. obsidian flakes), found mostly in valleys where necessary natural resources for survival were located. Earliest inhabitants subsisted primarily by hunting big game. Human groups practiced high residential mobility, likely moving seasonally from north to south and back again. Relict settlement sites from the late Pleistocene to the early Holocene (10,000 to 7,500 years ago) were located on the edge of the now extinct lakes and marshes that existed in the Great Basin. Sites can also be found in a variety of settings such as mountain meadows and riversides. Artifacts include ground stone metates and manos.

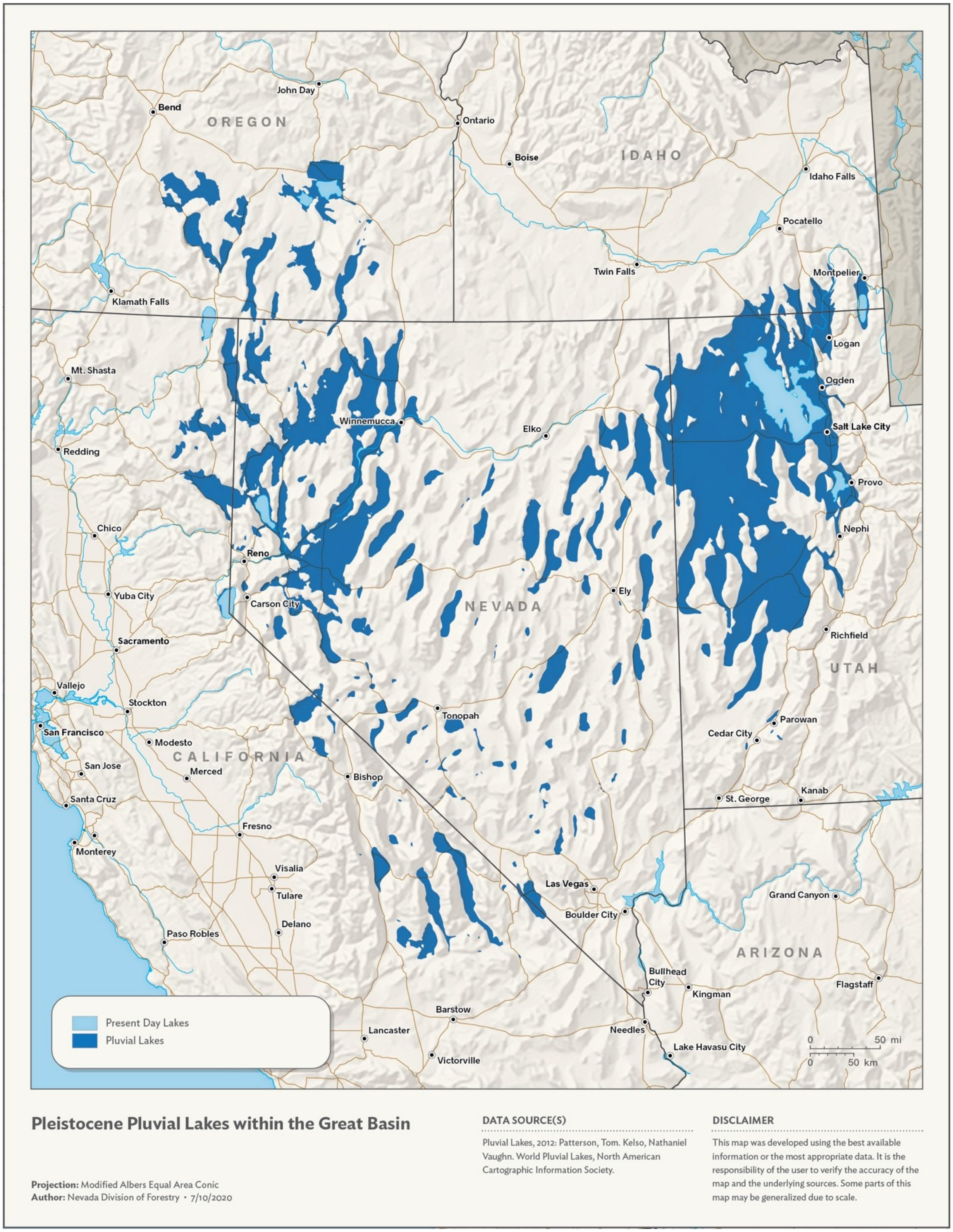

Figure 8. Map of Pleistocene lakes in Nevada and surrounding states.

A significant reduction in effective precipitation during this period, as evidenced in the demise of marshes and drying of springs and stream systems, likely drove human populations to occupy different locations and diversify their diets to include small mammals, freshwater mollusks and reptiles. The Middle Holocene in Nevada (7,500 to 4,500 years ago) was a period of hard times. Conditions were more arid and shallow water systems were desiccated. Pinyon pine had not yet arrived in central Nevada. Fewer relict sites can be found from this period. In comparison to the Early Holocene, more sites have grinding stones. Seeds, a resource that is labor intensive to collect, were exploited. Tools from this period include projectile points, chipped stone drills, antler wedges, bone awls, atlatls, mortars and pestles. As in previous geologic time periods, occupation sites were located near water bodies.

The Late Holocene in Nevada began 4,500 years ago, continuing to historic times. A relative explosion occurred in the number of sites and the environments in which they were located. Relict sites are found in upland areas and associated with rock walls, cairns and rings. Occupation sites were often associated with shallow water. Adaptations in the Late Holocene included the intensification of natural resource exploitation at high altitude. Indigenous bands migrated from low elevations in winter to high elevations in summer, burning lands behind them in order to rejuvenate wildlife habitat. Diets included roots and seeds of native plants. Pinyon pine arrived in central Nevada and upland sites are often related to pinyon nut harvesting and storage. Common artifacts associated with pre-historic cultures and found on NDF-led cultural resource inventory surveys, includes petroglyphs, pictographs, stone tools, pottery, and projectile points. Structures associated with hunting and lodging includes antelope/horse/deer traps and pits, wickiups made from wood, and agave roasting pits.

The recorded history of Nevada begins with explorations dating back to 1776. The state's early history is rich in accounts from Spanish explorers, trappers, guides, government funded explorations and their staff, mining entrepreneurs, Mormon settlers, farmers and bullwhackers. The earliest explorations crossed southern Nevada, by Francisco Garces (1776), Dominguez and Escalante (1776), Jedidiah Smith (1826) and Armijo (1829). Explorations crossing northern Nevada included Jedidiah Smith (1827), Peter Skene Ogden (1828), Walker & Bonneville (1832), and James Beckwourth (1848). Large government funded explorations, with accompanying scientists, topographers and naturalists, included those led by John C. Fremont (1843-44 and 1845), Edward Beckwith (1854), James Simpson (1859), Clarence King (1867-68), and George Wheeler (1869 and 1971). These explorations intended to aid westward expansion (i.e., Manifest Destiny), making maps of existing travel routes, geology and topography to aid immigration, as well as select a transcontinental railroad route. Emigrants followed in larger and larger numbers. Beginning with the Bidwell-Bartleson party (1841). They left accounts of specific travel routes followed by later parties, including those collectively referred to across northern Nevada as the California Trails. Emigrants on these trails peaked during the California gold rush (1849-58). The compacted trails and artifacts that were discarded along the trails can often be found, including wagon parts, food containers, animal tack, firearms, knives, utensils, and more.

Nevada became part of the United States with the Treaty of Guadalupe Hidalgo with Mexico in 1848. Early Settlements in the Utah Territory (pre-statehood Nevada) began in 1850-51. Truckee Meadows (Glendale), Mason Valley, Dayton and Ragtown were associated with services for emigrants, mining and agriculture. Mormon colonies were established in Las Vegas Valley, Panaca and Genoa, but later abandoned when federal troops were sent to Utah in 1857.

Pre-Comstock mining in southern Nevada occurred primarily at Mt. Potosi, Nelson's Landing, Ivanpah and Searchlight/Crescent. Mining camps began with tent camps and progressed to primitive urban if the mineral lode was sufficient. Features of these camps included housing, saloons, businesses, along with associated mills, waste rock and tailings. Comstock Era Mining originated in early Dayton, followed by the Comstock Bonanza in Virginia City in 1859. Subsequent 19th century mining districts sprung up as new deposits were located and claimed. Major mining areas included: Austin/Belmont, Aurora/Candelaria, Cortez/Eureka, Tuscarora/Sprucemont, Pioche/Bullionville, Rochester/Unionville, among others. Twentieth century mining areas included Tonopah (1900), Goldfield (1902), Rhyolite (1904), Rawhide (1908), Delamar (1899-1909), White Pine and Mason Valley (1912), among many others throughout the state. Each area provided extensive supporting businesses. Charcoal production to provide fuel for smelters centered in areas both near to mines and near to pinyon-juniper woodlands and forests. The wood was turned into charcoal in beehive shaped cooking ovens, located in the Spring Mountains, Tybo, Panaca, the Virginia Range, the eastern Sierras and Mt. Como, among other sites. The people and animals in mining boom towns needed to be supplied water through elaborate water conveyance systems, such as at Delamar, Marlette, Tonopah and Pioche. In order to feed miners and livestock, irrigation agriculture production, first initiated by the Paiutes (as per Dominguez and Escalante), was extensively used in the Carson, Mason and Washoe valleys, along the Virgin River in Bunkerville to Overton, and in water rich valleys around Panaca, Hiko, and Alamo. Artifacts, stone cabins and other cultural materials are widely dispersed from this era due to the large number of people scouring the land for opportunities to mine, hunt fowl and game (for consumption and to sell), harvest fuelwood, and graze livestock. Artifacts include dishes, coins, nails, animal shoes, can dumps, and any other imaginable possession one might have with them when trying to make a living on the land.

The lack of local water crippled early efforts to cultivate crops and dry farming was a bust. The Newlands Project (1911-1913) on the Truckee River was the first in Nevada to utilize dam diverted water transported by ditches and canals to reclaim desert lands which had sufficient soils for irrigated agriculture. Irrigation projects further altered the environment, such as draining lakes on reservations (e. g. Lake Pyramid), further displacing tribal people. Early ranching utilized free forage on Nevada's unclaimed lands. In order to water open range livestock, water rights needed to be taken. The first areas to be homesteaded were associated with springs, rivers and wet meadows. With overgrazing of the public lands and declining rangeland health, the Taylor Grazing Act was passed in 1934, which defined allotments tied to individual or groups of ranches.

Settlement of Nevada demanded development of a transportation system to improve routes first blazed by animal migrations and travel by indigenous tribes, including the Shoshone and Paiutes. Wagon roads were developed for stage travel. They were locally controlled by private landowners as toll roads, in areas where the road had to cross a river or pass through a narrow. Transportation wasn't just for human movement, but also for mail and supplies. The Pony Express Trail crossed the middle of Nevada in 1861. The first transcontinental railroad, the Union Pacific, was built across Nevada from 1867 to 1868, and completed across the nation in 1869. The Western Pacific would follow on nearly the same route. Southern Nevada would finally connect with Los Angeles and Salt Lake City via the completion in Rainbow Canyon of the Salt Lake, Los Angeles and San Pedro railroad in 1909. Shorter routes and smaller gauge railroads would service mining towns, like Pioche and Ely, or minable salt marshes like Roades Salt Marsh.

Common relicts and artifacts associated with early white, Basque and Chinese settlement of Nevada, as found on cultural resource inventory surveys, include: crimped and lapped seal tin cans, molded seal bottles with early neck and base designs, early ceramic designs, celadon wares, opium pipes, crocks, teapots, porcelain beakers, button shanks, animal shoes, horseshoe and construction nails, arborglyphs, and bow stave trees. Structures associated with early settlement and supporting activities, include headframes, charcoal ovens, cabins, stone structures or foundations, primitive corrals, stone walls, waterworks for water conveyance and electricity generation, sheep and line camps, and rock shelters (for shelter and explosives).

Water Resources

Water is one of the most valuable resources in Nevada, the driest state in the US. Historically, Nevada's average precipitation varies from eight to ten inches annually and has extreme variations between Nevada's southern desert valleys, with three to four inches to over 40 inches of precipitation at higher mountainous elevations. With so little precipitation throughout the year, Nevada relies heavily on water stored as snowpack in the state's upper elevations. Annual mountain snowpack's maintain lakes, reservoirs, rivers and streams which provide groundwater recharge and runoff to the valleys in the form of surface water accounting for 65 percent of the water used in Nevada. The total runoff water used, amounts to about four to five million acre-feet of water per year, of which, 65 percent is used for irrigated agriculture, 18 percent for municipalities, and 19 percent for wildlife and recreation (non-diversion sources).

The other form of water used in Nevada is groundwater. In Nevada, the water table (the depth at which water exists between soil particles) can be as shallow as 50 feet in valley bottoms or as deep as 500 feet beneath alluvial fans or north-central Nevada basins (Bedinger, 1984). Seventy percent of groundwater in Nevada is used for irrigated agriculture, other significant uses are mining at 10 percent and municipal uses at 9.4 percent. The groundwater in Nevada is divided throughout the state into 256 hydrographic basins, with the water being appropriated based on each basin's perennial yields while still considering system yields, sustainability, groundwater flow systems and conjunctive management. Many of Nevada's basins commit a greater proportion of groundwater than perennial yield. Sixty-four of the 256, hydrographic basins (or 25 percent) in the highest populated or irrigated areas of the state have over 200 percent of the perennial yield committed, 48 of which exceed their perennial yield in actual output. Sixty-six of the basins, mostly adjacent to the over committed basins, have over 100 percent of their perennial yield committed as well (Figure 9).

With Nevada's ever-expanding population, economy, and municipal water districts, the demand for a scarce resource continues to increase. Nevada's residences, businesses, and industries will face challenges allocating water as demands increase. All waters of the State belong to the public and may be appropriated for beneficial use pursuant to the provisions of Nevada Revised Statutes (NRS) Chapters 533 and 534 and not otherwise. The Nevada Division of Water Resources manages water rights in Nevada through its permitting and water allocation process. New permits to water rights are approved conditionally based on conflict with other existing rights or domestic wells, over appropriation of water resources, and whether the new permit will prove detrimental to the public. All water rights permitted or allocated must receive full compliance (Wilson, 2019).

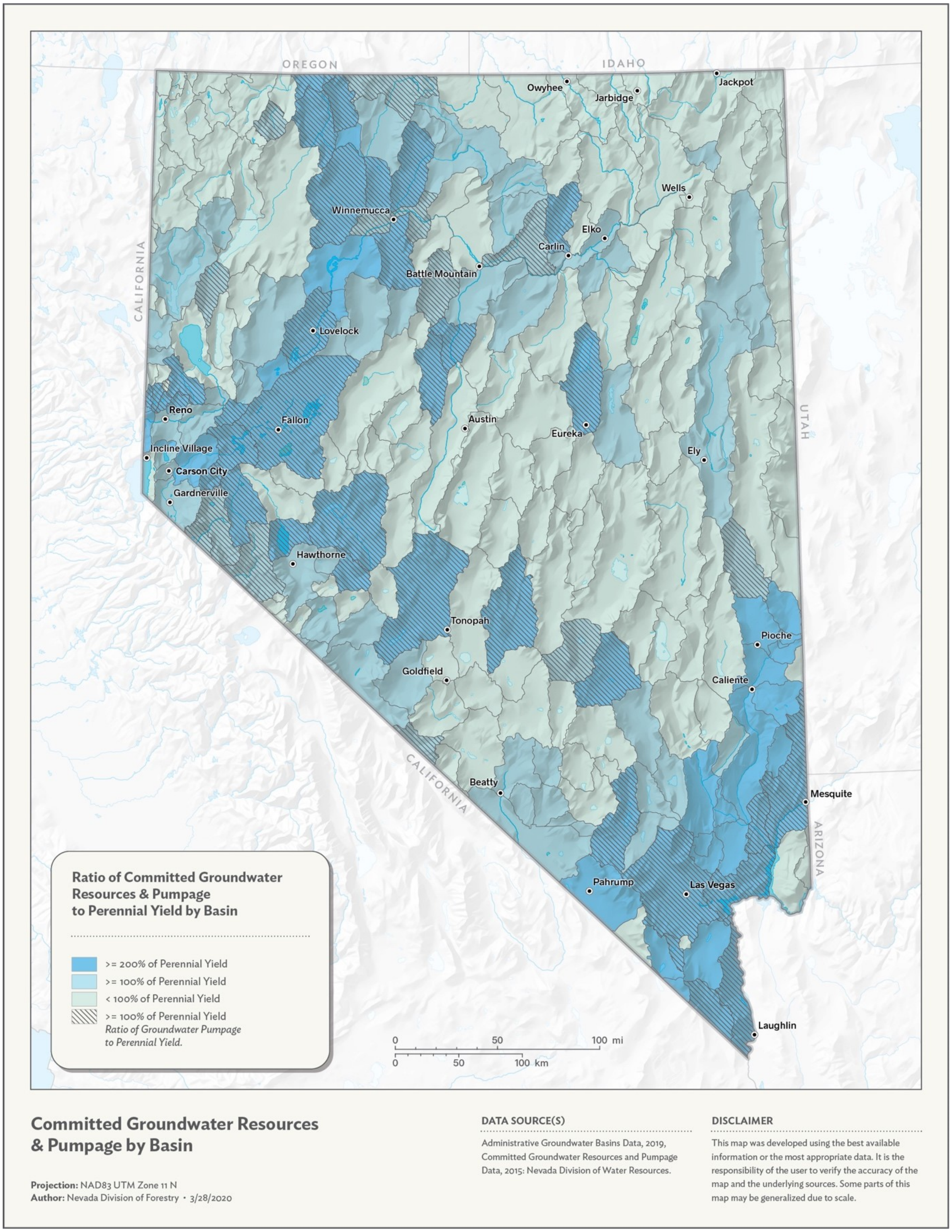

Figure 9. Groundwater basins in Nevada and their current designation status.

The Colorado River is an important and long-disputed water source for southern Nevada. Managed by the Colorado River Compact, the popular water source's 15 million acre-feet per year yield is divided in half for the upper-division states (Colorado, Utah, Wyoming and New Mexico) and the lower-division states (California, Arizona and Nevada). Of the 7.5 million acre-feet that is diverted for the lower-division states, only four percent is allocated to Nevada but accounts for 90 percent of Las Vegas's drinking water. When the compact put its water diversions in place in 1944, there was no accounting for the increased population in southern Nevada and the Colorado River was allocated based on a period of high-water quantities (McGrath, 2019). Historically, the water diverted from the Colorado River accounted for surpluses existing in reservoirs, Lake Powell and Lake Mead being among the largest, but an extended drought has diminished many reservoirs and illuminated a decades-old problem of over-allocating its water resources. Water conservation efforts put in place by many of the Colorado River Compact signatory states have begun to address this problem. For instance, the Southern Nevada Water Authority recycles about 40 percent of its water returning most of it back to Lake Mead and in the last 15 years has seen its consumptive use reduced by a third (Southern Nevada Water Authority, 2020).

Inter-basin transfers of ground and surface water provides the state with a method of distributing water from basins or waterways with excess to areas needing water to supply municipal water districts. There are currently 19 active inter-basin transfers in the state, four of which originate from the Truckee River alone (Lincoln County Water District, 2020). For an inter-basin transfer to be approved by the state engineer, the applicant must justify the need to import water, the receiving basin must implement a water conservation plan, and the transfer cannot limit future growth in the exporting basin.

To provide for an expanding southern Nevada population and prolonged drought, massive inter-basin water transfers to region have been explored. The most recent, which was blocked by the Nevada Supreme court and recently abandoned by the Southern Nevada Water Authority. The proposed project would have pumped groundwater from Spring, Cave, Dry Lake and Delamar valleys to supply 170,000 new homes in the North Las Vegas area through a 15-billion dollar, 300-mile pipeline (Figure 10). It was found that the pipeline project would deplete aquifers and the granted water rights to Southern Nevada Water Authority were inconsistent with state water law (Lochhead, 2020).

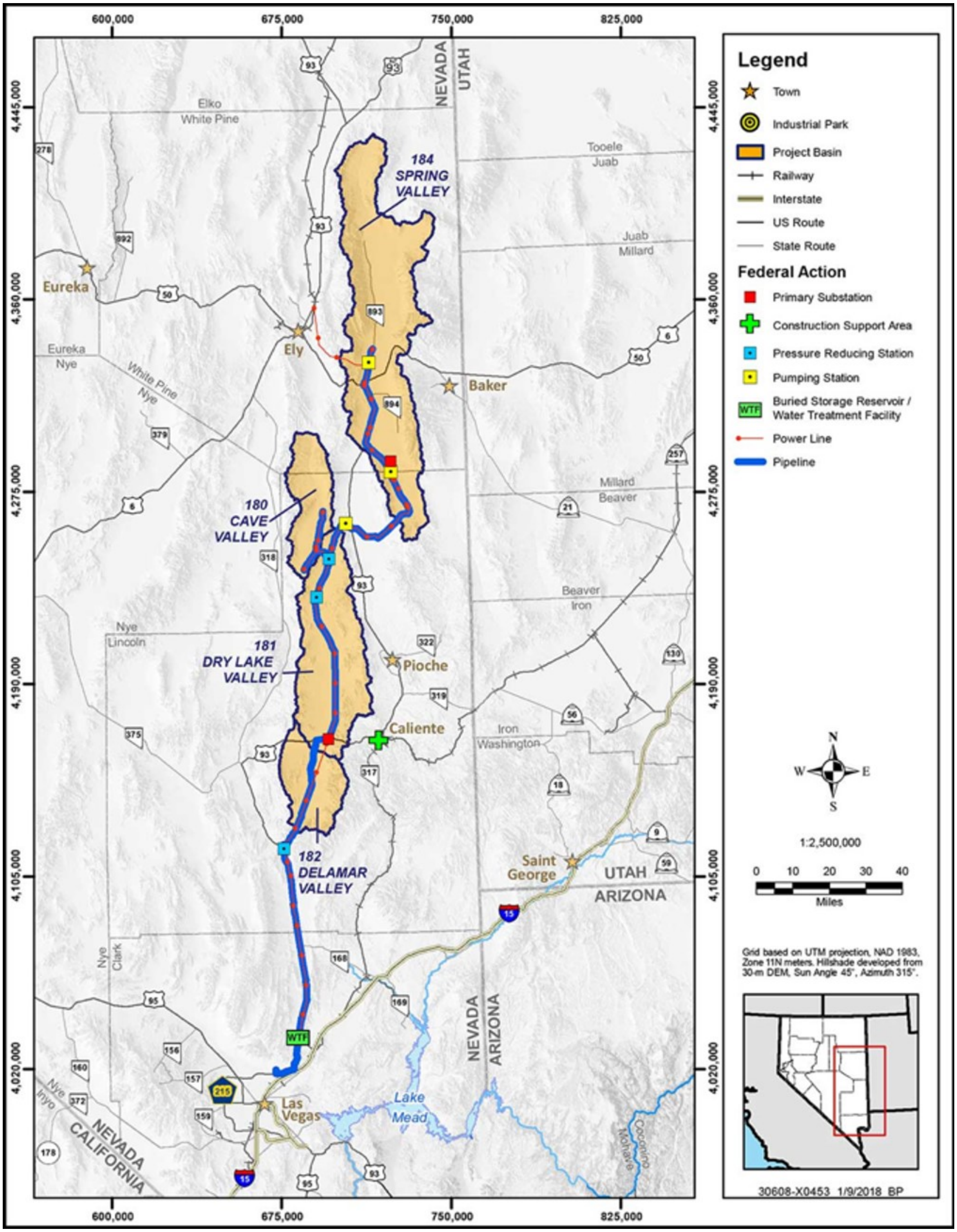

Figure 10. *Proposed Southern Nevada pipeline route and affected water basins (SNWA 2018).*

With water being very limited in Nevada, the quality of it is of great concern for water users and managers. Nearly 3,000 miles of perennial stream courses (~20 percent) and over 188 square miles of lakes and reservoirs (~22 percent) fall under the Environmental Protection Agency's classification of impaired waterways (EPA, 2012). Nevada Division of Environmental Protection (NDEP) is required by the Clean Water Act to identify impaired waterways in Nevada so that they may be improved by monitoring point source pollution discharges and implementing water management plans to control non-point source pollution (Figure 11). A biennial report for 2016-2018 tested 700 waterways between 2009 and 2016 and identified that 35 percent of waterways in Nevada exceed Total Maximum Daily Load (TMDL) for pollutants and are considered impaired based on their primary beneficial use. The possible beneficial uses include protecting aquatic life, recreation with contact, irrigation, watering of livestock, municipal or domestic water supply, and fish consumption. The single-greatest cause of impairment in Nevada is the presence of phosphorous in over 1,000 miles of streams and 120 square miles of lakes and reservoirs. The next greatest impairment is temperature exceeding the TMDL in 1,200 miles of streams and 48 square miles of lakes and reservoirs. Other significant sources of pollution include turbidity, total dissolved solids, and mercury in fish tissue.

Nonpoint source pollution is the leading cause of water quality problems in Nevada but controlling NPS pollution remains a challenge. Sources are difficult to locate and the effects of NPS pollutants on specific waters vary and may not always be fully assessed. These pollutants can have harmful effects on drinking water supplies, recreation, fisheries, and wildlife. NDEP has administers the Nevada Nonpoint Source Pollution Management Program that seeks to reduce the pollution coming from diffuse sources such as (EPA 2020):

- Excess fertilizers, insecticides, and pesticides from agricultural and urban applications
- Oil, grease and toxic chemicals from urban runoff and energy production
- Sediment from improperly managed construction sites, crop and forest lands, and eroding streambanks
- Salt from irrigation practices and acid drainage from abandoned mines
- Bacteria and nutrients from livestock, pet wastes and faulty septic systems
- Atmospheric deposition and hydromodification

To address increase focus on addressing nonpoint source pollution, the Program produced the Nevada Nonpoint Source Management Plan (NDEP 2015). The plan identifies land management and use activities that can contribute to nonpoint source pollution as well as key principles and strategies that can be used to reduce, mitigate, or eliminate nonpoint source pollution in our highly valued water.

Drinking water sources are the highest priority water resources in the state. These include both surface and groundwater emanating from watersheds and hydrographic basins near and far from their point of use. Land use and management can enhance or degrade the quality and quantity of these resources. For example, wildfires can denude lands of vegetation and create hydrophobic soil conditions that decrease infiltration and Increase runoff and erosion. Another example Is reducing woody vegetation around springs can Increase spring flows. The NDEP provides technical assistance in the protection of source water resources through their Source Water Protection Program. Source water protection planning teams in each county assemble water and land use and management stakeholders' groups to educate the staff on their roles and encourage collaboration to define threats and opportunities to protect source water resources. Source water protection plans protect drinking water sources by preventing contamination that would cause a breach of the EPA drinking water standards.

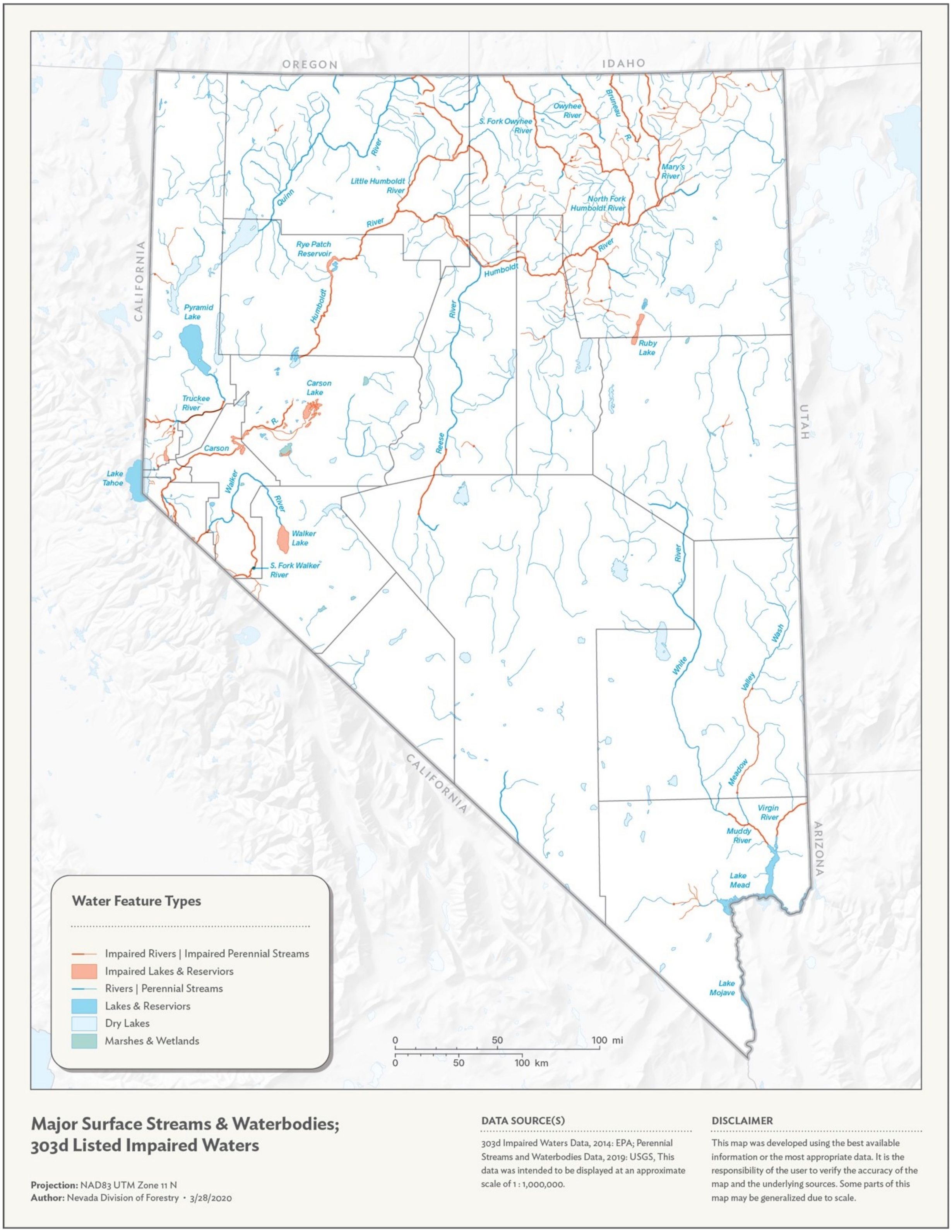

Figure 11. Map of surface water resources and 303d water quality.

Climate

Climate is generally defined as the average weather conditions over an extended period of time. Precipitation and temperature are among the key characteristics defining the climate in a given location, and both these measures are influenced by a number of factors.

The variable topography across Nevada results in dramatically different climate patterns across the state. Geographically, the majority of the state would be described as a plateau, with elevations varying between 500 to over 10,000 feet. Nevada is also home to several major mountain ranges that predominantly run north to south. Although annual average precipitation across the entire state is less than 10 inches, totals in different locations vary anywhere between four and 50 inches each year. Valley bottoms and lower elevations tend to be drier, particularly on the eastern sides of the state's mountain ranges, as precipitation brought by westerly flows tends to fall on west-facing slopes and at higher elevations (Figure 13).

The elevation patterns also contribute to the differences in climate between northern and southern Nevada. The north end of the state tends to be cooler throughout the year and has winter dominated precipitation patterns that include significant snowfall. In southern Nevada, annual average temperatures are approximately 10°F higher than in other parts of the state. Annual precipitation across the state is generally driven by storm systems moving from the Pacific Ocean across California, but the South also experiences monsoonal flows from the Gulf of California.

Precipitation in Nevada is also influenced by large scale changes in the ocean. El Nino, warming water in the eastern tropical Pacific Ocean, can cause more storms to flow toward the southern end of the state. La Nina, colder Pacific Ocean conditions, can cause dry conditions in southern Nevada. In both conditions, the winters can be wet or dry depending on how the storm tracks flow throughout the seasons. The entire state is subject to extreme precipitation events caused by atmospheric rivers. This phenomenon creates narrow bands of concentrated moisture that flow east from the Pacific Ocean, delivering large amounts of precipitation to the Sierra Nevada and western Nevada (Rutz and Steenburgh 2012; Rutz et al. 2014; Albano 2017).

Climatic factors cumulatively influence the kinds and amounts of vegetation and their distribution across Nevada's landscapes. In particular, temperature, precipitation timing and amount can be categorized in such a way that allows an accurate depiction of species survivability. The zones created by categorizing these factors are referred to as plant hardiness zones and are used for selecting tree and shrub species for urban and community landscape planting (Figure 12). In wildland settings natural resource managers utilize the NRCS ecological site description system to evaluate native vegetation community potential and successional pathways. This system utilizes a combination of climatic factors that include topography and soil conditions.

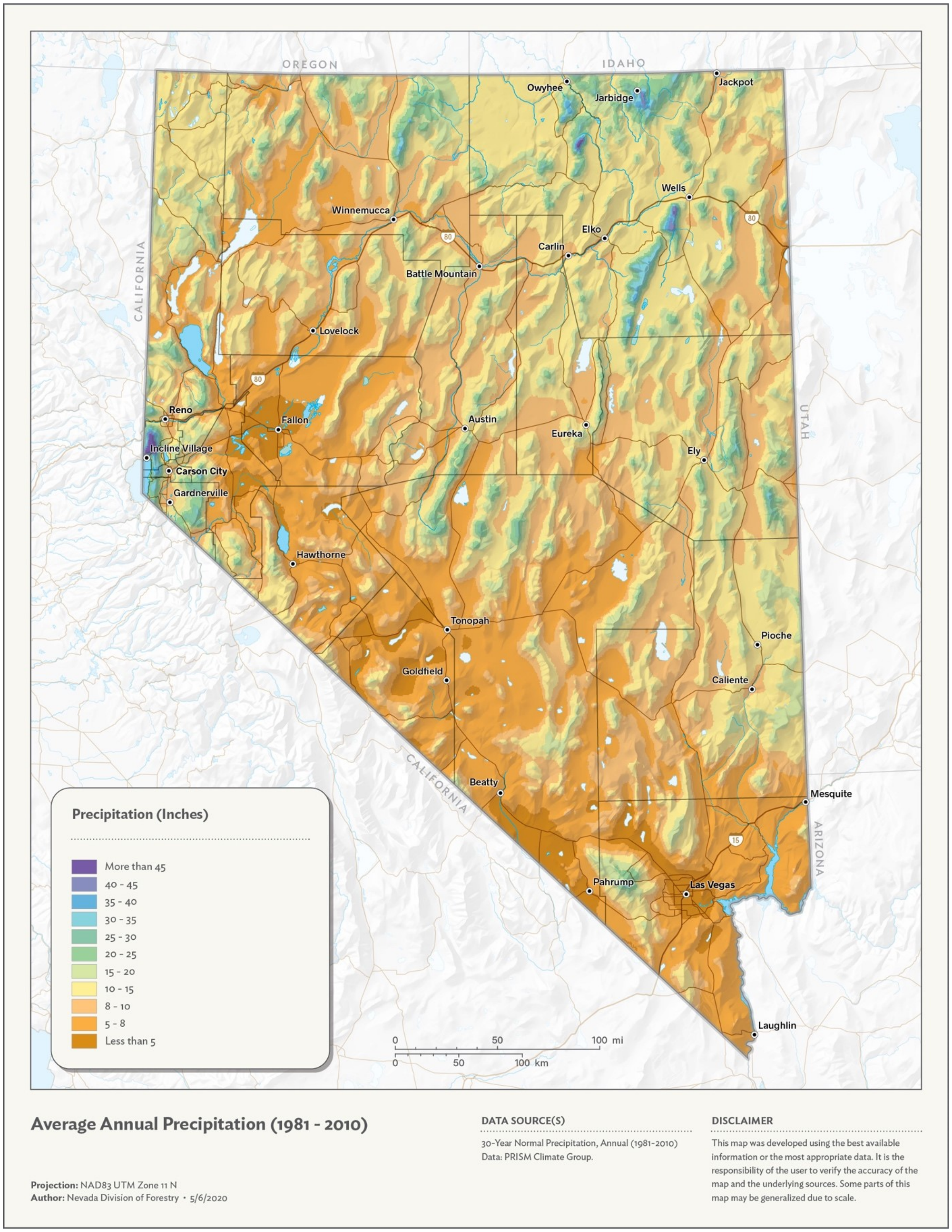

Figure 12. Map of average annual precipitation in Nevada.

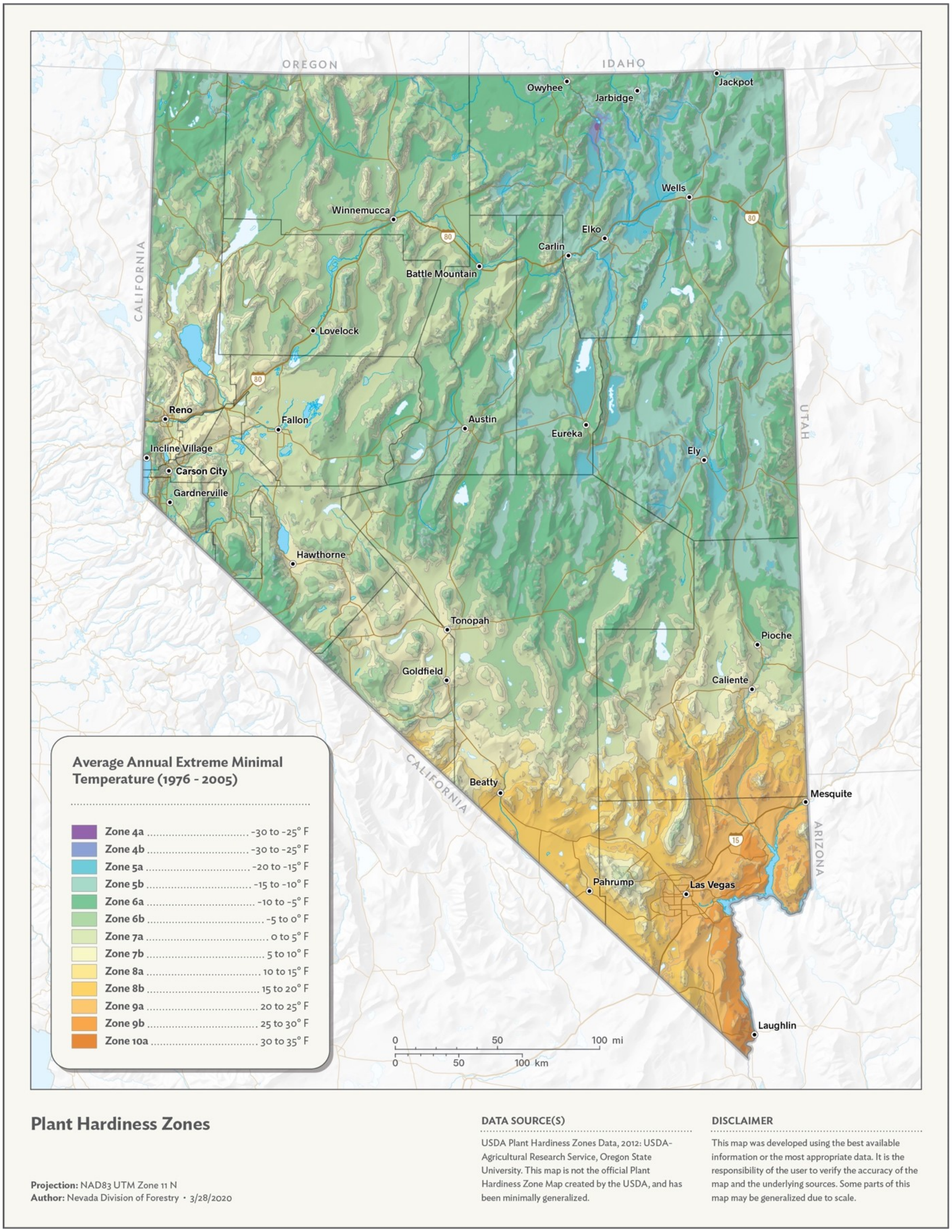

Figure 13. Map of plant hardiness zones in Nevada.

Regional Climate Divisions

Nevada is split into four climate divisions or regions where climate is broadly consistent (Figure 14). Climate divisions, by design, provide a very broad characterization of climate that does not distinguish mountains from valleys or the windward and leeward sides of mountain ranges. The descriptions here reflect average conditions in each division but will not be appropriate for any given point within the division. Values below are drawn from "Climate at a Glance," which are provided by the National Centers for Environmental Information (NOAA 2020).

Figure 14. Map of climate divisions in Nevada.

Division 1 - Northwestern Nevada

Division 1 encompasses the counties of Humboldt, Pershing, Churchill, Washoe, Storey, Lyon, Douglas, and Carson City. The region is relatively cool with monthly maximum temperatures ranging between 40.8°F in December and 88.8°F in July. Average minimum temperatures are cool, below freezing between November and March. They reach only to the mid-50s in July and August. Precipitation is relatively plentiful, by Nevada standards, with average precipitation of about 10. 7 inches per year. The wettest months are in the winter. Summer months are dry with little to zero precipitation. Between 1981 and 2010, there were 13 Augusts, four Julys and four Septembers with < 0. 1 inch of precipitation. There were also two very dry Octobers and one very dry June. The wettest month in this period was December 1983 with 3.88 inches of precipitation recorded. Precipitation is highly variable with monthly coefficients of variation (standard deviation/mean) ranging between 60 percent in February and 112 percent in August.

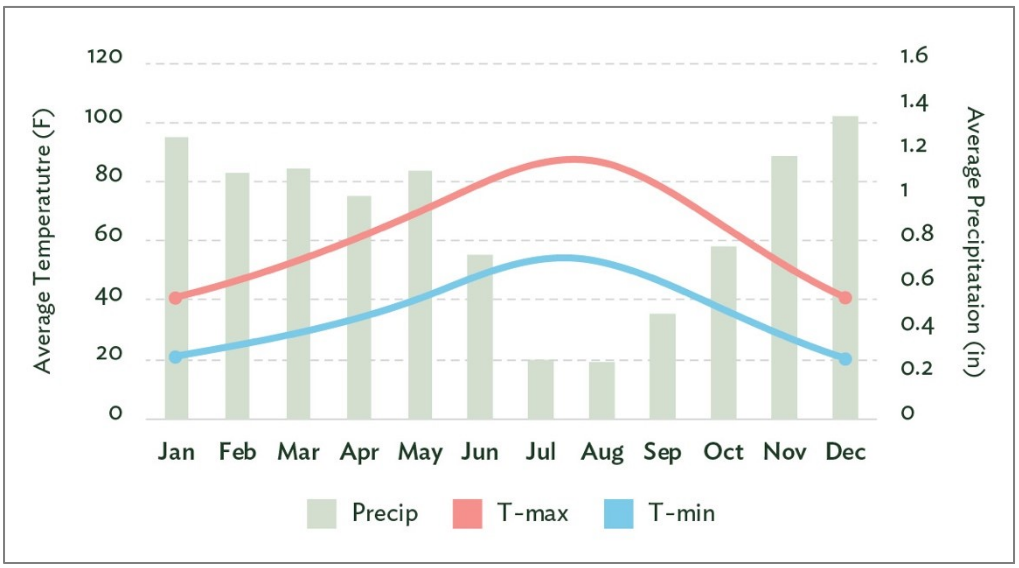

Figure 15. Climate zone 1 temperature and precipitation timing and amounts (NOAA 2020)

Division 2 – Northeastern Nevada

The northeastern Nevada climate division is comprised of Elko, Lander, Eureka, and White Pine counties. It is the coolest of Nevada's climate divisions with average high temperatures below 40°F in December and January. Even in July, average maximum temperatures reach only 85.5°F. By October the average monthly low temperature is 32°F, and monthly average minimum temperatures remain below freezing through April. Northeastern Nevada is also the wettest part of the state, with annual total precipitation averaging 13.2 inches. On average Spring is the wettest time of year, although the wettest single month in this period, with 4.03 inches of precipitation was December 1983. Relative variability in precipitation is also somewhat lower than in the northwest, with coefficients of variation ranging between 42 percent in March and 86 percent in August. Very dry months are relatively rare. In 30 years, there were only four months when precipitation was < 0. 1 inch.

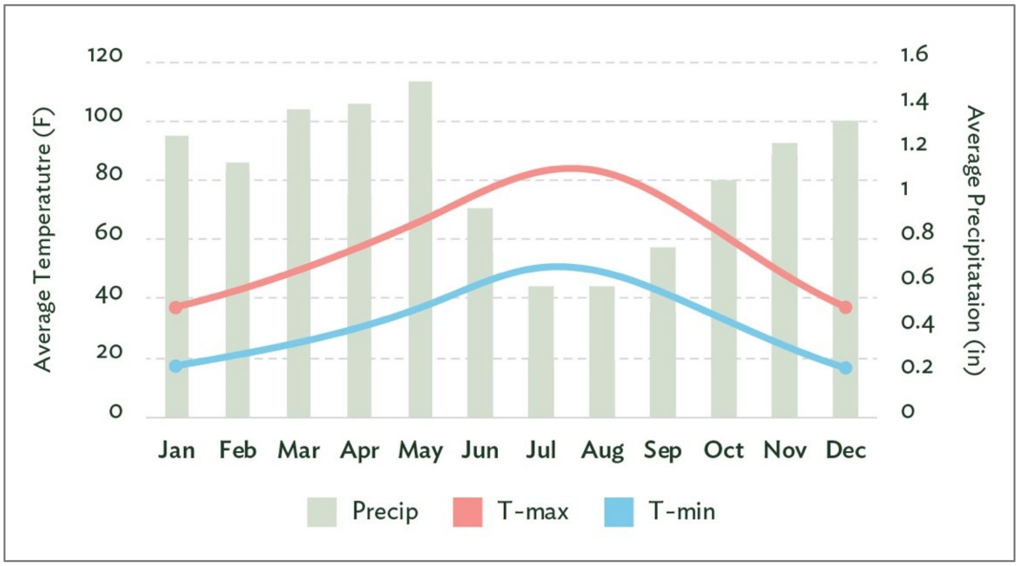

Figure 16. Climate zone 2 temperature and precipitation timing and amounts (NOAA 2020)

Division 3 – South Central Nevada

The northern boundary of the central Nevada climate division traces the northern limits of Mineral, Nye, and Lincoln counties. Its southern edge is physiographically defined, loosely following the northern edge of the Mojave ecoregion. This portion of Nevada is slightly warmer than the Northwest, but substantially cooler than the extreme southern part of the state. Average monthly maximum temperatures exceed 80°F from June through August but drop to the mid-40s in December and January. Monthly minimum temperatures range between 21.3°F (December) and 58.8°F (July). It is relatively dry, averaging just nine inches of precipitation per year. Like more northerly parts of the state, winter is the wettest season. Very dry months are both more common and more seasonally distributed than in the northern portions of the state. Between 1981 and 2010, there were 31 months with less than 0.1 inches of precipitation. Only January and February had precipitation ≥ 0.1 inch every year in this 30-year period. However, July and August can also be wet, like the southernmost portions of the state. Average monthly precipitation increases from 0.40 inches in June to 0.77 inches in August, dropping slightly in September. While the wettest month in this 30-year period was during the winter (February 1998, 3.54 inches), the second and third wettest months were in August 1983 (3.36 inches) and July 1984 (2.90 inches). Interannual variability in precipitation is relatively high, ranging from 76 percent during the winter (December – February) to 101 percent in September.

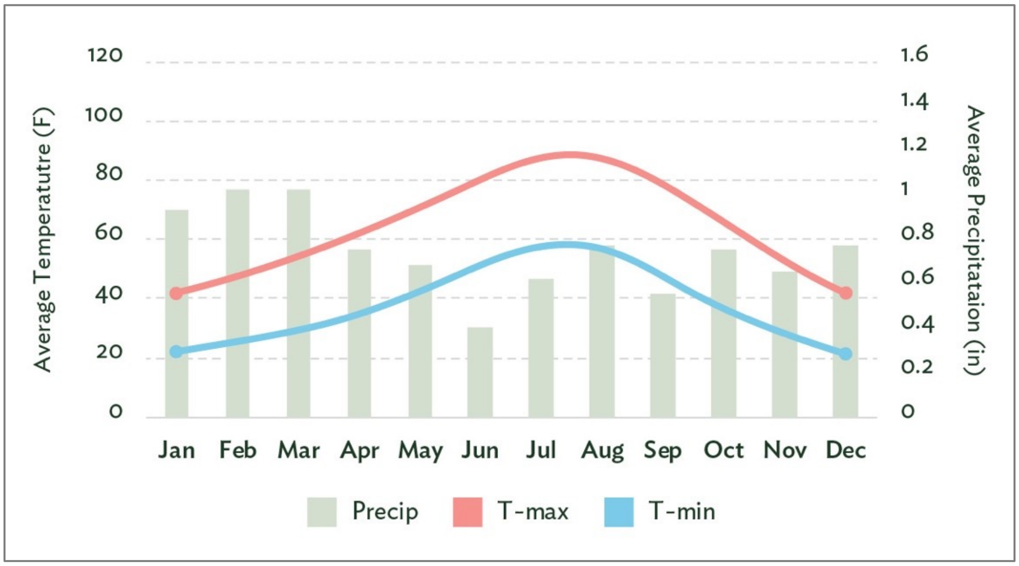

Figure 17. Climate zone 3 temperature and precipitation timing and amounts (NOAA 2020)

Division 4 – Extreme Southern Nevada

Division 4 covers most of the lowland Mojave Desert region in Nevada and extends to the state's borders with California and Arizona. It is by far the warmest part of the state with monthly average maximum temperatures exceeding 90°F from June through September and surpassing 100°F in July. Monthly average minimum temperatures across the division don't fall below freezing, although individual days could be below freezing. In July and August, monthly average minimum temperatures remain above 70°F. This is also the driest portion of the state, with average annual precipitation totaling only 7.1 inches. The precipitation distribution is somewhat bimodal, with relatively high precipitation (> 0.8 inches per month) between December and March, dry spring and early summer conditions (April – June), an increase in precipitation in July and August, and a slight decrease in average precipitation in September. Precipitation is highly variable, with coefficients of variation between 91 percent and 118 percent. Very dry months are exceedingly common. There were 31 months with <0.1" inch precipitation between 1981 and 2010; this was experienced across all 12 months, not just a single season. No precipitation at all was recorded in 22 months during this period. In contrast, the monthly precipitation in February 1998 was 4.33 inches, over half the annual average, and >3 inches precipitation was recorded in eight other months.

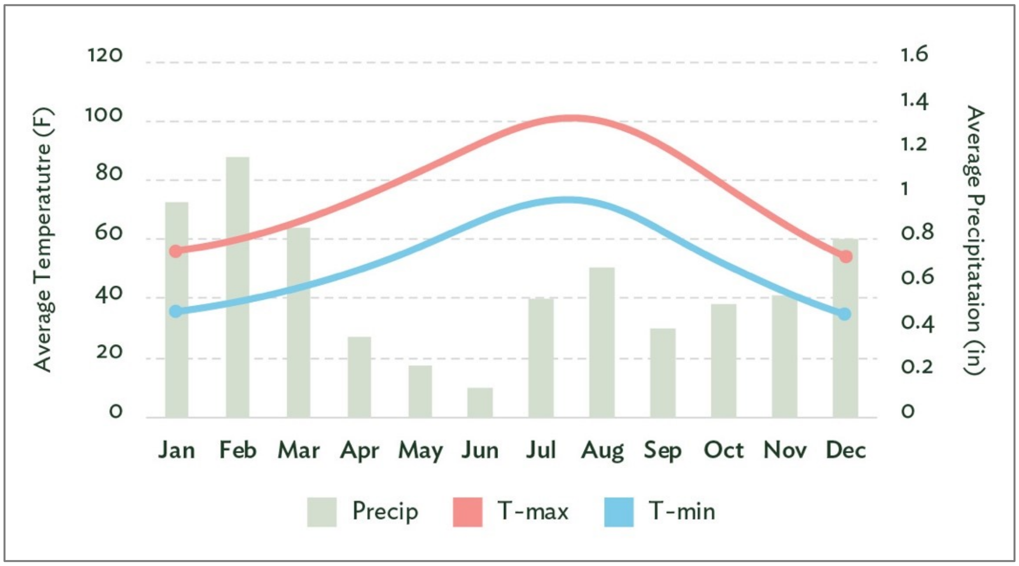

Figure 18. Climate zone 4 temperature and precipitation timing and amounts (NOAA 2020)

Climate Driven Ecological Events

Large precipitation events that surpass averages occur in various locations at low frequencies and cause flooding of streams and river systems. Droughts are more common and persistent yet occur in different parts of the state and in a range of severities. Droughts impact the health and moisture content of vegetation, thereby creating opportunities for greater size and amounts of wildfire as well as curtailed livestock grazing and wildlife habitat. The interaction between climate and wildfire varies because of regional weather patterns and vegetation types. Large wildfires predominately occur in northern Nevada where vegetation is more conducive to ignitions and fire spread, mainly tied to herbaceous understory vegetation that responds with two to three-fold production levels during peak precipitation years. This level of production increases the potential and occurrence of large wildfires (Figure 19). This pattern carries into the first and second year of drought many times because of the carry over fuel loads (Figure 20). Carry over herbaceous fuel loads are often decomposed by the third year of the drought and new growth is minimal; fire risk declines as the drought continues. The exception to this pattern is the dense forests and woodlands that experience a drying of large diameter fuels and increase in wildfire risk if the drought continues. Since these vegetation types are fewer in Nevada and wildfires tend not to spread as fast in these fuel types, they don't cause independently identifiable climate driven spikes of acres burned in the following figures. Climate also drives most of the naturally occurring wildfires because of lightning ignitions which account for about 50 percent of the wildfires in Nevada. Wind is common throughout the state and contributes to the explosive growth of wildfires whether they are human or naturally caused.

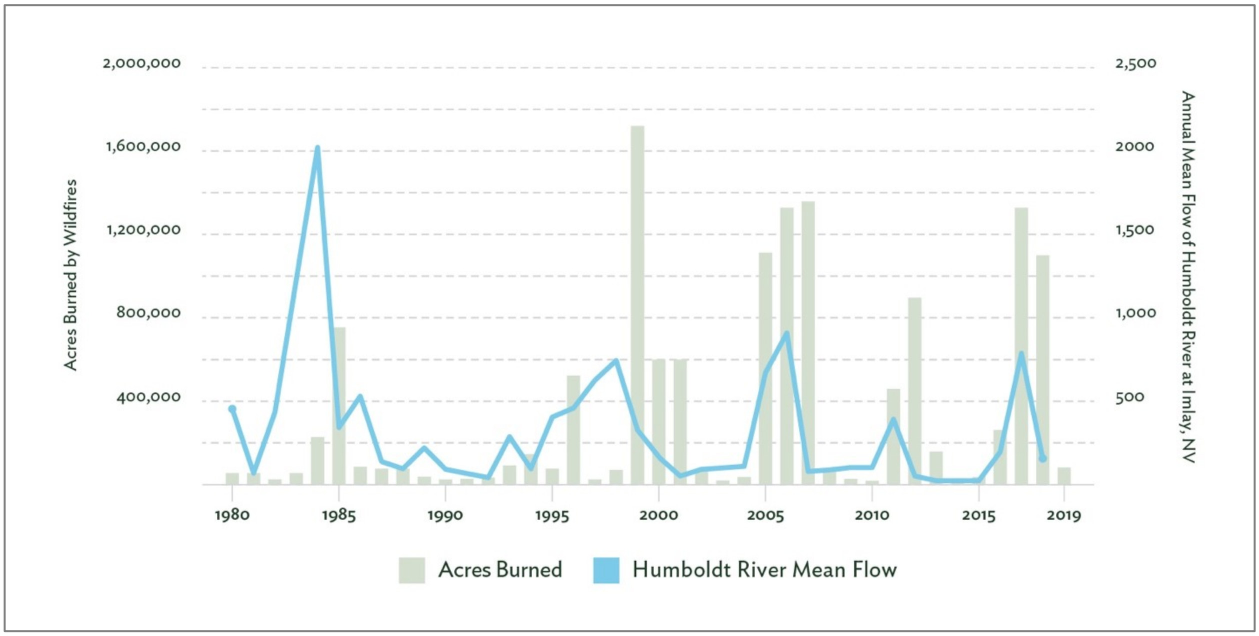

Figure 19. Acres burned annually versus Humboldt River flows at Imlay, Nevada (adapted from Swanson 2016)

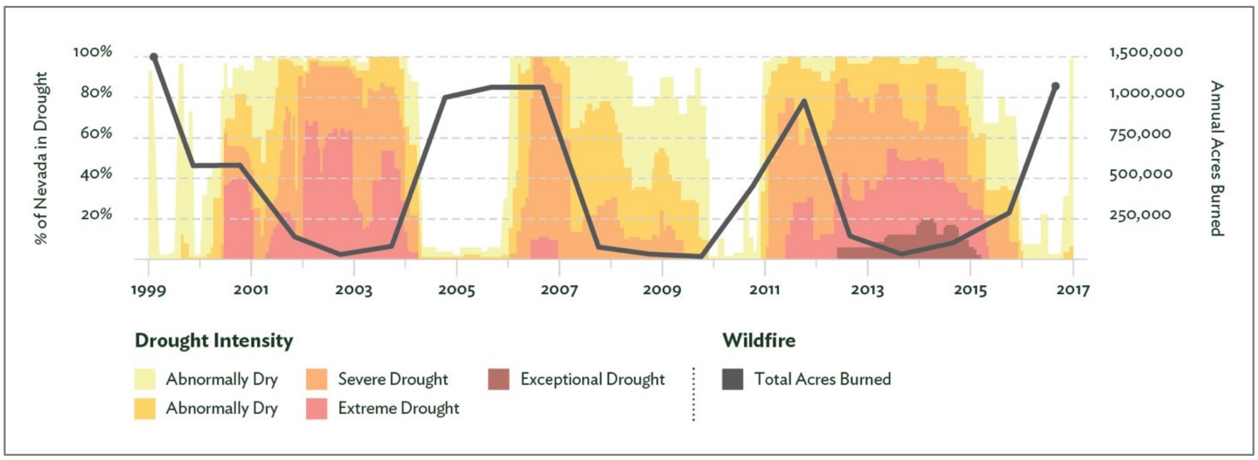

Figure 20. Interaction of drought indexes and acres burned in Nevada wildfires (Shane 2018)

Climate Change

Nevada's climate change has been documented as far back as 8,000 BC. These changes have generated shifts in vegetation communities, wildlife, and human populations over time in the state. This land has experienced a roller coaster of wetter and cooler, then drier and warmer conditions from 8,000 BC until the present, resulting in the migration of forests and woodlands up and down mountains and from south to north in the state. Such conditions have profound impacts on the rates of soil erosion and other biophysical processes on the landscape. Bison and Fremont Native Americans both inhabited Nevada during warming periods from 400 AD to 1300 AD but were both pushed out from the onset of the little ice age and the associated cooler and wetter climate resulting in unsuitable living conditions. The first European explorers arrived and encountered these conditions in Nevada. The recent (1850 to current) times have been dubbed the "Anthropocene" due to the impacts that human population growth and domination have had on the planet.

In the last century, the climate in Nevada warmed by about two degrees Fahrenheit. More frequent heat waves and earlier snow melt are some of the results of warming conditions. In some instances, a warming climate will create increased evaporation, humidity, and rainfall intensities while creating drought in other locations. Climate change creates unpredictable impacts to natural and manmade environments that may or may not be capable of adapting rapidly enough to remain sustainable and resilient. The warming climate has been attributed by scientists to Greenhouse Gas (GHG) production (e. g. water vapor, methane, carbon dioxide, nitrous oxides and chlorofluorocarbons) that traps heat from the sun in the lower parts of the atmosphere (NASA 2020). As of 2015, fossil fuel use in the transportation sector is now the largest greenhouse gas and carbon emitting sector in Nevada; however, these studies (NDEP 2019) exclude ecosystem processes such as wildfire as part of the emissions calculations. The warmer seasonal conditions foster increased grass growth and domination in some areas as well as increased woodland densities due to the longer growing seasons. Precipitation is falling more as rain instead of snow, reducing annual average snowpack, further reducing water storage that can melt slowly and sustain contemporary ecosystem functions and dependent human and wildlife populations. Additionally, pests that impact vegetation negatively thrive under increasingly warmer conditions and vegetation's ability to withstand and repel attacks decreases. Such conditions are resulting in increased size, frequency, and severity of wildfires. Additional threats to human health in the form of dehydration, ground-level ozone impacts to lungs, and wildfire smoke concentrations in populated areas can occur with increasing temperatures. Studies have shown that urban heat islands are exacerbating the warming conditions in most of Nevada's larger cities (Sauceda 2014). In Las Vegas, the city is 7.3°F hotter on average in the summer than rural areas and experiences 22 more days per year above 90°F than surrounding rural areas. If climate conditions continue in the directions that have been experienced in the last century, farming, rangeland livestock production, tourism, recreation, human health, economies, urban forests, and wildlife populations will experience negative impacts that could harm human populations, wildlife, natural environments, and economies.

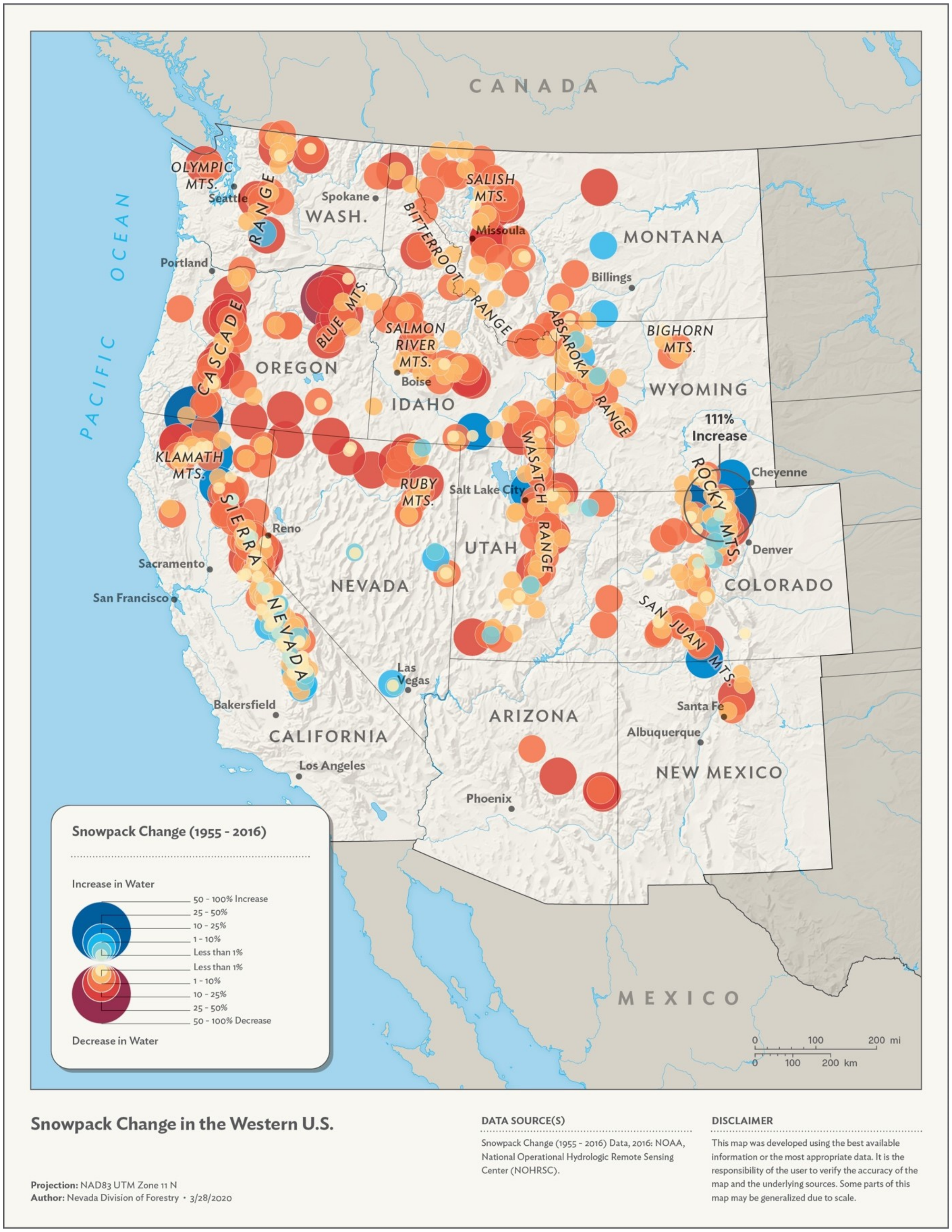

Figure 21. Map of snowpack change throughout the Western U. S. from 1955-2016.

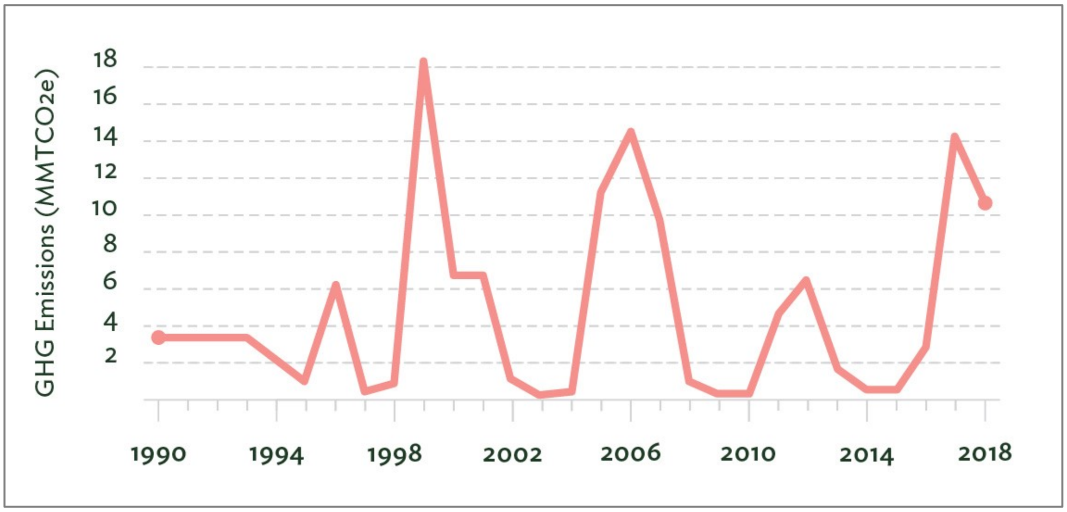

Figure 22. Nevada wildland fire GHG emissions 1990-2018 (NDEP 2019).

Models are used to predict a plateau of temperatures and associated negative outcomes if GHGs emissions are curbed. Informed by these models, policy makers in Nevada joined the US Climate Alliance, enacted the Climate Change Executive Order 2019-22, and Senate Bill 254, which sets GHG reduction goals, requires a statewide inventory of GHGs and projection of GHG emissions for the next 20 years. Nevada's natural lands and community forests, with their ability to sequester carbon and reduce GHGs (or conversely, release carbon via wildfire), will be a critical component of Nevada's climate change strategy. The 2019 Nevada Statewide Greenhouse Gas Emissions Inventory and Projects 1990-2039 report indicates that Nevada's overall GHG emissions are decreasing. According to the report, the natural environments and associated vegetation represent the only net GHG emissions sink of those analyzed. The report suggests that the amount of carbon currently stored and its change over time is not well understood however, GHG emissions from wildfires can become the largest emission source in years of intensive burns. Large wildfire years are becoming more frequent and the amount of land and vegetation burned is also increasing over time, therefore GHG emissions from fire are increasing over time. Because of the episodic and unpredictable nature of these emissions, the current inventory and tracking practices do not include them in the inventory of GHGs for Nevada. While the report identifies land use, land use change, and forestry as a sink, it also shows that sink diminishing over time by 50 percent from 1990 through 2016, yet projections show the trend leveling out from now until 2039. The trends for decrease in the sink and why the trend is projected to stop needs to be researched and identified. The current land use related activities that are tracked and inventoried under the current practices include urban trees, landfill wood waste, landscaped soils, agricultural lands, above and below-ground biomass, deadwood, natural litter, and soil carbon.

As part of the recent policy package the administration will identify and evaluate policies and regulatory strategies that create climate resiliency and mitigation of the impacts of climate change in urban and rural areas, including adoption of approaches to increase conservation, restoration and management of Nevada's forests, rangelands, and water resources. Strategies for managing natural resources to mitigate GHG emissions and adapt to climate changes in Nevada can be found in the Strategy Section of this document.

Renewable Energy

In 2019, the Nevada legislature approved bill SB254 which gradually raises the state's Renewable Portfolio Standard to 50 percent of the state's energy usage, with the goal of a 45 percent reduction in the state's current GHG emissions by 2030. The goals are to reduce Nevada's carbon emission production, meet goals set by the U. S. climate alliance (Nevada joined in March 2019), and match goals of the Paris Climate Agreement. The 2019 goals build on 2009 bills directing a series of changes designed to ease the process of acquiring permits for green or renewable energy generating plants and restricting new generating stations that produce large amounts of GHG's.

Renewable energy production, composing 26 percent of Nevada's energy production in 2018, may work concurrently with air quality benefits gained from forest health and urban forestry goals. However, the rapid expansion of renewable energy infrastructure such as solar and wind farms also results in potential land management conflicts. Solar is an increasingly popular option for energy production because Nevada has nearly 300 sunny days per year. As public land renewable energy corridors are established across broad swaths of wildland habitats, the disturbance of thousands of acres of land for renewable energy infrastructure may overlap with habitats of concern such as endangered plant communities and sensitive hydrological resources. By 2018, utility scale solar installations were installed across nearly 20,000 acres of public land, producing 4.7 TWh of energy (GOE 2018). As of January 2020, over 10,000 acres of new installations were proposed. As of 2020, Nevada had only two wind powered electrical generation facilities. They are the Spring Valley Wind Farm in White Pine County and JMS Wind Energy in Clark County. The generation of energy from wind also poses measurable environmental impacts from direct mortality of flying species (birds and bats) or the disruption of flight paths, disturbance of lands where the towers are installed and associated access roads, and the mining of rare earth materials instrumental in their magnetic components.

In 2009, the Nevada Division of Forestry created a state-wide assessment to expand biomass utilization facilities as part of the Fuels for School grant from the U. S. Forest Service. Using a Forested/Woody vegetation geospatial layer from the *National Land Cover* data set and a classification used in wildfire to determine the amount of fuel per acre, the assessment has determined there is approximately 4.9 million tons of biomass on state and private lands in Nevada. David E. Norman Elementary School located in Ely is the only facility that can use biomass for energy production in Nevada. Efforts continue to resume functions at the Northern Nevada Correctional Center's biomass energy production facility. The facility could serve as a more air quality friendly alternative to traditional burning of biomass waste resulting from forest thinning activities.

Nevada is also rich in geothermal resources and is second in the nation behind California in producing geothermal power. More than 20 geothermal power plants are located throughout the state. Some geothermal resources are coincidental with endangered species that are highly adapted to and dependent upon soils geothermally and chemically altered by the hot mineralized waters associated with the geothermal vents and outflows.

Wildlife Habitats and Populations

The Nevada Department of Wildlife (NDOW) is responsible for protection and management of the state's rich and varied biodiversity of animals. Nevada's wildlife diversity is due to the state's past and present diversity of vegetation, climate, geography and geology. The Nevada Division of Natural Heritage recognizes 136 species of mammals that occur or historically occurred in Nevada. According to the Nevada Bird Records Committee (NBRC), a total of 489 species of birds have been recorded in Nevada. There are 56 native reptile species and 15 native species of amphibians recognized in Nevada. Approximately 151 species or subspecies of fishes have been found in the wild in Nevada, with 87 endemic species and 37 as nuisance or incidental observations. NDOW also manages aquatic fauna, such as mollusks, bivalves, gastropods, and crustaceans, which can occur in isolated wetlands of the state. The Nevada Department of Agriculture (NDA) manages insects detrimental to agriculture. While the Nevada Division of Natural Heritage tracks insects falling within various "sensitive species" categories, there are no Nevada State agencies tasked with their protection and preservation. NDF, in cooperation with the USFS and NDA monitor insect and tree pathogen populations.

The Nevada Comprehensive Bird Conservation Plan, prepared by the Great Basin Bird Observatory (Great Basin Bird Observatory 2010), prioritizes 21 bird species in conifer, pinyon-juniper, and aspen habitats for special conservation needs. The predominantly forested Carson Range on the edge of the Sierra Nevada ecoregion is designated a high priority conservation site by the Nevada Division of Natural Heritage (Nevada Natural Heritage Program 2006). Several sensitive plant and animal species inhabit the area.

Among the 50 states, Nevada ranks eleventh in diversity of plants and animals (Stein 2002). It is sixth in the nation for endemics (including invertebrates), with 173 species found in Nevada and nowhere else in the world. Unfortunately, Nevada also ranks third, behind Hawaii and California, in the number of its species at risk of extinction. Nevada's seven highest ranking plant biodiversity areas (ranked from highest to lowest) include:

- Ash Meadows section of the Amargosa Desert
- Four distinct high elevations areas of the Spring Mountains
- Upper Muddy River
- Devil's Hole Range

These seven areas include the following 16 habitat types identified by the Nevada Wildlife Action Plan (WAPT 2012) and Nachlinger and Reese (1996):

- Intermountain Cold Desert Shrub
- Mojave Warm Desert and Mixed Desert Shrub
- Lower Montane Woodland and Chaparral
- Intermountain Coniferous Forest and Woodlands
- Warm Desert Riparian
- Springs and Springbrooks
- Mesquite Bosques and Desert Washes
- Marshes
- Desert Playas and Ephemeral Pools
- Sand Dunes and Badlands
- Barren Landscapes
- Sagebrush
- Grasslands and Meadows
- Aspen Woodland
- Alpine and Tundra habitats

Nevada's next 22 highest priority plant biodiversity areas include:

- Riparian areas of the Pahranagat Valley
- Sunnyside area of the White River Valley
- Six distinct lower elevation areas within the Spring Mountains
- Two distinct areas on the lower Meadow Valley Wash
- Two distinct areas in the Carson Range
- Overton Arm of Lake Mead
- Both unincorporated and uninhabited areas of the Las Vegas Valley
- Two distinct areas of the Virgin River Valley
- Spring Valley
- Great Basin National Park area of the Snake Range
- White Mountains
- Valley of Fire area of the North Muddy Mountains
- Toiyabe Range

The above-listed habitat types in these biodiversity areas include:

- Sierra Coniferous Forest and Woodlands
- Intermountain Rivers and Streams
- Lakes and Reservoirs
- Cliffs and Canyons
- Developed Landscapes
- Agricultural Lands

These 29 highest ranking biodiversity areas in Nevada contain all the 22 habitat types recognized by NDOW. Population levels of each species ebb and flow with the ecological conditions and processes within habitats and various states of vegetation that support generalist and specialist species.

It is important to recognize that many small and big game populations are dependent upon the 1,747 constructed guzzlers that capture, store and provide rainwater for extended periods of the drier portions of the year where perennial water sources are limited. Nevada Department of Wildlife and its partners perform maintenance on these facilities and construct additional ones annually. There are currently about 60-100 additional facilities scheduled for construction in the next decade. It is also important to recognize the seasonal habitat requirements of many species from birds to large mammals. In 2018, the Department of the Interior released Secretarial Order (S.O.) 3362 (Improving Habitat Quality in Western Big-Game Winter Range and Migration Corridors) which emphasizes the importance of conserving and improving elk, mule deer, and pronghorn habitat. In particular, S.O. 3362 directs that the BLM "appropriately apply site-specific management activities, as identified in State land use plans, site-specific plans, or the Action Plan that conserve or restore habitat necessary to sustain local and regional big-game populations (DOI 2018). There are many of these corridors in the state, and Nevada Department of Wildlife has identified their highest priority migration corridors and winter habitat for mule deer within Elko and White Pine as well as the far northern portions of Eureka and Lander counties.

Major Land Uses

Lands throughout Nevada are used for commercial and non-commercial benefits and services that support more than 80,000 jobs in the Natural Resource Technology and Agriculture sectors. The average annual pay for workers in these industries is $81,000 and $47,000 respectively (NGOED 2019a, 2019b). The primary land uses are residential and industrial development, watersheds, agriculture, recreation, and mining. All these land uses support the State's economy through job creation, community development, energy production, mineral extraction, manufacturing, technology, and supply chain businesses that consume renewable and non-renewable natural resources. Since Nevada has so few surface water resources, limited aquifers, and very low precipitation, watersheds influence all uses of the land and economy. Air resources are similar in that they are used by all people across all sectors of the economy as well as wildlife. Agricultural uses are typically rangeland livestock grazing, a very limited amount of traditional forestry activities, and forage crop production. Recreation is rapidly expanding to the use of all open lands in Nevada because of the increasing human populations. Mining continues to be an economic driver in rural communities, though the footprint of the mines is relatively small. Renewable energy production is an expanding market and economy in Nevada.

Rangelands

Rangeland covers an immense portion of the state and provides a variety of ecological and economic benefits. Benefits of healthy rangeland include habitat for wildlife, livestock production, ranching, mining, outdoor recreation, and land for rural and urban development. These lands also provide aesthetic value and open space. The term rangeland is often used to refer to a group of vegetation zones composed primarily of shrubs, grasses, and forbs that are suitable for grazing and browsing animals, most notably large native herbivorous wildlife (e. g., mule deer, antelope, and elk) and domestic livestock when properly grazed, with wild horses and burros also being suitable for rangeland habitat types.

About 57 million acres (81 percent of Nevada) may be classified as rangeland. The vegetation zones include: sagebrush/perennial grass communities (sagebrush zone); salt desert scrub, greasewood, blackbrush, and Mojave mixed scrub (lowland shrub zone); dry meadows, perennial and annual grasslands (herbaceous and grasses zone); creosote/bursage (creosote zone); and, bitterbrush, mountain shrub, and Sierra mountain shrub (mountain shrub zone). Streams, springs, and patches of wetlands and riparian zones, woodlands, and forested areas are interspersed throughout rangelands, adding to the diversity of wildlife and human uses.

Sagebrush/perennial grass and forb communities known as sagebrush steppe dominate the state, with subtly different shrub communities spanning 30.5 million acres. Of the 12 species and subspecies of sagebrush that dominate over half of the state's rangeland, mountain big sagebrush is prevalent above 6,500 feet in central and northern Nevada, and Wyoming big sagebrush dominates at lower elevations with reduced precipitation. Low sagebrush species are dominant in areas with shallow or claypan soils and basin big sagebrush tends to occupy deep soils in areas with more available moisture. The mountain big sagebrush community is more common in the Columbia Plateau ecoregion and mid-elevations in the central mountains in semi-arid microclimates. Associated shrubs may include bitterbrush, rabbitbrush, currant, gooseberry or cliff rose; stands of pinyon and juniper may be intermixed or, along the Sierra front, stands of Jeffrey and ponderosa pine. Perennial grasses tend to make up a significant portion of this community. The Wyoming big sagebrush community is the most widespread and abundant in Nevada and typically occurs above 4,500 feet with native grasses that may not be present at all in degraded states. This ecosystem evolved with infrequent fire and has less precipitation and established perennial grasses to aid in fire recovery, therefore it is highly vulnerable to cheatgrass invasion especially as fires become more prolific.

The herbaceous and grass zone covers about 1.9 million acres dispersed throughout the state. Dry meadow vegetation type is most prevalent in the foothills and mountains of the northern Great Basin, Columbia Plateau, and the Sierra Nevada ecoregions, which offers more forage than shrub communities, and is often privately owned. The grassland vegetation type is more prevalent in northern Nevada, yet is quite variable, often consisting of pure cheatgrass grasslands, introduced perennial grasslands, or patches of native grasslands. Well-represented native grass species include wheatgrasses, bluegrasses, needlegrasses, basin wildrye, blue grama, squirreltail, and Indian ricegrass.

The warm and hot deserts are dominated by lowland shrubs including salt desert scrub, greasewood, blackbrush, and Mojave mixed scrub. Lowland shrubs cover 20. 4 million acres on valleys and slopes below 5,000 feet. The largest expanses occur in the southern, central and northwestern part of the state, including the Mojave and Amargosa deserts northward to the Black Rock and Smoke Creek desert basins. This zone receives the least precipitation and experiences the warmest temperatures. Moist, saline soil conditions exist in some valley bottoms, generally identifiable by the presence of greasewood and salt grass, often up to the edge of a playa. In the salt desert scrub zone, dominant shrubs include shadscale, greasewood, winterfat, budsage, horsebrush, fourwing saltbush, and Mormon tea. Saltgrass, Indian ricegrass and cheatgrass are associated species. The salt desert scrub zone provides winter forage and cover for many forms of wildlife and livestock. Mojave Desert mixed scrubland occupies lower slopes, washes or upland areas. The zone is characterized by creosote with bursage, desert thorn, hopsage, blackbrush, yucca, and cacti. The creosote-bursage zone is widely distributed in the Mojave Desert below 4,000 feet on valley floors and mildly sloping lowlands. Blackbrush, Mormon tea, indigo bush, honey mesquite, and brittlebush are associated shrubs. Yucca, prickly pear, and Joshua tree are also present (Cronquist, et. al. 1972).

A much smaller, but more productive rangeland component is the mountain shrub zone. Mountain shrubs occupy almost 1.2 million acres, generally at elevations above 6,500 feet. Unlike the lower sagebrush and salt desert scrub zones, this vegetation zone has eluded major vegetation conversions and remains in relatively good condition. Serviceberry, snowberry, currant, and bitter brush are present throughout. Unique shrub species in the Sierra Nevada ecoregion include varieties of manzanita, chinquapin, tobacco brush, and other species in the *Ceanothus* genera. Patches of mountain mahogany, aspen, and conifers are common. The moist and cooler conditions at upper elevations help sustain the vigor of native plants, giving them a competitive edge over aggressive annual grasses and weeds. Moderate environmental conditions dampen the risk of large and severe wildfires and aid in fire recovery. In many cases, wildfires prevent the long-term occupation of tree species on these sites and allow shrubs to maintain dominance over time.

The Nevada Pinyon-Juniper Partnership estimates that currently nine million acres of Nevada's landscape is pinyon-juniper woodlands, with over 100,000 acres each year converting to the highest density of pinyon-juniper, where it crowds out the shrub and grass understory. Overcrowded woodlands reduce forage, creating competition among big game populations and livestock herds. These conversions are a product of the removal of natural wildfire regimes by humans, allowing sites ecologically suited to rangelands to cross an ecological threshold and become woodlands. This transition can exacerbate conversion to invasive and undesirable species following catastrophic wildfires. Mechanical thinning and prescribed fire are among the alternative measures being used to manage pinyon-juniper in the interest of resistant and resilient rangeland vegetation communities.

Scientists uncovering the natural prehistory of Nevada's ecoregions found that rangeland plant communities were adapted to light-to-moderate grazing by comparatively small populations of large and small herbivores [(e.g., pronghorn antelope, mule deer, elk, bighorn sheep, jack and cottontail rabbits) (Grayson 1993)]. Other major influences on vegetation include human harvesting practices and frequency of natural and human-set fires. Given the low population densities and seasonal movements, native populations' food gathering and use of fire likely affected only a small fraction of the landscape (Griffin 2002). Since settlement, domestic livestock grazing has been the primary use of rangelands.

Rangelands have long relied on an interdependence between public land and local private landowners, a tradition that began as smaller, more productive, mesic areas with accessible water were homesteaded when the West was settled. Lands well-suited for settlement that remained available were later privatized and sold as well. Vast, arid, and relatively unproductive upland areas on public lands were used as additional forage for livestock, although overgrazing by many on public lands eventually led to Dust Bowl conditions. The Taylor Grazing Act of 1934 regulated public lands grazing., It solidified the concept that private base properties were best suited for grazing operation headquarters and production of hay for winter feed, while public lands grazing allotments expanded opportunities for summer grazing, when permitted in a manner that required appropriate land management for sustained multiple uses. Presently, the BLM and USFS manage about 85 percent of the rangelands in the state, comprising numerous grazing allotments that account for more than 45 million acres. Cattle, and to a lesser extent sheep grazing, are managed by permittees within their allotments working with Federal agency range conservationists on managing according to permit conditions. Permits come at a modest cost per animal unit month (AUM) that corresponds to a share of a general forage availability estimate and are valid for ten years. While continuing under the same permit thereafter is generally warranted, updating terms and conditions within a new permit requires National Environmental Policy Act (NEPA) analysis that Federal agencies presently lack sufficient capacity to complete. Monitoring of range condition and trend is also required of permittees. For these reasons, many permittees, if not the vast majority, are operating under permits that are multiple decades old with fairly rigid terms and conditions and hard turn-on and off dates. This often leads to a lack of flexibility for even the most progressive permittees to adaptively manage the range. Adaptive management takes into account significant annual differences in precipitation amount and timing, which changes forage conditions. It also allows flexibility in implementing emerging best management practices.

Another difficulty in this historical private-public partnership is that range improvements on public lands can come at the expense of the permittee. While fence repairs, weed treatments, and similar endeavors are often conducted by permittees along with fine fuel reduction through grazing, wildfire restoration and other large-scale actions are generally cost-prohibitive to permittees. Further making matters difficult is that modest improvements (e.g., a cross-fence or water distribution) can require NEPA review. This can greatly lengthen the time necessary to implement improvements, even if the improvement results in improved values for wildlife, water resources, or other attributes.

A vital component of managing grazing for sustainable and distributed forage harvest across allotments is the use of water source improvement facilities. Many of these facilities are defunct or in disrepair, which causes overuse problems instead of distributing grazing more evenly across the landscape. Distributed grazing facilitates healthy vegetation communities, soil conservation and improved water quality and quantity. BLM has 5,950 of these water improvements and their process for maintenance is administered under general guidelines that request three to five-year inspections. It is known that this and the associated repairs and maintenance do not always occur accordingly. USFS has 2,055 of these water improvement facilities that are the responsibility of the grazing permittee to inspect and maintain. New facilities are proposed and authorized during the grazing allotment reauthorization process.

Due to such issues, overutilization of private ranch lands can result as well. Private ranch lands often contain some of the more valuable meadows and streams for wildlife, fish, riparian communities, healthy watersheds, and water resources. Factors incidentally contributing to overuse of private lands can include a lack of flexibility of public lands grazing permits, more frequent and widespread wildfire affecting grazing plans or resulting in a temporary or permanent loss of high quality forage, the need for more rest brought on by more frequent restoration actions post-fire, and a reduction in forage due to wild horse populations well above Appropriate Management Level.

Fire has historically been a part of the Great Basin as a means of resetting successional pathways that maintained diversity but has long been caused far more frequently by lightning at higher elevations with ample precipitation for recovery whereas infrequent fires at moderate elevations provided ample time to ensure recovery. At higher elevations with fire now long suppressed, vast increases in pinyon-juniper cover and density have reduced rangelands and led to less frequent yet more intense significant fires that make recovery formidable. At moderate elevations, cheatgrass invasion in many areas and the coinciding more frequent and widespread wildfire that coincide with its arrival have led to further cheatgrass abundance and increasingly common and large wildfires and megafires that often ultimately prohibit the recovery of sagebrush and other shrubs. This vicious cycle of wildfire and cheatgrass in the Great Basin of Nevada remains its biggest threat. Other areas of the state differ, although invasive grasses are a common problem that upsets the ecological and successional balance and reduces the amount and productivity of rangelands. Scientists and land managers are continuously working toward solutions to inhibit annual grass domination after wildfires and manage the intensity, severity, and frequency of wildfires to re-produce ecologically supportive conditions for native plant species.

Wild Horse and Burro (WHB) populations are also problematic in many rangeland areas of Nevada. As of 2018, horse populations according to the BLM were more than three times their Appropriate Management Levels (AMLs). AMLs were calculated to describe the population that could graze available forage without damaging the range, with AMLs also designated for domestic livestock forage within allotments as well as wildlife. When horse populations are well above AML, not only do livestock and wildlife have consistently less forage available, but temporary to long-lasting negative impacts to soils, vegetation, and water sources are consistently an issue. The largest impacts are where the populations are most above AML and where water sources are most limited because the animals become territorial and protective of these limited resources. The timing, duration, intensity and location within an allotment can be controlled in livestock to reduce their impacts, and wildlife movement along corridors is often well-known, whereas wild horses have less predictable movements and are often well beyond their designated BLM Herd Management Areas and USFS Wild Horse and Burro Territories. Moreover, where the numbers of livestock are managed as well as wildlife through predation and hunting, populations of horses are likely to continue the tendency to double every four years under current management strategies, which creates an extremely problematic trajectory for humans, livestock, wildlife, and even the horses dependent on the ecosystem, ecosystem health, and management costs under any timeline. AML is often exceeded due to inadequate management by the jurisdictional agencies that have responsibility over the animal due to insufficient budgets, regulatory-restricted management practices, and political pressures from special interest groups. The 2019 Nevada Greater Sage-Grouse Conservation Plan offers further detail.

The use and management of public rangeland resources is becoming more challenging with the growing number and diversity of public land users and reduced acres of pristine landscapes especially due to increasingly large wildfires. Various types of development, as well as the rapidly increasing WHB populations that often exceed population targets present significant challenges as well. Pressure on today's federal public rangelands comes from livestock grazing, dozens of outdoor recreation pursuits, fish and wildlife habitat, riparian management, endangered species management, mining, hunting, cultural resource protection, wilderness, exponentially increasing wild horse and burro populations, energy development, and various special uses. Investment in restoration of deteriorated conditions is vital to the future of sustainable resource use such as agriculture, wildlife, and the quality of outdoor recreation experiences in Nevada.

Timberlands and Woodlands

Forestland types cover approximately eight million acres (approximately 12 percent) in Nevada. Forests can be divided into two major types, timberland and woodland. Timberland is comprised of conifer tree species (575,850 acres) formerly used for saw-log wood products such as ponderosa, Jeffrey, western white, sugar, and lodgepole pine; white and red fir; and incense cedar. Heavily logged in the past, conifer forests in many mountain ranges have rebounded and form semi-continuous forested areas, especially in the Carson Range of western Nevada and the Spring Mountains of southern Nevada. Large conifer forest patches also occupy higher mountains of central and eastern Nevada in varying mixtures of whitebark, bristlecone, ponderosa and limber pine as well as subalpine fir, white fir, and Engelmann spruce. Aspen and cottonwood are the most common deciduous trees and are widespread along riparian areas, sometimes forming large groves around streams, springs and seeps on large, north facing slopes.

Hardwoods and deciduous woodlands occupy about 283,865 acres. Mountain mahogany (535,500 acres) typically occurs above the pinyon-juniper woodlands, mostly in the mountains of northern, central, and eastern Nevada. These types have limited commercial value at the present time, which is largely focused on small instances of fuelwood harvesting.

Pinyon-juniper woodlands are the most common woodland type in the state. From the 1860s to the 1920s these woodlands were cut extensively in Nevada for the production of charcoal, the only available fuel source for mining smelters in many locations including the Comstock in western Nevada where 190,000 acres of nearby pinyon–juniper woodlands were cut before mines started sourcing pine from the Sierras. Additional uses included firewood, fence posts, other commercial mining, and land development construction materials. Around other mines, 4,000-5,000 acres of woodland had to be cut annually to keep up with the demand, creating treeless circles with a radius as large as 20 to 70 miles. Many of the trains that transported goods, supplies, and people were also fueled with wood from these woodlands. Hundreds of woodcutters surrounded these areas with cutting as their primary job. Chinese residents followed the woodcutters and dug out the stumps and root balls to heat their homes and fire their laundering operations (Young and Budy 1979). With the advent and widespread use of fossil fuels, electricity, and steel fence posts, the demand for fuelwood and charcoal subsided.

From 1970 until present, land managers have been attempting to find uses for the woody material removed from the woodlands by turning them into products to provide economic stimulus for local communities. Pinyon-juniper woodlands have been scrutinized for possible development of forest products beyond traditional Euro-American uses, including energy production, feed stocks, fuel pellets, finger jointed studs, laminated lumber, water filters, composite boards, oriented strand board, particle board, composite roofing shakes, fences, furniture, erosion control structures, and animal litter. The lowest value for wood is energy. The value of wood products made from these trees could range from $10/ton to more than $200/ton. Poles, posts, and lumber are generally worth more than $200/ton, while the market value for firewood, chips, and gasifier fuel is generally less than $30/ton (Knaeb 2008). Management of woodlands for nut production will yield 100 times more income than management for livestock forage, the two activities can be done on the same land without interfering with each another (Aldon and Douglas 1993). The average production of nuts per tree is 40 pounds, which occurs every two-to-three years when cones are produced (Pinchot 1909). Currently, the only substantial harvestable products derived from pinyon-juniper woodlands are firewood and pine nuts. In eastern Nevada, the BLM is administering stewardship and fuelwood cutting contracts with private wood cutters on tens of thousands of acres. Pine nuts are harvested by permitted private businesses on thousands of acres annually. These woodlands can produce from 150 to 300 pounds of pine nuts per acre annually (NRCS 2003).

Figure 23. Mule team hauling bagged charcoal made from pinyon and juniper trees to Eureka, Nevada in the 1880s (Young and Budy 1979).

More than 92 percent of forestland occurs on Nevada's public lands and is managed primarily by the USFS and the BLM. Since 1969, the USFS has acquired 71,000 acres of forestland in the Carson Range of western Nevada. Conversion of private forestland to public land has decreased private commercial timber harvests and revenue. Approximately 750,000 acres of forestland is in private ownership with concentrations in the Carson Range of western Nevada, the Ruby Mountains, the Schell Creek Mountains of eastern Nevada, and portions of the Spring Mountains in southern Nevada (Nevada Division of Forestry, 2000). Most non-industrial private forestlands are not managed for their extractive forest uses but are instead managed for non-extractive uses, such as recreation, wildlife habitat, and other non-industrial uses.

Table 6. Area of land by forest type and ownership in acres.

Forest Type	USFS	Other Federal	State & Local	Private	Total
Aspen/birch	193,711	30,151	1,401	15,030	240,293
Cottonwood	2,803	--	--	3,372	6,175
Douglas-fir	5,953	11,906	--	--	17,859
Fir/spruce/mountain hemlock	96,058	87,432	5,605	4,465	193,560
Lodgepole	14,966	--	4,204	--	19,170
Non-stocked	113,487	472,966	--	39,218	625,672
Other western softwoods	91,767	47,646	--	--	139,412
Pinyon /juniper	2,240,380	5,983,248	5,953	308,180	8,537,761
Ponderosa pine	40,358	3,582	1,423	6,558	51,921
Woodland hardwoods	391,264	327,295	--	25,043	743,602
Totals	**3,190,747**	**6,964,226**	**18,586**	**401,866**	**10,575,425**

FIA data accessed December 2015 (http://apps. fs. fed. us/fia/fido/index. html)

Few forested areas are representative of the range, density, and mix of species that existed prior to Euro-American settlement. Forests and their ecological conditions have been altered to accommodate commercial and domestic uses including, but not limited to agricultural, urban, mining, and railroad development. As a result, most of the timberland resources during the 19th century were depleted or high-graded for the most valuable timber. The second growth stands present today can be found at all elevations and include areas of steep terrain that is difficult to access for product removal. The margins of some conifer forestlands that were clear-cut have not regenerated, likely the result of erosion, barren soils, and drier, warmer micro-climates across exposed slopes. Overstocked stands which are common in most forested areas in the state generally have low resilience to disturbance events that can result in large scale tree mortality. These disturbance events can be sudden and dramatic. Drought, insect epidemics, and wildfire often act in combination to cause change at the landscape level.

The forests in the Sierra Nevada ecoregion of western Nevada generally receive substantially more investment of management resources than other forested areas because of the association with the large continuous Sierra forests, higher timber production potential, generally good access, national level recognition for recreation experiences and the proximity of rapidly growing urban areas. In the past 20 years, remaining foothill conifer forests along the eastern Sierra Front in western Nevada (including the Lake Tahoe Basin and the Carson Range) have become popular sites for residential development. Approximately 3,500 acres of timberland have been converted along the Sierra Front, resulting in the loss of commercial harvesting, recreational opportunities, and restricted public access to public lands (Nevada Division of Forestry, 2001). Developments in forested areas also threaten critical watershed values, diminish scenic beauty, and increase the risk that lives, and personal property will be lost to wildfires. Many of the timberland areas are overstocked, lack age class diversity, and contain a significant number of standing dead trees. Bark beetle outbreaks and mistletoe infestations are common in these forests. The Sierra Front extends south to north for nearly 90 miles and has experienced numerous wildfires over the past 35 years. Some of the areas have had multiple fires in that span of time. Wildfires combined with accelerated development has contributed to forest fragmentation and the establishment of large areas of cheatgrass and other invasive plant species.

Timber harvests have been permitted primarily for private commercial timberlands, and these declined from about 2.3 million board feet per year in the 1990s to about 150,000 board feet in the 2000s. Specifically, fuelwood production in the Carson Range declined from 3,162 cords in 1990 to 550 cords in 2000. More recently, with fuel reduction and forest restoration activities, timber harvest production has sporadically returned to millions of board feet for some individual years. Sawmills near northwestern Nevada in Truckee, Loyalton, and Pioneer, California, have closed. The closest sawmills are now located in Quincy and Lincoln California more than 80 miles away. Although potential commercial forest product uses have been identified by biomass utilization working groups, such as power cogeneration feedstocks, biochar, and mass timber building materials, significant markets have not emerged in the western Nevada region.

Watersheds

Nevada's watersheds extend across the state's nearly 300 mountain ranges and basins. Areas in Northern Nevada contribute a few streams and the Owyhee River to the Columbia River Basins and other areas in the South contribute to the Virgin River and larger Colorado River systems that run through Lake Mead in Southern Nevada and Lake Mojave along the border of Arizona. The vast majority of Nevada, however, lies in the Great Basin. Portions of the Great Basin also originate in California, Oregon, and Utah and terminate in Nevada (McLane 1978).

The Great Basin is unique in that it has no outlet to the ocean and water loss is dominated by evaporation, and to some extent infiltration. These processes occur throughout Nevada's hydrological systems, but lakes or sinks, which tend to accumulate salts due to the dominance of evaporation, are present at the terminus of the Carson, Humboldt, Truckee, and Walker river watersheds. Despite the name, the Great Basin is not composed of hydrologically connected surface waters and instead describes several terminal basins.

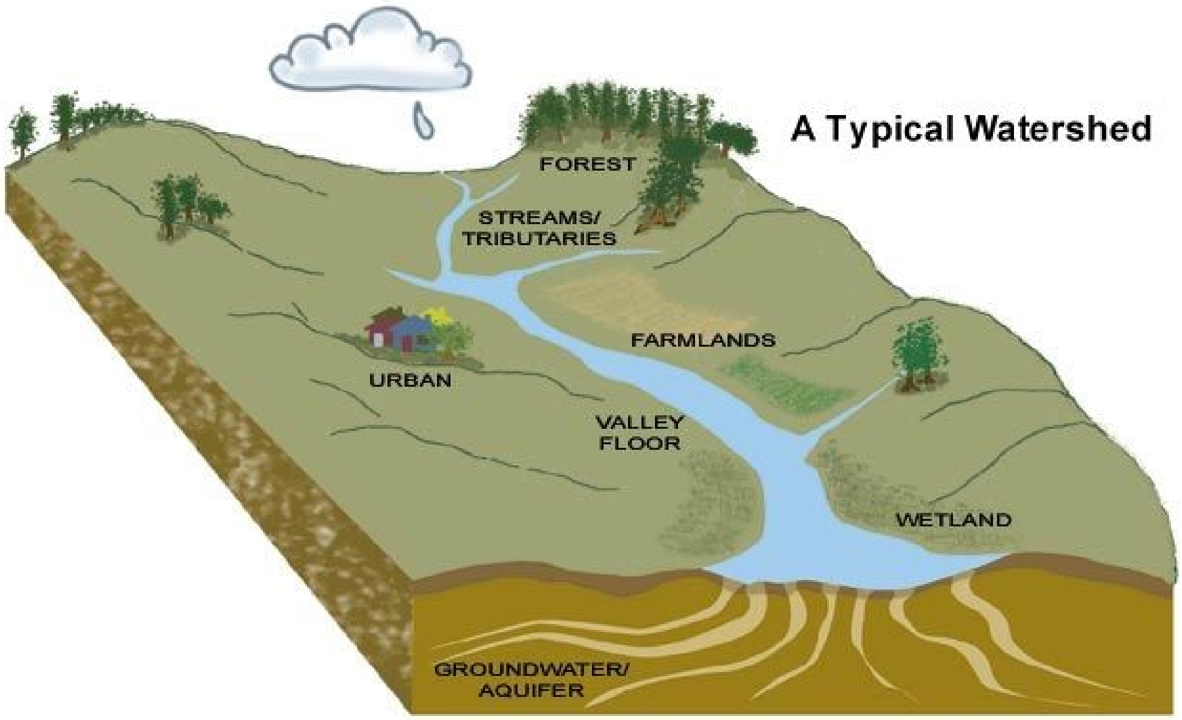

Figure 24. Diagram of a typical watershed with the pathways from precipitation on developed and undeveloped lands, surface water flows and ground water aquifer recharge (Source: http://www.miwaterstewardship.org/).

All waters are critical in the driest state in the nation and while the larger rivers and reservoirs, which support large communities command more attention. The availability of water at smaller scales determined the other areas where people settled long ago and determine where people still live today. Perennial streams, those that run year-round, most often occur in proximity to high elevations that tend to receive ample snowpack. They are maintained by this snowmelt and supplemented by springs and seeps and summer monsoonal moisture in some areas of the state. Some areas are still inhabited by Lahontan cutthroat trout or other fish species, some of conservation concern, or stocked for fishing. However, except in the areas where they coalesce with some of the larger streams and rivers of the state, it is not uncommon for these streams to run intermittently or seasonally as they approach the local valley floor. These dry washes lower on the landscape as well as ephemeral streams, those with short-lived flows after snowmelt and precipitation events, are also important to Nevada's hydrological systems.

The riparian zones and floodplains along streams and meadows and other lentic systems, like marshes and spring ponds, often connect with streams and lotic systems are all critical to watershed functions. Riparian areas exhibit distinct vegetation or physical characteristics of permanent surface or subsurface water (Swanson 2020). Often, they occur in floodplains situated above stream channels that are inundated during high water events and maintain sufficient connectivity with the water table to maintain riparian soil and vegetative composition. Put simply, where in proper functioning condition and lacking development, streams, rivers, and or other waters with sufficient riparian and floodplain functions exhibit reduced erosion as well as sediment and pollution inputs. The water table is also maintained through stabilizing root systems along the channel and vegetative roughness and increased water storage capacity in the floodplains that attenuate the erosive energy of large hydrological events. Functioning riparian areas also offer vegetative shade to reduce water temperatures and act as a sponge to store water and carbon in rich organic soils and riparian vegetation ensuring flows remain for a longer period of time on the landscape.

These watershed functions provided are of great importance to thirsty urban and rural communities, agricultural producers, rangeland livestock producers, miners and other industries as well as fish and wildlife across Nevada. There is a great amount of interdependence and overlap among water users and beneficial water resources at large and small scales. An example of this importance is how ranch headquarters often occur along larger meadows systems due to their value in forage production. Wet and mesic meadows are also the most limiting habitat for sage-grouse, where chicks are reared in late summer on a diet of insects and forbs. When lacking these functions and others, watershed values can be lost and streams as well as meadows can experience incision. As a result, the stream will lose base elevation and floodplain connectivity, which can lead to deep gullies that no longer provide year-round surface and shallow soil water conditions that support broader extents of riparian vegetation, the rich forage for livestock and wildlife, as well as clean, consistent water flows for downstream users.

With water being the limiting factor within Nevada, much attention and effort should center on maintaining watershed functions at all scales. The Colorado River Watershed receives the bulk of attention with its multi-state agreements in flux in recent years. Watershed management at all scales ensures vegetation, soil, and land uses are managed to protect hydrologic function and services including sustaining infiltration rates, and reducing water runoff rates, thereby also controlling soil erosion. When this management is effective, optimization of the amount and quality of the water that is released by a watershed is achieved. In general, when a watershed faces a landscape disturbance, like high-intensity fire, its soil may become hydrophobic (water-repellent), vegetative cover is lost and the likelihood of flooding from a given rainfall event increases (Conedera et al. 1998). These events have the potential to permanently alter the productivity of the land to support native vegetation communities, thereby alter the amount and cleanliness of water that is shed. It is important to expand the concept of watersheds beyond just surface water runoff because of the high degree of water pumping from deep water aquifers in Nevada to support agricultural, rural and urban populations and uses. Maximizing infiltration and minimizing erosive events will provide dependable sources of water to support influx of water into deep aquifers.

Keeping the water on the land longer is a concept that has been taught to natural resource managers to uphold practices that promote management of native vegetation communities toward conditions that support species with strong roots that can bind soils and resist erosive forces and well as be resilient in the face of natural and expected disturbances such as wildfire. Many watersheds in Nevada are occupied by vegetation communities that are in a non-managed or otherwise unhealthy state creating suboptimal rates of infiltration, stream flows, groundwater recharge, flood frequency, soil erosion and wildfire risks. Examples of these conditions are overstocked conifer forests, conifer-invaded hardwoods, annual grasslands, and decadent shrublands with little or no perennial grasses and forbs. Effective management, from upstream to the basin floodplains, is necessary for properly functioning healthy ecosystems, safety from catastrophic flooding, and water security for Nevada's residents.

For purposes of identifying areas of resource significance and subsequently designating priority landscapes in this Action Plan, the Hydrologic Unit Codes (HUC) 10 and HUC 12 divisions were used. HUC-10 watersheds are typically from 40,000 to 250,000 acres (62 to 390 mi^2). HUC-12 sub watersheds are typically between 10,000 and 40,000 acres in size.

Recreation

Nevada's natural lands are the backbone of outdoor recreation and its resultant economy. Recreational activities on undeveloped and developed green spaces occurs throughout the state. From small regional urban parks and hiking trails, to larger state parks and public wildlands, outdoor recreation is popular, beneficial to human health and wellness, supports local economies, and may increase awareness and investment in land management.

Recreational opportunities on federal, state and local public lands are very numerous and expansive since these lands comprise 70 percent of the land area in Nevada. There are places on public lands where recreation is prohibited or regulated heavily, these include permitted mining, wind and solar projects, Nevada National Security Site, military bases and training grounds, and wilderness areas. In 2019, the Nevada Department of Wildlife showed that over 243,000 individuals hunted and fished for over two million visitor days. The US Census shows that in 2011, wildlife watching was one of the most popular outdoor recreation activities that entertained over 300,000 people per year. Running and hiking trails as well as rock climbing entertained the largest number of people per year. In Nevada, recreationists that operate Recreational Vehicles (RVs) to travel throughout the state and camp in more 100 developed RV campsites or ubiquitous dispersed camping locations have an economic impact of $1.1 billion, support more than 7,000 jobs and pay more than $333 million in wages to Nevada workers. Overall, the outdoor recreation economy supports 87,000 jobs in Nevada and pays workers a combined $4 billion in wages. In total, economic activity created by outdoor recreation in Nevada has reached $12.6 billion. A billion dollars of recreation sourced funds are paid in taxes that support local schools, roads, and public safety officials.

Table 7. Active outdoor recreation statistics for Nevada (2005 and 2019).*

Activity	# of Participants	% of Population
Bicycling	376,009	21%
Camping	359,715	20%
Fishing	147,837*	12%
Hunting	95,557*	5%
Paddling	78,067	4%
Snow sports	104,745	6%
Trails	528,208	30%
Wildlife viewing	320,000	17%

There are negative aspects of outdoor recreation when it's not managed properly. High-traffic areas and popular recreation sites are susceptible to pollution, soil compaction, sensitive species impacts, vegetation destruction, and decreased water quality. There are 200,000-400,000 off-highway vehicles (OHV) in Nevada operated annually on public and private lands (NLCB 2016). When operated on existing roads, impacts can be negligible. When operated in roadless areas, emerging networks of trails and pathways create an ever-expanding system of unregulated disturbances to soil, wildlife and water courses (NDOW 2017a). For Nevada to move forward in a strategic way to enhance outdoor recreation and positive economic outcomes, policy makers passed Assembly Bill 486 in 2019, which created the new Nevada Division of Outdoor Recreation (NDOR).

The 2016-2021 Nevada Comprehensive Outdoor Recreation Plan contains eight goals and associated strategies that focus on developing, maintaining, and improving recreational facilities to be safe, functional, and environmentally friendly. There is also an emphasis on connecting people to the outdoors more frequently and to decrease potential conflict between user types when possible.

Nevada also signed the Outdoor Recreation Industry Confluence Accords that aligns policy, management, and activities with a set of principles, values, and best practices surrounding recreation and conservation. The Accords outline a collaborative approach to stewarding natural resources and providing public access to them for recreation that has health and wellness benefits as well as the ability to support a vibrant economy. The Accords promote education and workforce training for outdoor recreation awareness, engagement, and career development. Furthermore, it encourages development and maintenance of sustainable infrastructure and funding.

Scenic, Aesthetic, and Outstanding Geological Features

For most Nevada residents, the desert views are the backdrop to their daily lives. Nevada is mostly desert and semi-arid, much of it residing in the Great Basin. South of the Great Basin is the Mojave Desert, while Lake Tahoe and the Sierra Nevada are on the western edge. Both residents and visitors passing through the state are quickly aware of the presence of vast rangelands, mountains, and big sky. Nevada has 172 mountain summits and has more mountain ranges than any other state, with its highest summit, Boundary Peak, at 13,146 feet. Nevada also has outstanding geologic features throughout the state and especially in the Ruby Mountains, Jarbidge Wilderness, Spring Mountains, Sierra Front, and many of Nevada's State Parks.

Travelers on the two interstate highways that bisect the state, Highway 80, and Highway 50 – "The Loneliest Highway in America", notice immense landscapes, long views, and solitude. The aesthetic and recreational value of Nevada landscapes are major attractions. In addition to Great Basin National Park and a portion of Death Valley National Park, Nevada contains 28 state parks and recreation areas, and 68 designated wilderness areas covering approximately 6.5 million acres. Nevada is a state with many opportunities for high quality outdoor experiences and a landscape full of unique scenic beauty.

Mining and Mineral Resource Potential

Nevada's mining industry produces more than $7 billion per year in total mineral value from less than one percent or 167,000 acres of the land in the State. Over seven percent of the revenues in the State general fund come from mining. There are more than 100 mining operators and over 2,000 connected companies actively working deposits in the State at any given time. The extent of their activities is proportional to the net worth of the minerals in which they are extracting, meaning when mineral prices are low, operations are scaled back. Conversely, when mineral prices are high, operations are scaled up to produce more to sell to the market. The primary minerals mined in Nevada are gold, silver, molybdenum, lithium, copper, magnesium, and barite. Mines in Nevada produce around three-quarters of the gold produced in the US. Nevada is also capable of producing natural gas and oil. Natural gas production is largely a result of the development of fracking technologies and has active operations in Elko County. Oil production largely occurs in Eureka and Nye counties and can produce over a quarter million barrels of oil annually. Minerals that are mined and extracted are generally located in trends or isolated locations throughout the state. Many of them are coincidental with modern day rural populations, such as Carlin, Battle Mountain, Winnemucca, Lovelock, Virginia City, Beatty, and Eureka. There are many additional locations that are not coincidental with rural populations and exist in wildland areas (Figure 25). Most of these mineral resource extraction operations are in rural parts of the State and support relatively large numbers of rural, high-paying jobs. The average annual salary for mining jobs is over $90,000 and unemployment remains low in counties with active mining.

Many of these mineral markets experience boom and bust cycles, the prior drawing workers in large numbers to rural communities and outposts, only to have them leave during economic downturns. More people in rural communities coupled with mining activities creates additional recreational use of the surrounding landscapes, such exposure supports conservation and recreation economies.

Although mining occurs on less than one percent of Nevada's landscape, known direct and indirect impacts affect a much greater area and fragment important wildlife habitat and migration corridors. Post-mining reclamation is required for many sites, though not all post-mining features are required to be reclaimed or rehabilitated. Open pits are left open and groundwater infiltration usually ends up filling the pit resulting in a pit lake. Pit walls are left exposed and shear, creating nesting and perching habitat for migratory birds and raptors. Other features are reclaimed to specified topographical standards, remediated with topsoil, and planted with native and adapted species that meet specifications to return a vegetation community capable of supporting ecological functions and roles.

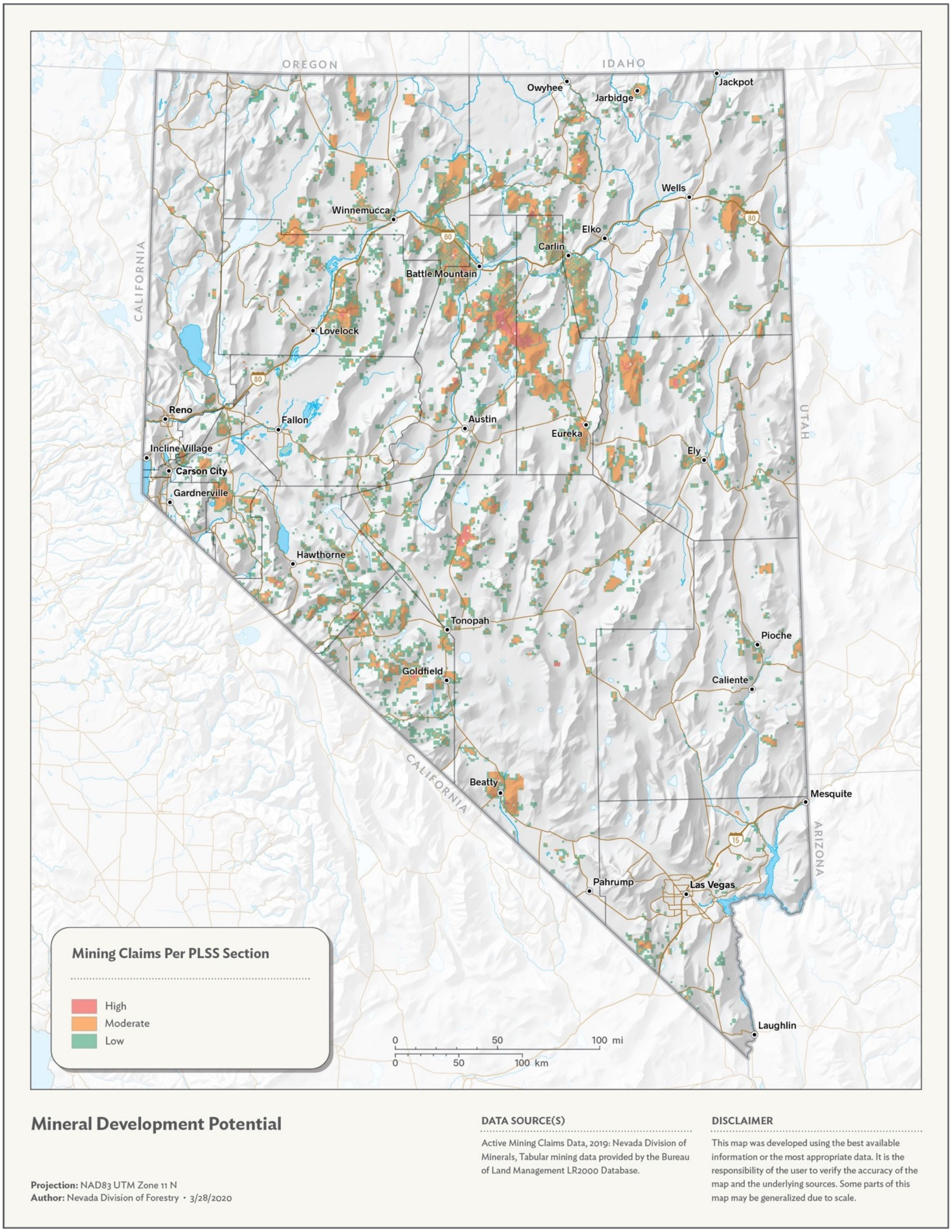

Figure 25. Map of mineral development potential in Nevada.

Collaborative Natural Resource Management and Stewardship

Collaborative natural resource management has been used informally for probably centuries in one form or another. Starting in 1937 and in response to the Dust Bowl, the Conservation District model operated in partnership with the Soil Conservation Service, now the Natural Resources Conservation Service. Conservation Districts (CDs) are entities of state government comprised of locally elected governing boards that coordinate public-private efforts to identify resource concerns and enhance natural resource conservation within their boundaries. There are 28 CDs in Nevada who work at varying levels of activity. Beyond the Conservation Districts, the formal application, scientific documentation and evaluation of this approach in the Western US started in the 1990's to help natural resource managers and land users seek and find common solutions to mutual challenges (Conley and Moote 2003). These are best described as multidisciplinary groups that use science, local knowledge, tradition, and culture in the presence of defined processes that unite people behind common visions and pathways toward successful grassroots conservation.

In Nevada, the success has been widespread and documented. In some cases, these groups are focused on addressing a statewide topic and other times they are focused on solving localized issues. One of the keys to success has been providing good information in the presence of motivated and inspired people. In Nevada, great efforts have been put into creating interagency and multidisciplinary approaches to assessing issues, collecting and sharing data, as well as choosing unified approaches to developing and using science. Many of these efforts have been distributed through various agencies including the University of Nevada-Cooperative Extension. Examples of these are the training and application of the Nevada Rangeland Monitoring Handbook, Nevada Range Management School, Riparian Proper Functioning Condition, and Creeks and Communities. The UNR Rangeland Lab is also developing decision support tools that enable statewide Ecological Site Description, State and Transition Model, and Disturbance Response Group usage. NDOW and BLM are currently collecting large amounts of data through the Assessment, Inventory and Monitoring (AIM) protocols to contribute to statewide database. Effective collaboration is delivered by motivated people that want to work together in the presence of good information. Their agreement on the sources, validity and partnering of collection, and analysis of data collected, allows these groups to unite and more easily find agreement on problems and approaches to solving them. The following provides examples of both geographic and topic based collaborative approaches that have a track record of success in Nevada.

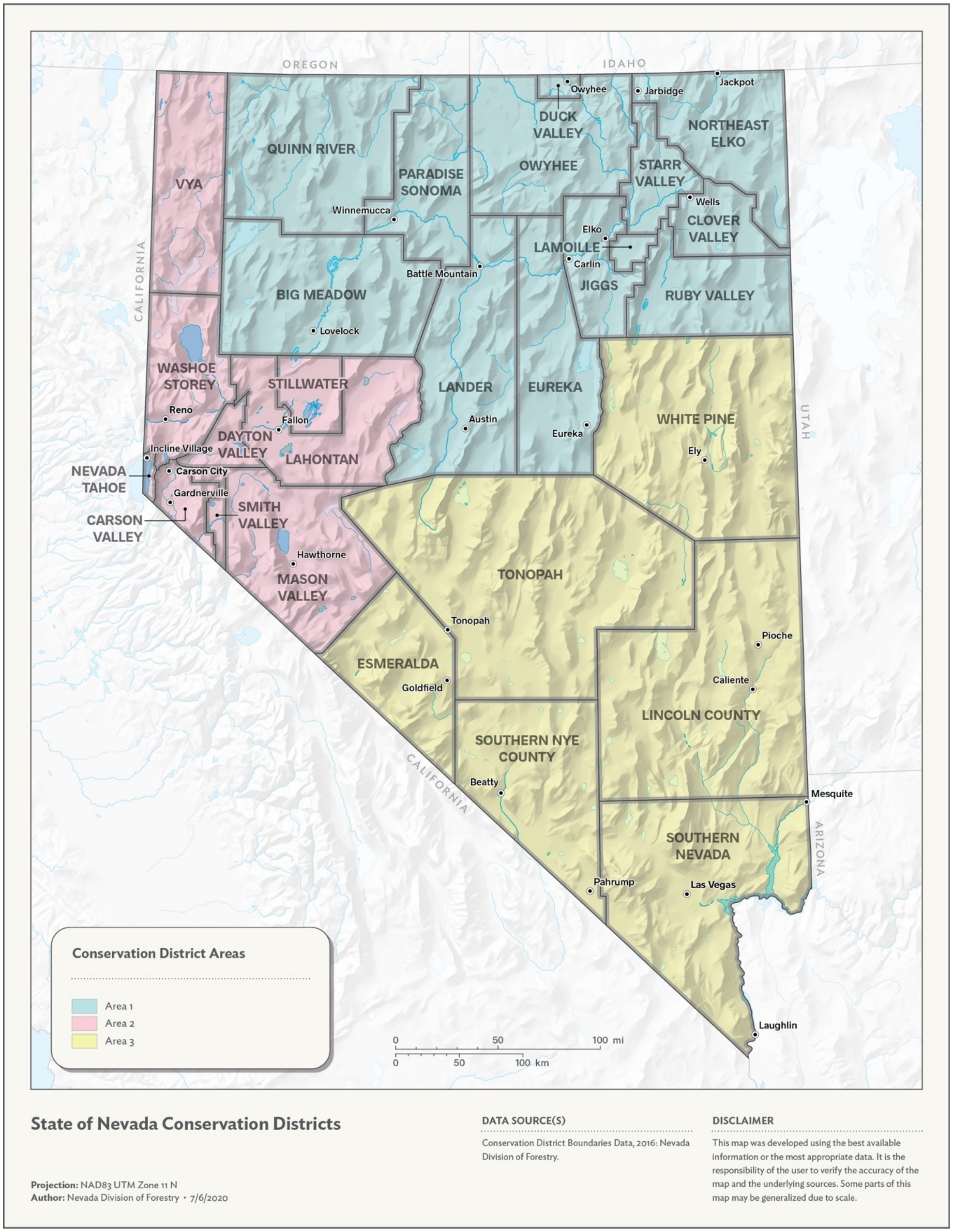

Figure 26. Map of Nevada's Conservation Districts.

Grazing Management

Starting in the mid 1990's, ranches started forming collaborative groups, like the Shoesole Management Team, and others to deal with long-standing challenges between agency and land user management objectives. The result was improvement in working relationships between land managers, land users, scientists, and even the public. From these relationships and well-managed processes, improvements in natural resource conditions were realized and the collaborative teams worked together to ensure that shared objectives were achieved (Nikonow 2019).

"In early 2016, a group of Nevada ranchers with a proven track record of ecologically sound management across millions of acres of public and private lands in greater sage grouse habitats came together with various Federal and State Agency leaders and staff. The goals were to seek solutions for adaptive management within current and impending sage grouse land use plan amendments and improve ecological resilience, landscape health, and productivity. The Results Oriented Grazing for Ecological Resilience (ROGER) group continues to work together towards these goals." (ROGER 2020)

Wildfire Mitigation and Management

In the late 1990s, the scale and intensity of wildfires increased dramatically and threatened communities across the state. Several stakeholders in the state came together and formed the Nevada Firesafe Council, which operated until 2012 to mitigate wildfire hazards and educate cooperators within the wildland-urban interface where values at risk were greatest. The functions of this organization were re-introduced under the Nevada Network of Fire Adapted Communities in 2014. The Network fosters the widespread occurrence of Fire Adapted Communities where people living in high fire threat locations fully prepare themselves, their homes, and the landscape where they reside to survive the destructive force of wildfire (NNFAC 2020). The organization supports a network of local community-based chapters that work with local cooperators to ensure that communities are well educated, prepared and equipped to deal with the inevitability of wildfire threats. Within the Tahoe Basin, a sister organization called the Tahoe Network of Fire Adapted Communities is operating to achieve similar goals. This multi-agency and community collaboration helps residents take individual action to help collectively reduce their neighborhood's risk from wildfire. Led by the Tahoe Resource Conservation District and working closely with local fire districts, Tahoe Network members have the opportunity to work together with neighbors to become fire adapted communities (Tahoe Network 2020). Additionally, the Tahoe Fire and Fuels Team (TFFT) was formed in 2008 to implement the Lake Tahoe Basin Multi-Jurisdictional Fuel Reduction and Wildfire Prevention Strategy. The TFFT is overseen by a Multi-Agency Coordinating Group which includes the seven Lake Tahoe Basin fire chiefs and nine local agency executives. Members are a group of dedicated professionals committed to protecting life, property, and the environment at Lake Tahoe through proper management of the forests to reduce the threat of catastrophic wildfire. In doing so they are protecting communities, while safeguarding the exceptional natural resources of Lake Tahoe (TFFT 2020). All these organizations collaborate to develop localized Community Wildfire Protection Plans (CWPPs) that adhere to the national standards (Communities Committee 2004) and guidance (CGPC 2008) on their development process, collaborators and contents. These foundational documents empower communities and stakeholders to unify and focus efforts on effectively mitigating wildfire threats through adequate suppression resources, structure ignition protection, community protection through hazardous fuels reduction, and community preparedness through education. While there was a statewide push to get CWPPs in place for all communities statewide in Nevada in 2004, the vast majority of them have not been updated since that time, leaving communities without a current strategy to effectively mitigate the dangers and impacts of wildfire.

Virtually all of the wildfire stakeholders in Nevada rely on the collaboratively guided Living with Fire (LWF) program "to provide education materials to the public with recommendations to residents on preparing for wildfire and reducing wildfire threat to homes and communities. Since its inception in 1997, LWF has created materials for residents that have been shared and applied to fire-prone regions throughout the country. LWF provides resources to homeowners, educators, community groups and firefighting professionals to improve defensible space, ensure homes have proper building materials, manage native and non-native vegetation and prepare for evacuation. Through community outreach events, peer-reviewed publications, social media and television and radio interviews, the LWF team brings the most up-to-date information on wildfire preparedness to Nevada residents and others across the country. LWF is a collaborative effort among federal, state, local firefighting agencies, and resource management agencies" (LWF 2020).

In 2015, most of Nevada's land and wildfire management stakeholders joined to develop Nevada's Cohesive Wildfire Strategy using the three tenets of resilient landscapes, fire adapted communities and safe and effective wildfire response to make a concerted impact on Nevada's growing wildfire problems. The strategy was released in 2016 and updated in early 2019 (NCWS 2019). This effort was merged with Nevada's Shared Stewardship Initiative later in 2019 and more information can be found in Appendix C for both efforts.

Sage-grouse Conservation

As sage-grouse gained attention in the early 2000's, Local Area Working Groups (LAWGs) were formed across the state to help produce assessments and actions plans to help preclude listing of the sage-grouse and develop regional and statewide sage-grouse conservation strategies. Some of these LAWGs were associated with pre-existing collaborative groups, such as the Northeast Nevada Stewardship Group (NNSG), some with Conservation Districts, and others independently formed. Many of the LAWGs subsequently disbanded after the strategies were completed. Some pre-existing collaboratives remained intact because they had a broader mission than the sage-grouse strategies. The second round of concerns about sage-grouse in 2012 created another wave for these collaboratives to become active and dedicated in a new way. Three examples of this include the NNSG, Stewardship Alliance of Northeast Elko (SANE 2020) and the Bi-State Sage-grouse Group (Bi-State 2020). They have created regionalized plans to assist in sage-grouse habitat conservation in the presence of traditional land uses and remained united and engaged through the present day.

General Conservation

As mentioned earlier, Conservation Districts were established in response to the Dust Bowl era. They were built on the philosophy that conservation decisions should be made at the local level with a focus on voluntary, incentive-based actions. They have authority under NRS 548 and a specific role in the Natural Resources Conservation Services' federal planning system which gives them an effective nexus for Nevada with the intermixed federal, state, local and private ownerships. They possess the ability to unite interested parties in similar geographies around issues of concern and aggregate funds to focus collective resources through the CD-led Local Work Group function authorized under NRCS Manual Title 440 Part 501. In Nevada, where the federal government administers and manages more than 85 percent of the land, CD's hold the key to locally led conservation; they have statutory authority and are an integral part of the NRCS planning system. This system offers a way to bring all entities in an area together to identify resource concerns and possible solutions by working together, because the CD can work across ownership boundaries and meld money. In 2017, some CDs in Nevada began a Resource Needs Assessment process that will lead to conservation action plans; this work will be an important method to get the strategies of this document applied on the ground by a locally-led process.

Growing from the experiences of the previous groups and the need to engage larger portions of the state in broader conservation needs, the Nevada Collaborative Conservation Network was formed in 2016. "This group is a network to enhance meaningful communication and provide structure to support local, diverse stakeholder groups working to achieve conservation that incorporates best science with local knowledge through a collaborative planning and implementation approach. The NVCCN has been developed within the state to serve as a bridge between various groups that are already operating at the local, state and federal levels to enhance and expand conservation efforts across the state" (NVCCN 2020).

Assessment of Nevada's Forest, Rangelands and Watersheds

Assessment of Nevada's Forest, Rangelands and Watersheds

The nine major terrestrial vegetated ecosystems introduced earlier in this plan are further described in this section. These descriptions provide a deeper understanding of the current conditions, trends, benefits and services they provide, and primary dependent wildlife populations.

While various ecosystem classifications exist and experience continual refinement, much of the information on current ecosystem conditions and trends results from significant and often large-scale and long-running ecosystem monitoring efforts within the state. These include the USFS Forest Inventory and Analysis (FIA), BLM's Assessment, Inventory, and Monitoring (AIM) program, the Habitat Assessment Framework (HAF) program on BLM and USFS lands, NDOW's Project Effectiveness/Vegetation Monitoring, UNR's Range Lab, and the Sagebrush Steppe Treatment Evaluation Project (SageSTEP), and various chrono-sequencing efforts, among others. Additionally, geographic information systems (GIS) and the associated datasets sourced from multiple entities that collect and store the data in various layers was used to visualize and describe the status, conditions, and trends of topics discussed in this section.

High Elevation Forests

This ecosystem occurs in remote locations in the island mountain ranges in Nevada and the Carson Range on the western border. Five needle pines, including whitebark, limber, and bristlecone pines are the predominant species. Also included in this ecosystem are the Engelmann spruce[1] and subalpine fir forests that are primarily in the Jarbidge, Pilot, Snake, Schell Creek, and White Pine ranges.

Figure 27. Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland Ecological System in the Las Vegas Valley-Islands in the Sky Priority Landscape.

We describe the various Ecological Systems that are included in High Elevation Forests by using a combination of NDOW Key Habitats (NDOW 2012) and NatureServe Ecological Systems (NatureServe 2020b). Some of these habitats and ecological systems represent stable or unstable states within NRCS Ecological Sites (NRCS 2020)

[1] This document follows common grammatical patterns and does not capitalize common names of most species, unless it is a proper noun (e.g. someone's name). However, common names of birds are capitalized per the Ornithological Society's grammatical guidelines.

and University of Nevada Reno's State and Transition Models and Disturbance Response Groups (UNR 2020). Six ecological systems are representative of the High Elevation Forests in Nevada (Appendix L). They include woodlands and forests, from montane through subalpine zones throughout the state.

Conditions

The typical forest structure is open with older aged trees, as well as isolated stands of dense structure, and older age classes. Fires are infrequent in this forest type due to its open nature, low fuel accumulation, and cooler conditions. Fire return intervals vary (Keeley & Zedlear 1998).

Historically, fire regimes of mixed severity in the subalpine fire and Engelmann spruce forests occurred on a 50 to 80-year cycle, with lethal fires every 100 to 300 years. Because of increased mortality in these older age class forests the potential for stand replacing fires has increased. However, current conditions within the region are within the historical range of variation for the type with respect to wildfires. Most of Nevada's high elevation forests are owned and managed by the federal government, and on average fall into natural historical fire regimes. The current fire regime condition class is likely condition class 3m, due to the high risk of loss to key ecosystem components wherein wildfires continue to burn at high intensity and are stand replacing fires. Wildfires such as the South Sugarloaf Fire (2018 in Elko County) and the Carpenter 1 Fire (2013 in Clark County) are examples of this condition class since they burned large acreages in high elevation forests in the Jarbidge and Spring Mountains. Loss of these critical forest ecosystems will take ≥100 years to recover and with a different tree species composition due to climate change, insect, and disease impacts (especially white pine blister rust).

Trends

Whitebark pine, bristlecone, and limber pine forests are experiencing multiple threats including climate change, fire exclusion, mountain pine beetle, and white pine blister rust. Insect outbreaks from the mountain pine beetle have impacted these forest species in northeast Nevada, especially in the Jarbridge and Ruby mountains. Aerial surveys from 2010-2019, reveal ongoing damage and mortality caused by mountain pine beetle in the Jarbridge, Ruby, Schell, Spring Mountains, Toiyabe, Shoshone, East Humboldt, Spruce, Cherry Creek, and Pequop ranges. The 10-year average for damaging outbreaks is approximately 5,600 acres, and fluctuates yearly; however, this type of consistent damage has not been observed in Nevada prior to 2010, and the high elevation five needle pines have been significantly impacted in these areas. Five-needle pines are also susceptible to white pine blister rust (*Cronartium ribicola*), an exotic disease. This pathogen is established in the Carson Range, and has been previously recorded in the Jarbridge and Schell Creek mountains. Losses to these species have occurred from wildfire in the past 15 years but is secondary in nature. Although fires occur at high elevation stand replacing fires are not common, however they do pose a threat to these tree species since fire damage can cause tree stress and lead to bark beetle outbreaks.

Sub-alpine fir mortality is occurring at high levels in the Jarbidge mountains, and the Schell and Snake ranges due to a complex of insects and disease pathogens. Extended drought in the late 1980's, early 1990's, and mid 2010's stressed the trees, leading to increased insect and disease susceptibility and activity. The drought from 2014-2017 that Nevada experienced was unprecedented due to the extreme departure of precipitation norms (NDF 2017). High elevation forests continue to exhibit related stress from this last drought. High levels of subalpine fir mortality can significantly change the structure and composition of the subalpine fir forests. Potential major changes in stand structure and composition are high for this type. Changes will eventually occur as a result of large, stand-replacing fires, insect epidemics, or a combination of the two throughout much of the subalpine fir range.

Benefits and Services

These high elevation forests are critical for maintaining snowpack, delaying snowmelt, and providing food and habitat for the Clarks Nutcracker[2], a bird that is intricately tied with whitebark pine regeneration. If high whitebark pine forests are to be maintained, attention must be given to this important tree species, especially as temperatures continue to increase and white pine blister rust spreads throughout the rest of the state. Engelmann spruce and subalpine fir forest cover types provide these same benefits as well as providing wildlife habitat and security and thermal cover for ungulate species, and small non-game species, as well.

Dependent Wildlife Populations

Clarks Nutcracker, hummingbirds, Black Rosy-finch, Short-eared Owls, mule deer, bighorn sheep, sierra snowshoe hare, and montane pocket gopher are just a small list of species that depend on high elevation forests. Small non-game species and multiple bird species also utilize these forests and depend on them for habitat and food.

Among vertebrate and invertebrate animal species, the Nevada's High Elevation Forests harbors one federally threatened invertebrate species, one federal candidate vertebrate species, no state endangered or threatened vertebrate or invertebrate species and one vertebrate species that is designated protected in Nevada. Among plants, the High Elevation Forests harbor three of Nevada's state Critically Endangered plants (Appendix G).

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[2] Common names for birds follow the convention of using all capitals.

Quaking Aspen

Quaking aspen is distributed throughout the state. Where it occurs at lower elevations, it is primarily along drainages, springs and seeps. In higher elevation mountainous terrain, it can occupy entire hillsides that have north to west aspects.

Figure 28. Quaking aspen forest in the Ruby-Cortez Priority Landscape (Lamoille Canyon, Elko County).

We describe the various Ecological Systems that are included in Quaking Aspen by using a combination of NDOW Key Habitats (NDOW 2012) and NatureServe Ecological Systems (NatureServe 2020b). Some of these habitats and ecological systems represent stable or unstable states within NRCS Ecological Sites (NRCS 2020) and University of Nevada Reno's State and Transition Models and Disturbance Response Groups (UNR 2020).

Two ecological systems are representative of the Quaking Aspen in Nevada (Appendix L). They include woodlands and forests, with and without conifers, from montane through subalpine zones throughout the state.

Conditions

The age of trees generally varies from 60 to 120 years. Most quaking aspen stands in Nevada are in a mid-to-late seral stage of succession. Stands are not regenerating across much of Nevada for different reasons. Drought and ungulate grazing are the two most important factors influencing aspen stands throughout the state. Quaking aspen occurs where annual precipitation exceeds evapotranspiration. Warming annual temperatures have the potential to significantly affect aspen in Nevada if the pattern of repeated drought cycles continues. The distribution pattern of aspen in Nevada is widely scattered patches in mountainous areas in most areas of the state, although it can occupy large amounts of land area in higher elevation mountain ranges. In upper montane locations, conifers are beginning to dominate and out-compete aspen. Without some form of disturbance to stimulate aspen suckering, and reduce shade tolerant conifers, these stands will continue to decline. Aspen stands in Eastern Nevada are currently suffering from the effects of white fir encroachment. The density of the conifers shades out aspen suckers and makes aspen groves more susceptible to high intensity stand destroying fires. In other areas, native ungulate wildlife that coevolved with aspen and domestic livestock that are now commonplace are consuming all suckers before they grow above browsing height, preventing the stands from producing mature trees. Without management, these aspen clones will continue to decline, and the probability is high that aspen acreage will decrease. Unmanaged heavy browsing pressure on existing quaking aspen and other forage species will result in habitat degradation for all species found within this type. Insects and disease organisms have had a noticeable influence on aspen. Increasing numbers of invasive species such as the white satin moth, are additional stressors on stands that are already at risk from a combination of factors.

Trends

While the discussion often centers about the successional stages of aspen clones and their trends, it is important to identify and mitigate stressors that affect aspen. Knowledge of history, as it relates to the establishment and development of aspen clones, and an understanding of the site conditions that influence the process can help accurately assess trends. Some things are subtle while others are more noticeable.

Aspen stands throughout Nevada and across most western states have been suffering from a general decline in health and lack of regeneration. Available water is a primary stressor for many stands, but other contributing factors are altered fire regimes, continued browsing by native ungulate wildlife and more recently introduced livestock, forest pathogens, and a host of forest insects including defoliators. The variety of habitats, site conditions and stressors make it impossible to manage aspen with a single approach. Some aspen is stable. A good example is aspen clones that exist in isolated locations with snow drifts as their water source. They have been around for a long time and are regenerating even in the absence of fire. The trend in Nevada is that aspen will have difficulty regenerating because of the aforementioned issues of grazing and drought and lack of disturbance. Aging aspen will succumb to either old age or a combination of pathological organisms and repeated drought cycles. If regeneration does not keep pace with the rate of mortality, then acreage will decline. In the absence of the sanitizing effect of fire, disease organisms will likely become more significant. Regeneration is a concern in those stands with competition from conifers and where the collective unmanaged grazing impacts of both native ungulate wildlife and domestic livestock repeatedly remove new suckers.

Benefits and Services

Since aspen communities are known to support a large diversity of vegetation and wildlife, the loss of these stands would constitute the loss of a critical Nevada habitat type. Aspen are often associated with more mesic environments, so their contribution to soil stabilization and watershed function is extremely important. Additionally, being a broad-leafed tree increases their attractiveness and utility to recreation and agricultural interests who seek shelter from the heat and other climatic elements. Aspen supplies brilliant color on the landscape during the Fall season drawing many visitors to parks and other viewing areas for an annual visit to enjoy the scenery. Arborglyphs carved into aspen in the early 1900's by Basque sheepherders still exist today, but as mature aspen trees die so too will this cultural resource.

Dependent Wildlife Populations

The habitat value of aspen plant communities is well documented. The diversity of nesting and foraging opportunities in aspen communities results in high biodiversity. Aspen are favored by primary excavators such as multiple sapsucker and woodpecker species, and by secondary cavity nesters such as bluebirds, nuthatches, wrens, chickadees and others. Numerous ground and canopy nesting species also rely on aspen for its diverse canopy structure, and the abundant insect populations that can be found there provide ample foraging opportunities for warblers, vireos, flycatchers, bats, shrews and other species that consume insects. Birds of prey take advantage of the nesting and hunting opportunities that exist in aspen communities. For example, Northern Goshawks are known to nest primarily in aspen across much of the state because it is the only available habitat type that meets their nesting needs. Aspen stands also provide high quality habitat for larger species, including elk and deer, which utilize the cover, forage and water found there, as do the small mammal populations that often include moles, voles, gophers and mice.

Figure 29. White fir-ponderosa pine-mountain mahogany woodland in the Las Vegas-Islands in the Sky Priority Landscape.

Nevada's Quaking Aspen harbors four federally endangered or threatened vertebrate and invertebrate animal species, four state endangered or threatened vertebrate and invertebrate animal species and one species designated in Nevada as protected, no federally endangered or threatened plant species and two state protected plants (Appendix G).

Mixed Conifer Forests

Nevada's Mixed Conifer Forests are comprised of diverse forested communities that occur in the mountains above the lower montane woodland and below the high elevation forests such as spruce-fir type. The Nevada Wildlife Action Plan separates them into the intermountain conifer forests and the Sierra coniferous forests. Within the intermountain conifer forests ponderosa pine dominates stands that occupy the lower elevation range. Conifer species included are white fir, Jeffrey pine, ponderosa pine, Douglas-fir, and lodgepole pine. White fir dominates at higher, colder locations while Douglas-fir is a minor component in intermediate zones in a few eastern mountain ranges. These forests are found on gentle to very steep mountain slopes, ridgetops and upper slopes, plateau-like surfaces, basins, alluvial terraces, well drained benches, and inactive stream terraces. The Sierra coniferous forests range from the foothills of the Sierra Nevada up to the high elevation forests. Conifer species found within this range include California white fir, Jeffrey pine, incense cedar, ponderosa pine, lodgepole pine and sugar pine. The Sierra coniferous forest is further classified into Mediterranean California dry-mesic mixed conifer, Mediterranean California red fir forest, Sierra Nevada subalpine lodgepole pine forest (dry), Sierra Nevada subalpine lodgepole pine forest (wet), and Mediterranean California ponderosa-Jeffrey pine forest. White fir tends to be the most ubiquitous species since it is shade tolerant and can survive long periods of suppression in brush fields. Within the ponderosa-Jeffrey pine forest, Jeffrey pine is the dominant species on the Nevada side of the Sierra Nevada range and mature specimens of both species are referred to as "yellow pine". Jeffrey pine is better suited to growing on colder more serpentine sites than ponderosa pine which prefers lower elevation and warmer growing sites. Western white pine is a common associate at higher elevations. Red fir occupies sites in the highest elevations of the mixed conifer zone. Some stands are nearly pure red fir, but western white pine and Jeffrey pine are frequently found growing with red fir. Lodgepole pine stands are usually even aged and can be nearly pure lodgepole. The species occurs in two very different biophysical settings – dry and wet. The dry lodgepole occurs on upper montane and subalpine dry benches and moderate slopes in association with Red fir and Mountain hemlock in nutrient poor granitic or pumice soils. Individual trees can attain large diameters. The wet cold lodgepole pine grows on upper montane sites usually on gently rolling slopes and drainage bottoms where soils might be water-logged, more like Rocky Mountain lodgepole pine. Aspen and mountain hemlock are occasionally found on the same site.

We describe the various Ecological Systems that are included in Mixed Conifer Forest by using a combination of NDOW Key Habitats (NDOW 2012) and NatureServe Ecological Systems (NatureServe 2020b). Some of these habitats and ecological systems represent stable or unstable states within NRCS Ecological Sites (NRCS 2020) and University of Nevada Reno's State and Transition Models and Disturbance Response Groups (UNR 2020).

Thirteen ecological systems are representative of the Mixed Conifer Forest Ecosystem in Nevada (Appendix L). They include forests, woodlands and savannas in primarily montane elevations throughout the state.

Conditions

The condition of intermountain conifer forests is consistent with conditions of mixed conifer forests in the western U. S. from the standpoint that altered fire regimes have favored ingrowth of shade tolerant white fir to the exclusion of other fire adapted, intolerant pine species. Stands that were once dominated by Jeffrey and ponderosa pine had fewer trees per acre and more open canopies. Forests now have higher densities, a higher white fir complement, and are more significantly influenced by insect and disease organisms in the absence of low to moderate intensity fire. Major insects include bark beetles, defoliators, wood borers, terminal shoot feeders, and sap sucking insects. Dwarf mistletoes, foliage diseases and root disease, especially in true firs, have increased as have introduced agents such as white pine blister rust. This rust is severely impacting sugar pines and other white pine species and jeopardizing their place in the species mix. Forest types in Nevada are adapted to drought conditions but extended droughts have periodically contributed to extensive mortality events in conifers. The various stressors affecting trees and plants, when combined with extended periods of drought or even short periods of extreme drought, are too much and trees die, especially in dense stands. The accumulation of fuel (both live and dead) in mixed conifer forests has increased the potential for a high intensity, high severity fire to dramatically change the forest structure on some sites. The mixed conifer forest provides a variety of recreational opportunities and use will likely continue to increase in accessible areas near population centers. Thinning treatments or disturbance events that reduce the number of trees per acre would result in more understory grass, forb and shrub vegetation increasing forage and habitat for species dependent on that habitat. Although commercial timber harvest isn't as common now, fuelwood cutting in areas near population centers is still a popular activity.

The Comstock mining era had a profound effect on the Sierra coniferous forests with wood extracted for building, mining timbers, fuelwood, and other uses associated with the mines. Between 1860 and 1875, much of the Carson Range was cutover. Nearly all the mixed conifer forest is second growth and has a high percentage of white fir when compared to fire dependent species like sugar pine, ponderosa pine and Jeffrey pine. Some sites are highly productive and have accumulated a lot of biomass in trees and other vegetation in the absence of fire. This area has many of the same insect and disease issues described in the intermountain mixed conifer forest. A ten-year drought that extended from the mid 1980's to the mid 1990's resulted in the death of millions of Jeffrey pine, white fir and red fir trees within the Lake Tahoe region and the Carson Range. Fuel reduction projects are a high priority in this area that continues to see development in the urban interface. The Reno area is experiencing a population boom due to the growing tech-industry (tax-break incentives) and retiree's moving here from around the country (no state taxes; 300+ sunny days a year, etc.). With population growth wildland fires are a major concern.

Nevada's Mixed Conifer Forests harbor one federally endangered or threatened plant species and five state protected plants (Appendix G).

Trends

One of the most concerning trends for the Sierra mixed conifers is the increasing size and frequency of high intensity, high severity wildfires (Holden, et al. 2018). Large acreages of this forest type have burned in the last 5-10 years in California. The mixed conifer forests in Nevada are also at risk for large fires as the dry, windy conditions that accelerate fire spread are common on the east side of the Sierra. Much of the Sierra front has experienced fire in the mixed conifer type and recent fires have exhibited more active burning at night in the mid elevation thermal belt. The Sierra mixed conifer type will continue to experience significant urban and suburban development pressure. The expanding urban interface and increasing demands for recreation will exert increasing pressure on the adjacent forest land. Recent droughts of varying intensity are influencing these stands as they age. Trees that have the genetic capability to adapt and function at low levels of available water will outcompete trees with lower drought tolerance. This will likely affect species composition and may strongly influence tree densities as well. Regeneration failures in the last couple of decades are an indication of changing site conditions and it is likely that following large disturbance events, brush species may replace conifers on difficult sites like steep, south aspects or excessively well drained soils. Mortality in sugar pine, white pine, and other five needle pines from white pine blister rust is increasing as the rust continues to spread. Drought related mortality from bark beetle activity is currently at endemic levels but periodic spikes in localized areas are common. In the Tahoe basin *Scolytus* and mountain pine beetle continue to cause mortality in white fir and sugar pine respectively. Stand manipulation to reduce fuels is a priority. Thinning to reduce or eliminate ladder fuels has targeted white fir extensively and treatments with the primary objective of creating more resilient forests are being implemented at larger scales than before.

The trends for intermountain mixed conifer include a concern with altered fire regimes. As these stands age, the accumulation of fuel and a shade tolerant understory increase the risk of crown fires. These widely dispersed forest types are extremely important habitat for diverse populations of wildlife. Altered fire regimes, drought, increasing stress from insect and disease organisms, and growing pressure from recreation particularly around population centers, are influencing the growth and development of these mixed conifer stands. Degradation of the understory vegetation from increased recreation pressure, unmanaged grazing, and the effects of climate change will continue on sites that are more accessible. Forest stands located in areas that are steep and rocky may not be affected by fuelwood cutting and increased recreation use. Treatments to modify fuels will have the potential to affect the development of these stands.

Benefits and Services

The mid-elevation mixed conifer forests have historically been the source of a variety of wood products due to their accessibility and generally high productivity. Sawlogs, posts and poles, fuelwood, Christmas trees and biomass have been the primary products. Green sawlogs and tree mortality salvaged following wildland fires provides a small amount of wood for the few sawmills located in the region. Fuelwood and biomass generated during hazardous fuel reduction projects are increasing, as the emphasis to reduce fuel in this type has made funding available.

Following the closures of sawmills throughout the western states, the value of the forest for wood products has been surpassed by recreation, watershed, wildlife habitat and other ecosystem services. These forests function as important watersheds in a state growing in population where demands for water are increasing. There is a large outdoor recreation industry, marketed extensively by the Nevada Department of Tourism and Cultural Affairs, that includes a wide array of activities including off-road vehicles, mountain bikes, and hiking. There is a network of trails to get them to destinations often located in mixed conifer forests where they can find water, shade, scenery, hunting, fishing, and wildlife viewing opportunities. The increasing emphasis on carbon sequestration and other climate related actions as they relate to conifer forests could strongly influence the value of benefits and services identified in the mixed conifer forests statewide.

Dependent Wildlife Populations

Intermountain mixed conifer forests in Nevada are patchy, so wildlife populations that occupy those areas are often isolated from each other. The mixed conifer forest is strongly tied to upper portions of the mountain ranges that are typically separated from each other by broad valleys or vast expanses of sagebrush or pinyon-juniper woodlands. The canopy structure that is found in mixed conifer forests provides a variety of habitat elements that determine what populations are likely to utilize those forests. Some species rely on the canopy of a mature forest for nesting and roosting, such as Northern Goshawks and Flammulated Owls. Foraging opportunities that are found in the mid-story structure are utilized by several bat and rodent species, and many species depend on the shrub and herbaceous layer below the tree canopy, including dusky grouse, mountain quail, chipmunks, shrews and mule deer. Snags and trees with cavities in this forest type serve as nesting and roosting habitat for several species of woodpeckers, owls, and bats. Many wildlife species are also dependent on the riparian ecotones and mesic microsites found within mixed conifer forest interspersed within this forest type. Reptiles such as the Sonoran mountain kingsnake and rubber boa can be found in these areas, as well as shrews, voles, mice, and other small mammals.

Within the Sierra coniferous forest there are larger contiguous patches of forest habitat and connectivity to other parts of the Sierra Nevada. This results in a unique suite of species that occupy this forest type. Sooty Grouse, Cassin's Finch, hoary bat, silver-haired bat and long-eared myotis can be found utilizing the overstory canopy of this type. Where old growth forest is present the California Spotted Owl, Northern Goshawk, Flammulated Owl, northern flying squirrel, and marten can be found. The shrub and herbaceous layer has Mountain Quail, Sierra Nevada snowshoe hare, multiple shrew species, Sierra alligator lizard and mule deer. *Aplodontia* (mountain beaver), mountain pocket gophers and multiple bat species occupy the riparian/wet meadow ecotone within the Sierra coniferous forest. Nevada's Mixed Conifer Forests harbor eight federally endangered or threatened vertebrate and invertebrate animal species, six state endangered or threatened vertebrate and invertebrate animal species and one species designated protected in Nevada (Appendix G).

Pinyon-Juniper Woodlands

The pinyon and juniper (PJ) type is the most widespread forest type in Nevada. PJ woodlands are found throughout the state, occupying about 7.1 million acres (10 percent of Nevada). The most extensive woodland areas occur in eastern Nevada, though western and central Nevada woodland areas are also large. The PJ woodland type is composed of pure stands or a mix of singleleaf pinyon pine and three species of juniper: western, Utah, and Rocky Mountain. Utah juniper is by far the most widespread of the three.

Figure 30. Great Basin Pinyon-Juniper Woodland Ecological System near Gold Spring, Nye Co., NV.

We describe the various Ecological Systems that are included in Pinyon-Juniper Woodlands by using a combination of NDOW Key Habitats (NDOW 2012) and NatureServe Ecological Systems (NatureServe 2020b). Some of these habitats and ecological systems represent stable or unstable states within NRCS Ecological Sites (NRCS 2020) and University of Nevada Reno's State and Transition Models and Disturbance Response Groups (UNR 2020).

Four ecological systems are representative of the Pinyon-Juniper Woodlands in Nevada (Appendix L). They include woodlands, shrublands or pygmy forests and savannas at montane to valley elevations throughout the state.

Conditions

Over the past 500 years, pinyon and juniper have expanded further north, into the higher elevations, and down slope onto deep, well-drained soils on alluvial fans. The expansion has been attributed to fire suppression, changing climate, and human influences. Aggressive wildfire suppression has presented pinyon and junipers opportunities to establish in shrub and grass communities. These factors may also be creating favorable conditions for PJ stand density to increase and create closed canopy conditions that cause the loss of understory species.

The Pinyon-Juniper Woodlands harbor five federally endangered or threatened plant species and eleven state protected plants (Appendix G).

Trends

For the past 150 years, the area occupied by pinyon-juniper (PJ) has increased 125 to 625 percent in the Great Basin (Miller et al. 2008). A limited number of these increases on select sites can be attributed to second growth following clear-cutting practices up to 30-miles in diameter around localized mining centers in the state since the mid-1800s. Otherwise, the lack of normal fire regimes due to effective fire suppression and removal of fuels by livestock grazing has contributed significantly to these increases. Increases have primarily occurred as infill into shrub-steppe communities. These communities have relatively open, low density stands of trees which have expanded into sagebrush-steppe communities that previously did not support trees, as evidenced by their rangeland (versus forest) soils. Wildfire in pre-settlement PJ woodlands is thought to have been comparatively frequent, with 10 to 30-year recurrence, compared to 30 to 50-year intervals for Great Basin sagebrush. Burning results in small trees and lighter fuels, leaving more of this vegetation type open with thickets confined to rockier and more dissected terrain (Griffen, 2002). Risk of catastrophic wildfire is greater in the crowded conditions that are often referred to as Phase II and III stands, where shrubs decrease below, and trees increase above 20 percent cover respectively. When conditions allow for extreme fire behavior, stand-replacing fires can carry from the younger stands into the sparse, older stands, eliminating them as well. Additionally, post-fire conditions in many stands results in domination of annual grasses and forbs.

As cover of pinyon-juniper and density increase on true woodland sites, other plant communities disappear. Areas occupied by PJ have increasingly thickened and in many cases former rangeland sites have become woodland sites, crossing an ecological threshold from previous sagebrush or co-dominant sagebrush PJ communities. In the Great Basin, there are approximately 100,000 acres a year moving into these woodland states, known as Phase III PJ (Miller et al. 2008). As this ecological threshold is crossed, sagebrush, grasses, and forbs, Greater Sage-grouse (GRSG) habitat, and the forage utility of the lands are lost, and often water availability is reduced in the watershed. Further, thick stands of PJ make for hazardous fuel conditions with potentially more severe and intense wildfire that may convert woodlands to monocultures of invasive annual grasses and weedy species. For decades, ranchers, sportsmen, and agency land managers have attempted to remove and thin PJ forests using heavy equipment, herbicides, and fire in favor of shrub/grass vegetation. Insufficient data exists to determine the amount of PJ forest converted through these actions.

The issue is not limited to the loss of more diverse sagebrush habitat after transition to Phase III PJ, but also includes the encroachment that leads to transitions from treeless shrub communities to shrub-dominated states with scattered PJ known as Phase I to eventual co-dominant shrub-woodland states called Phase II. Encroachment of PJ into these shrub and grass vegetation communities diminishes the quality and suitability of GRSG habitat and after conversion of habitat by wildfire and invasive grasses is viewed as one of the primary threats to GRSG in Nevada. Tree competition reduces sagebrush cover, and water availability from springs and groundwater, as well as out-competes the grass/forb understory lowering wildfire resiliency and creating hazardous fuel conditions. Despite having adequate sagebrush cover and forage, Phase II PJ is generally avoided by GRSG due to the prominence of predator perches, whereas Phase I is used by GRSG yet with higher mortalities due to PJ presence on the landscape still allowing perching opportunities for predators (Coates et al. 2017).

Figure 31. Phase I and II pinyon-juniper within GRSG management areas and bi-state sage-grouse habitats that represent some potential areas of PJ expansion in Nevada.

Due to increases in hazardous fuel conditions, loss of water availability in watersheds, as well as loss of forage and GRSG habitat that occur with its expansion, treatment of PJ is important within rangeland ecosites where expansion can be assumed to have occurred. Although the GRSG was not listed as an endangered species by the USFWS in 2015, ongoing efforts by state and federal partners are working to improve the sagebrush habitats. Tens of thousands of acres of PJ Phase I and II are treated each year in strategic locations across the state. When effective, part of these habitat improvements can be seen as herbaceous plants and shrubs generally increasing in cover thereafter.

Conversion from Phase II to sagebrush, as well as hazardous fuels reduction projects in pinyon-juniper woodlands, can reduce the available nesting sites for some birds, including Ferruginous Hawks and Pinyon Jays. Agencies delay cutting to afford protection to spring nesting using best management practices under the Migratory Bird Treaty Act. Thus, Greater Sage-grouse habitat improvements are likely at odds with Pinyon Jay unless planned to minimize unintended negative impacts. On the other hand, Phase III thinning for crown fire risk reduction could be beneficial to Pinyon Jays.

Insect activity in the woodland type has historically been at low levels, but with recent droughts and dense stand conditions, the pinyon woodlands have seen significant mortality due to insects and diseases. Insects that pose the greatest threats to pinyon pine include pinyon pine engraver beetle (*Ips confusus*) and other agents such as pinyon blister rust (*Cronartium occidentale*) and pitch mass borer (*Dioryctria* sp.). The most common destructive insects are pinyon *Ips* bark beetle and defoliators such as pinyon needle scale (*Matsucoccus acalyptus*) and pinyon needle sawfly (*Neodiprion edulicolus*). Large-scale defoliation from pinyon needle scale occurred from 2009-2012 with almost three million acres of damage being recorded during that time. Damage decreased dramatically from 2013-2017 but is slowly increasing again in 2018-2019. These populations have a boom & bust cycle, which stresses trees to where other insects can cause mortality. Defoliated trees can rebound, and population increases in these insects are usually local and triggered by some sort of disturbance. Mediterranean pine engraver (*Orthotomicus erosus*), a new exotic bark beetle was documented by the Nevada Department of Agriculture in 2015 in areas around Las Vegas. This exotic species attacks native pinyon and has no natural predators. Thus far, the insect has not become established and only isolated beetles have been trapped. Dwarf mistletoe (*Arceuthobium divaricatum*) is widespread in the pinyon pines and is the trees most significant pathogen. Heavily infected trees are often the first to be attacked by bark beetles. Areas of lower and middle elevation pinyon have recently been killed or impacted by heavy defoliation by pinyon sawfly and pinyon scale in eastern, central and western Nevada. Local pockets of black stain root disease occur across this ecosystem. True mistletoe is common in the juniper species, but its harmful effects are minimal.

Benefits and Services

PJ woodlands have been harvested for fuel wood, posts and Christmas trees, and these uses continue today. Opportunities exist to further utilize PJ but hauling distances and transportation costs to market are high. Promising economic ventures include combustion with other fuels at power plants to generate electricity, production of engineered chipboards, distillation of products from pinyon and juniper oils, and most recently bio-char production. As in other forest types of Nevada, the number of residential and commercial developments encroaching into woodland areas has increased. The risks and environmental impacts are the same. A major concern is the threat and management of wildfire. Alternatives such as mastication and hand removal via thinning projects by state and federal agencies are exploring and promoting productive uses of the biomass that is created. However, this is a slow evolving process due to market limitations.

Dependent Wildlife Populations

Figure 32. Elk are an important big game species in Nevada. These elk were seen near pinyon-juniper woodland and aspen-narrowleaf cottonwood riparian forest at the historic site of Fort Hallack, Elko Co., NV.

Pinyon-juniper woodlands provide wildlife habitat for multiple species of wildlife. This forest type provides a variety of sheltering functions to wildlife that range from hiding cover, cavities nesting trees, nest sites for other birds, bats, and small mammals. As an evergreen forest, these forests provide thermal protection in both summer and winter. One of the critical products of PJ woodlands is the pinyon nut crop that humans and wildlife utilize. Pinyon Jay and small mammals are strongly tied to this resource. The juniper berry crop is also an important food resource for birds and small mammals. Several priority species, including Pinyon Jay, Ferruginous Hawk, Dusky & Sooty Grouse, and several bat species utilize various features of this forest type. Additionally, mule deer, elk, mountain quail, bighorn sheep, and various chipmunks also use this forest type and are dependent on its features. A full list of dependent species can be found in the Nevada Wildlife Action Plan (WAPT 2012).

Nevada's Pinyon-Juniper Woodlands harbor 12 federally endangered or threatened vertebrate and invertebrate animal species, 11 state endangered or threatened vertebrate and invertebrate animal species and two species designated protected in Nevada (Appendix G).

Riparian and Wetland Ecosystems

Wetlands and riparian corridors serve several essential ecological functions including water filtration, erosion and sedimentation prevention, and runoff regulation. These systems are defined by a water table near (or at) the soil surface. They produce vegetation that is often dense with a diversity of vertical structure which provides unique wildlife habitats in the otherwise sparsely vegetated and short statured habitats that dominate most of the state. Wetlands broadly include wet meadows, vegetation around springs and perennial streams, riparian habitats, and even ephemeral washes.

Figure 33. Rocky Mountain Subalpine-Montane Fen Ecological System along Deer Creek in the Las Vegas Velley-Islands in the Sky Priority Landscape.

Riparian forests and woodlands are present throughout the state across a wide range of environments ranging from snowmelt sourced intermountain streams and rivers to spring fed streams interspersed with wetland corridors, to rivers flowing through the low elevation valleys. These systems are relatively rare in arid lands throughout the state and therefore are exceedingly important for animal habitat, rangeland resources, and for recreational use. They occupy the transition zone between aquatic and upland areas and are present where soil moisture is greater than surrounding land and therefore sufficient to support vegetative communities distinct from surrounding forests, shrublands, or deserts. In Nevada, riparian corridors are generally narrow, often extending just a few hundred yards across the water course. However, some systems such as those found along the Carson or Humboldt Rivers may span several miles in width. Typical patterns of riparian vegetation would result in more narrow riparian channels in upland, steeper montane systems, with a

Figure 34. Wet meadow and willow shrubland above a ranch reservoir in Central Basin and Range Priority Landscape (Lander County, Nevada).

broader extent in valley bottoms. Additionally, wetter-cooler environments will often sustain a wider riparian corridor than in the most arid regions of the state.

Montane riparian vegetation typically follows the stream course lined with aspen, birch, willow, and cottonwood, and often consist of a heterogeneous and complex forest structure ranging from a shrubby dense thicket directly adjacent to the waterway to a closed canopy tree dominated system with a sparse and diverse shrub and grass understory. Aspen is largely restricted to upper elevation riparian zones and high elevation saturated soils. Mid-elevation riparian systems are dominated by various willow species and cottonwoods. Lower elevation riparian corridors, in a natural state, are generally composed of linear corridors dominated by cottonwood, willow, and occasionally ash.

Wet meadows form in areas where the water table is high, and soils are often saturated by adjacent springs, streams, or other bodies of water. Wet meadows especially occur in areas where large flood events have cut riverbanks (often from snowmelt) allowing water to flow across the landscape, and pool in depressions or near seeps and other springs. Vegetation is largely dominated by grasses and forbs, ranging from species that are dependent on surface water like that found in backwater areas (rushes and sedges), to grass and grass-like species that often have a high tolerance for saline soils and are adapted to withstand dry periods. These ecosystems are essential for the "sponge-like" function of riparian areas – referring to their ability to absorb water after large rain events and slowly release it mitigating catastrophic flooding and extending the water flow throughout the soil surface.

Understory and flood-scoured areas (common in systems where natural flows are allowed) are often composed of a variety of shrubs, sedges, rushes, grasses, and riparian forbs. Areas where rivers have historically, or currently experienced episodic flooding produce a constantly changing river channel where the episodic flooding of the surrounding land along with deposition of silt and nutrient rich debris results in a floodplain with a distinct vegetative community of species. Vegetation common to lower elevation floodplains have a slightly higher water need than in surrounding arid desert shrublands such as mesquite, catclaw, or desert willow (particularly in low elevations); these species often establish along the river benches, throughout sandbars, and exposed land along the braided river channels. The rarity and importance of riparian systems make them invaluable to the state and its inhabitants. They provide unparalleled environmental, recreational, and economic resources; they are priority landscapes.

We describe the various Ecological Systems that are included in Riparian and Wetland Ecosystems by using a combination of NDOW Key Habitats (NDOW 2012) and NatureServe Ecological Systems (NatureServe 2020b). Some of these habitats and ecological systems represent stable or unstable states within NRCS Ecological Sites (NRCS 2020) and University of Nevada Reno's State and Transition Models and Disturbance Response Groups (UNR 2020).

Nineteen ecological systems are representative of the Riparian and Wetland Ecosystem in Nevada (Appendix L). They include woodlands, shrublands, shrub-steppe, fens, marshes, interdunal swales, hot springs, vernal pools, playas, meadows and cienegas throughout the state at virtually any elevation.

Conditions

Currently many (if not most) of the riparian forests in the southern half of the state are invaded by saltcedar (also known as "tamarisk") or Russian olive. Most of the warm desert riparian corridors (virtually all Colorado River tributaries) have experienced saltcedar invasion which generally forms monocultures and outcompetes native species. Saltcedar has replaced native woody vegetation in many areas across the Mojave riparian systems and floodplains. The species negatively impacts water quality through translocating minerals from subsurface to soil surface and water quantity through the sheer density of the species which may exceed the vegetative biomass of an uninvaded ecosystem.

Meadows in poor condition often resulting from improper management suffer from soil compaction, erosion, "pedestaling" of vegetation and soils, and lack of residual vegetation that provides critical cover to rodents and nesting birds. As "pedestaling" and erosion advance, water flow increases and accelerates over the meadow, leading to downcutting of the soil base and eventually a significant lowering of the water table that changes the character, productivity, and site potential of the meadow.

Riparian corridors have narrowed through the decades from water management efforts controlling the timing and amount of flows through a channel, land management practices resulting in gullying, and invasive species artificially stabilizing streambanks. These changes have reduced: habitat for wildlife, the effectiveness of ecosystem services such as enhancing water quality, and nutrient retention associated with riparian corridors and floodplains. Stream and river degradation throughout the state has, in part, resulted in the decline of riparian tree gallery stands leading to high decadence and low regeneration rates. Surface water availability and depth to groundwater in many regions of the state has been reduced through time due to gullying often associated with regional vegetation disturbances (nearby wildfires or land management practices). As mentioned earlier in this report, aspen stands throughout Nevada and across most western states have been suffering from a general decline in health and lack of regeneration speculated to be the result of reduced fire frequency, continued browsing by large ungulates including native wildlife and domestic livestock, and other factors linked to general tree stand stress such as water availability.

Invasion by non-native shrubs (specifically saltcedar) magnify the wildfire risk to these sensitive systems as fuels from leaf drop and episodic die-off of dense stands results in an extremely dry fuel load. Some native species, (willow and mesquite) remaining in the invaded system, respond well to fire often re-sprouting, while other keystone species (cottonwood) are not fire tolerant and mass die-off occurs post-fire. Saltcedar is fire tolerant and readily reestablishes within several months after fires occur. Nevada's Riparian and Wetland Ecosystem harbors six federally endangered or threatened plant species and 14 state protected plants (Appendix G). Water quality can also directly affect the vegetative composition and vigor in riparian and wetland communities. Nonpoint sources of pollution such as runoff from agricultural uses, urban development, resource extraction, and wildfire can be linked to degradation of riparian and wetland ecosystems and may affect proper health and function of these ecosystems.

Trends

Water quantity and quality, largely determined by a combination of climatic patterns and land management practices, drive the health and abundance of riparian corridors throughout the high and cool desert environments across the state. Water extraction for human use may threaten some watershed resources (i.e. Carson River) as populations increase. Uncertainty in future precipitation amounts, timing, and intensity of precipitation events will directly determine the health and vigor of water dependent systems.

Encroachment of upland plants into historically wetter floodplains has often resulted when incision disconnects floodplains and increases the distance from the surface to the water table, creating drier conditions that facilitate the ignition and spread of fire. The cost to mitigate the issue is an enormous, in terms of monetary and human resources necessary. However, many entities throughout the state are currently implementing management actions to address the issue.

With the recent focus on improving sagebrush habitat quality across public and private lands throughout the state, there has been renewed focus on improving the ecosystem functions of wetlands and meadows that are often aligned with riparian corridors. Effective techniques have been developed and are becoming increasingly deployed throughout central and northern Nevada to correct damaging channelization and improve water retention onsite. These activities also provide the opportunity to re-establish dwindling riparian corridors with the improvements in surface water availability and stream course management.

Benefits and Services

The health of riparian areas surrounding water sources is of the utmost importance. Effective riparian systems provide crucial habitat and economic opportunities. Properly functioning riparian systems are necessary for water quality through buffering the impacts of flooding, pollutants, sediment flow, and nutrient inputs into water bodies. These processes concurrently provide erosion control and the deposition of vital nutrients to surrounding lands. Functioning riparian forests provide stability to stream and river channels. Water sources for cities and towns across much of the state originate in high elevation forests, thus watershed level protections benefit Nevada's human population.

Humans and wildlife alike are dependent on the health and availability of these systems as a direct water source. Nevada's economy is dependent upon available clean water that is necessary for human consumption, industrial processing, and agricultural production. Additionally, the recreation and tourism industry largely depend upon these systems to provide clean water and cool environments for humans and wildlife. Riparian environments provide a multitude of recreational opportunities including fishing, hunting, motorized and non-motorized boating opportunities, hiking, camping, and other water centered activities that are beneficial to the mental and physical health of Nevadans. Many riparian systems in Nevada have established open spaces surrounding them which increases physical and mental health of visitors. For example, aspen has a fundamental scenic value and local human communities benefit economically from the associated tourism.

Figure 35. Narrowleaf willow characterizes the vegetation in this example of a North American Warm Desert Cienega Ecological System at Rock Spring, Nye Co., NV.

Riparian dependent tree species like aspen, cottonwood, willows, and water birch are ecologically and culturally important. Many riparian systems in Nevada have established open spaces with trails in the riparian forests which increases physical and mental health of visitors and engages local communities in economic investment. Recreation opportunities are highly correlated with access to shade and the aesthetic appeal of riparian forests. Additionally, recreation opportunities such as hunting, and fishing are correlated with local business opportunities. Healthy wildlife populations depend on habitat availability linked with the riparian forest and corridor.

Dependent Wildlife Populations

Riparian habitats house the greatest animal biodiversity in the western mountain ranges (Hamilton et al. 2015). Animals depend on the vegetation that grows in the riparian and wetland zones. Riparian corridors serve as migration routes for many species, including federally endangered bird species that breed in the state.

Closed canopy cottonwood dominated stands (referred to as "galleries") are prevalent throughout the state, stretching across the riparian corridor and serving as a unique densely vegetated habitat utilized by many avian species. Aspen communities with a dense multi-aged tree canopy are particularly important to cavity nesting species in Nevada because stems attain sizes over 10 inches in diameter and the wood is soft and easy to excavate. Riparian aspen stands tend to support greater amounts of large diameter trees than aspen stands found across slopes and are therefore preferred for cavity nesting species. Aspen are essential habitat for the Northern Goshawk which can live in and utilize high-elevation shrub-steppe habitats because stringers of large-diameter aspen trees with closed canopies in the riparian zones will support their nesting needs. Downed trees in aspen habitat can create slow moving water conditions favorable to Columbia spotted frogs.

Salmonid species in montane and sub-montane systems need streams and rivers that are narrow and deep with a healthy riparian community to provide cover and stabilize banks. Riparian communities provide food for aquatic organisms, which in turn provide food for animals and birds living along the stream banks. Mountain streams are home to rich aquatic communities, including native Lahontan cutthroat trout. Nevada's Riparian and Wetland Ecosystem harbors 15 federally endangered or threatened vertebrate and invertebrate animal species, 14 state endangered or threatened vertebrate and invertebrate animal species and two species that are designated protected in Nevada (Appendix G).

Sagebrush Ecosystems

Figure 36. Wyoming big sagebrush-longspur lupine community on a ranch enrolled in the Nevada Conservation Credit System within the Ruby-Cortez Priority Landscape.

Nevada's sagebrush dominated ecosystems are found in moderate to high elevations throughout the Great Basin. The moderate elevations are predominantly Wyoming big sagebrush communities. Higher elevations with more precipitation transition to mountain big sagebrush communities, such as at the 7,500-foot elevation level in Lamoille Canyon of the Ruby Mountains. Low and black sagebrush species are dominant in areas with shallow or claypan soils. Basin big sagebrush tends to occupy deep soils in areas with more available moisture, such as in stream and river floodplains. These shrublands, alternately called shrub-steppe, tend to have perennial grasses and forbs present, although these physiognomic groups vary and may be absent in degraded areas.

We describe the various Ecological Systems that are included in Sagebrush Ecosystems by using a combination of NDOW Key Habitats (NDOW 2012) and NatureServe Ecological Systems (NatureServe 2020b). Some of these habitats and ecological systems represent stable or unstable states within NRCS Ecological Sites (NRCS 2020) and University of Nevada Reno's State and Transition Models and Disturbance Response Groups (UNR 2020).

Six ecological systems are representative of the Sagebrush Ecosystem in Nevada (Appendix L). They are shrublands, dwarf-shrublands, shrub-steppe and badlands which are differentiated by the height of the sagebrush which dominates, whether grasses and forbs are co-dominant with shrubs, by the sparseness of their vegetation cover, or by their unique substrate. They are generally found in valley and montane settings throughout the state. Within these six ecological systems are a wide variety of vegetation alliances and associations dominated by various species and subspecies of sagebrush, including hybrids. Furthermore, sagebrush can co-dominate with other shrubs, in which case they are listed in alternate ecosystem types (i.e., Other Cold Desert Shrublands and Grasslands, or Warm and Hot Deserts). NDF nurseries staff are careful to identify the sage brushes they collect seed from and propagate, to best match to the areas intended for out planting.

Conditions

Sagebrush ecosystems in Nevada historically occupied an even larger portion of the State but have been in decline for several decades with losses in the millions of acres. Natural events such as wildfire and invasion of cheatgrass have most heavily contributed to these declines. Historical overgrazing and lack of low-severity wildfires for many years changed the sagebrush zone. Thickening shrub canopies and cheatgrass understory filled the voids in many areas leading to fuel that is more continuous. The flammability of cheatgrass much of the year and closure of the shrub canopy has created conditions favorable to extreme wildfire (Young, 1985). Roads provided vectors for cheatgrass expansion and human populations that frequently serve as ignition sources led to more frequent wildfire at moderate elevations previously prone to only seldom, small, low intensity fires. Much larger and more intense when fuel loads are continuous, these fires have a greater tendency to deplete the perennial grasses present and native seed banks. Cheatgrass excels after high intensity fires which in the presence of ignition sources tends to lead to more fire and more cheatgrass. The sagebrush-fire-cheatgrass cycle spirals into an increasingly positive feedback loop where cheatgrass perpetuates an increasing frequency of fire in which greater and greater areas are impacted by increased dominance of cheatgrass and fire that is more frequent. These issues are more prevalent in the Wyoming big sagebrush communities which tend to occur at lower elevations with reduced precipitation and greater soil temperatures and are classified as less resistant to invasion of annual invasive grasses and less resilient after wildfire (Chambers et al. 2014; Stringham and Snyder 2017).

Restoration is difficult in areas with low precipitation and in areas ideal for cheatgrass such as south facing aspects. The presence of abundant perennial grasses reduces the vulnerability to cheatgrass invasion and aids in recovery from wildfire. However, perennial grasses are already depleted in many moderate elevation areas and can be lost in higher intensity wildfires. Furthermore, perennial grasses are difficult to restore where precipitation is limited or cheatgrass is abundant. Sagebrush recovery requires ample precipitation and decades without fire; thus, it is limited in areas experiencing low precipitation and frequent fires. Other related concerns include how the loss of forage from wildfires results in concentrated grazing on remaining for age and restoration areas by livestock, wildlife, and wild horse and burro populations. Concentrated grazing exacerbates the issues of restoration and contributes to a wildfire prone ecosystem.

The widespread issue of pinyon-juniper encroachment into traditional sagebrush steppe is the second greatest threat to Greater Sage-grouse in Nevada after wildfire and invasive annual grasses. This issue is covered in greater detail above in Pinyon-Juniper Woodlands.

Sagebrush ecosystems and other rangeland areas are undergoing more permanent changes as developments for residential, commercial, industrial, utility, and transportation uses continue to increase and fragment the landscape. Though direct disturbances are often small, other associated activities and indirect impacts extend the influence of development beyond building footprints. Solid waste disposal; illegal dumping; hiking, biking and motorized recreation trails;

as well as road and utility corridor construction are examples. Mining also constitutes a substantial and expanding use of Nevada's rangeland, and often requires new access roads, powerlines, and increased rural transport. Proponents of mining, oil and gas development, renewable energy infrastructure, additional roads and powerline infrastructure, and other anthropogenic disturbances on public lands are now required to avoid, minimize, and mitigate for planned direct and indirect impacts to Greater Sage-grouse habitat through Nevada's Conservation Credit System (CCS), administered by the Nevada Sagebrush Ecosystem Program. The added consistency and durability of compensatory mitigation as well as consideration of indirect impacts within the CCS is meant to improve mitigation within the state, ensure mitigation is commensurate with the impacts, and still allow for economic development that rural areas depend on.

The sagebrush ecosystem harbors one federally endangered or threatened plant species and nine state protected plants (Appendix G).

Trends

The sagebrush steppe is identified as the most at-risk habitat in Nevada due to increasingly frequent and large wildfires, invasive species, and conifer encroachment. Wildfire seasons that exceed a million acres burned no longer represent a rare occurrence and tend to come in years with heavy fuel loads that grow and accumulate in response to increased precipitation. Megafires are more frequent due to increasing cheatgrass and insufficient restoration efforts on the landscape which leads to repetitious burns on a single footprint. Continuous fuels, adverse weather conditions, and longer fire seasons all play a role in the degradation of the sagebrush steppe into a cheatgrass, fire dominated system. Large fire prone areas continue to grow such as much of the I-80 corridor across the state. There is a high level of concern among the agencies, scientists, and interest groups working on special collaborative studies and planning efforts involving restoration of sagebrush ecosystems. High profile cooperative efforts mentioned previously that focus on the sagebrush vegetation zone at-large include the Great Basin Restoration Initiative, sponsored by the BLM, and state sponsored initiatives for sage grouse conservation such as Nevada's Sagebrush Ecosystem Program, fire management endeavors, and invasive weed control efforts. A few of the strategies targeting fire prevention, suppression, and restoration include managing vegetation to reduce the risk of fire, protecting priority habitats, and improving the success of restoration.

Benefits and Services

The sagebrush ecosystem has long been a critical resource to livestock grazing, the ranching community, and heritage within Nevada. In addition, the sagebrush ecosystem supports wildlife, hunting, recreation, watershed services, and various other uses including the aesthetics of Western landscapes. Cheatgrass-dominated landscapes represent a huge cost sink to society as transition occurs from a 30-year or greater fire interval to that of a five-year interval. Moreover, while budgets are already insufficient for pre-suppression and rehabilitation treatments, the practice of fire borrowing at the federal level, where budget shortfalls resulting from wildfire suppression costs are met by transferring funds from various other programs, leads to further reduced and less consistent funds for these treatments that perpetuate and exacerbate these wildfire issues. In summary, the benefits of the intact sagebrush ecosystem are plentiful and critical to Nevada's ranching industry, communities, and wildlife populations, while the degraded alternative has very limited utility to society and any values are offset or eliminated by the frequent and continual costly firefighting resources deployed at large scales. Scientists and managers are partnering with livestock producers to employ low-cost, large scale outcome-based, prescribed and targeted grazing approaches that limit fire fuel quantity and more detrimental continuity, cheatgrass competition with desirable perennial plants, and overall healthier rangelands.

Dependent Wildlife Populations

Figure 37. A nursing pronghorn doe with fawns near Secret Pass in the Ruby-Cortez Priority Landscape (Elko Co., NV).

More than 70 mammal and 100 bird species are present in healthy sagebrush communities. Eight common obligate species include Greater Sage-grouse, Brewer's Sparrow, Sage Sparrow, Sage Thrasher, pygmy rabbit, sagebrush vole, pronghorn and sagebrush lizard. Additional mammal species associated with sagebrush ecosystems include elk, mule deer, bighorn sheep, and multiple species of weasels, hares, rabbits, rodents, and bats. Predators can include mountain lions, coyotes, badgers, and long and short-tailed weasels. Additional reptiles include North American racers, gopher snakes, leopard lizards, and horned lizards, among others. Smaller bird species are numerous, and birds of prey include Prairie Falcons, Kestrels, Golden Eagles, Swainson's Hawk, Red-tailed Hawk, and Ferruginous Hawks. Special status wildlife species dependent on sagebrush habitats include Greater Sage-grouse, Burrowing Owl, Mountain Quail, Brewer's Sparrow, pygmy rabbit, sagebrush vole, and the sagebrush lizard (McAdoo et al. 2002). Particularly, Greater Sage-grouse and the bi-state populations have received much attention due to their declines and considerations of listing under the Endangered Species Act. Consequently, conservation efforts have increased, with these species now considered umbrella species inspiring greater conservation efforts put forth within these habitats.

The Sagebrush ecosystem harbors 12 federally endangered or threatened vertebrate and invertebrate animal species, 10 state endangered or threatened vertebrate and invertebrate animal species and one species that is designated protected in Nevada (Appendix G). Discussion of mule deer migration corridors, their stop-over areas and wintering grounds can be found under individual Priority Landscape Areas in the chapter "Priority Landscape Areas Needing Management in Nevada."

Other Cold Desert Shrublands and Grasslands

Figure 38. Letterman's needlegrass-slender wheatgrass characterizes the dominant vegetation in a high elevation grassland within the Las Vegas Valley-Islands in the Sky Priority Landscape.

Nevada's cold desert shrublands occur throughout the Great Basin and the Mojave-Great Basin transition zone. It is the most extensive habitat type in the state of Nevada, covering roughly fifteen million acres. They are characterized by having cold winters in which most of the precipitation occurs as snow, with warm summers punctuated by precipitation from infrequent thunderstorms. There is generally less than 10 inches of precipitation per year. Temperatures range between extremes of -20°F and 110°F, with mean temperatures somewhere in the low 50s (°F). Distribution of the salt desert shrub type generally follows valley bottoms in the state that occur within the Great Basin physiographic region. Plant communities are generally characterized by the presence of a variety of salt-tolerant shrubs of the Goosefoot family (Chenopodiaceae).

We describe the various Ecological Systems that are included as "Other Cold Desert Shrubland and Grasslands" by using a combination of NDOW Key Habitats (NDOW 2012) and NatureServe Ecological Systems (NatureServe 2020b). Some of these habitats and ecological systems represent stable or unstable states within NRCS Ecological Sites (NRCS 2020) and University of Nevada Reno's State and Transition Models and Disturbance Response Groups (UNR 2020).

Fourteen ecological systems are representative of the Other Cold Desert Shrublands and Grasslands in Nevada (Appendix L). They include shrublands, dwarf shrublands, steppe, chaparral, grasslands on substrates including scabland and badlands and landforms including sodic basins, badlands and washes. They range in elevation from alpine to inter-mountain valley bottoms, mostly to the north of the Mojave Desert.

While the Sonora-Mojave Salt Desert Scrub is included in the Intermountain Cold Desert Shrub Key Habitat by NDOW (2013), all but one of the Mojave Desert region ecological systems are included in the Hot and Warm Desert Ecosystem. The sole exception is Inter-Mountain Basins Shale Badlands, which is the ecological system that gypsum badlands of the Mojave Desert are classified under by NatureServe. The Mojave Desert differs from the cold desert of the Great Basin by mild winters and hot summers, with monsoonal thunderstorms in the summer. Between the two is a broad transitional zone across Nye and Lincoln counties, where Great Basin and Mojave vegetation mixes.

Community composition is largely influenced by soil salinity and drainage. Most often, the salt desert shrub type is dominated by either shadscale or greasewood. At the lowest flats of the valleys where soils drain poorest and salinities are highest, the most salt-tolerant plants are found, including pickleweed and quailbush. The salt desert shrub type generally gives way to sagebrush somewhere near the tops of the alluvial fans where the primary fault lines of the mountain range are situated. These upper soils are often gravelly and well-drained, and more likely to support spiny hopsage, bud sagebrush, and associated plants. The dominant grass species in the salt desert shrub type is Indian ricegrass, and to a lesser extent, needle-and-thread grass.

Nevada's grasslands are distributed throughout the state. Included in the term "grasslands" are also forb or grass dominated meadows and fens and forb dominated or sparsely vegetated alpine. Grasslands differ from wet meadows as they are found on xeric sites or sites with periods of dryness throughout the year. Because grasslands, meadows and fens can be small areas or stringers within a landscape with a mosaic of plant physiognomic types, they are often poorly classified and mapped. Alternately, they may be lumped into more extensive types, at the risk of missing important habitats for endemic plants.

As classified by the Nevada Natural Heritage Program and NatureServe, Nevada's grassland and forbland ecological systems include areas of "semi-natural" and cultural vegetation (Peterson 2008, NatureServe 2020b). This can include grazing land seeded to crested wheatgrass (i.e. *Agropyron cristatum* Semi-natural Herbaceous Alliance) and planted alfalfa hayfields. Productive montane grasslands and meadows are often dominated by introduced forage grasses, like smooth brome, tall fescue, Garrison creeping foxtail and Kentucky bluegrass. Most typically seen in Nevada uplands would be invasive grass dominated International Vegetation Classification alliances characterized by cheatgrass (i.e. *Bromus tectorum* Semi-natural Herbaceous Alliance), red brome, and Mediterranean grass, which have naturalized to varying degrees on disturbed landscapes (Figure 39). The most frequent causes of disturbances include wildfires, unmanaged grazing, clearing of Phase III invasion pinyon-juniper, abandonment of agricultural fields, land grading and quarries. The disturbances may also lead to persistent invasive or noxious forb dominance, as seen in landscapes of Russian thistle, Sahara mustard, tumble mustard, kochia (*Kochia scoparia*), halogeton or common stork's-bill. Mitigation of the type change can only occur with pre-emptive rehabilitation seeding and other revegetation treatments. Knowledge of the soil and precipitation zone aids vegetation restoration by choosing the appropriate Ecological Site Description or and Disturbance Response Group, which identifies appropriate seeding mixes.

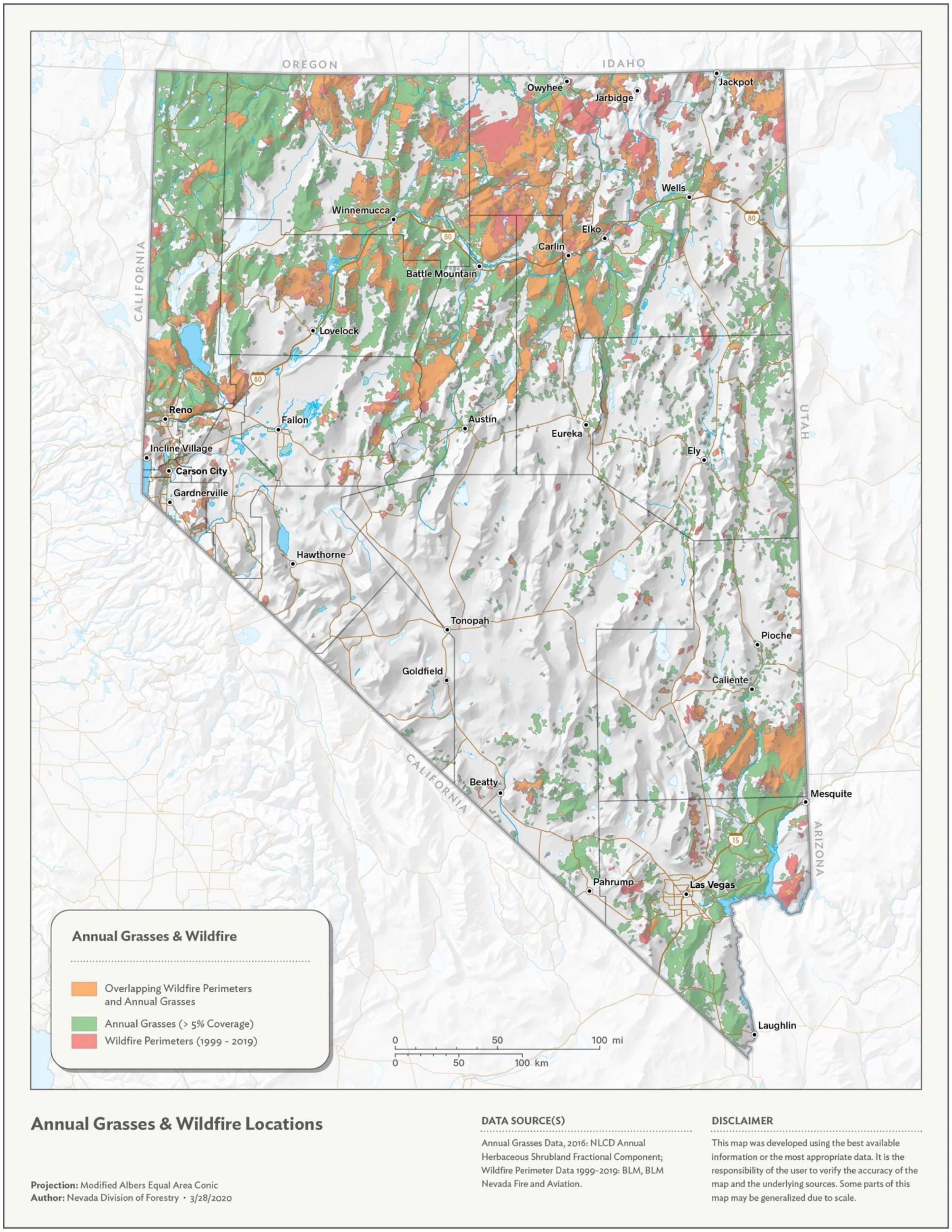

Figure 39. Map of annual grasses and wildfire locations.

Conditions

Habitat conditions vary greatly within the grassland key habitat because the plant communities within it are compositionally and geographically diverse. Variability in upland grasslands depends on elevation, slope, aspect, soils and geology, which defines the available soil moisture and nutrients available to support their flora. An intact natural disturbance regime helps reduce shrub and tree invasion. Grasslands dominated by ricegrass, or various needlegrasses and dropseeds, can appear in profusion during wet years and nearly disappear at the same sites during drought years. Ricegrass stands in some areas of western Nevada and on ancient Lake Bonneville beach terraces, have recovered in the last 20 years with rest from livestock grazing.

Issues that affect salt desert shrub habitat include excessive grazing by native ungulate wildlife (e. g., deer and pronghorn), cattle, and wild horses as well as loss of grass seed production. Historically, Indian ricegrass was likely much more prevalent in cold desert shrub than it is today. Invasion of exotic plants, including cheatgrass, halogeton, Russian thistle, and in certain places, tamarisk, has compromised native communities and affected a shift toward less desirable conditions. Fire generally does not carry well in this type and it is assumed to not have evolved with fire. Shadscale range, once burned, can be extremely difficult and costly to restore to native type. The occurrence of cheatgrass in this type increases its ability to burn more readily. More intermountain cold desert shrub is burning annually than it likely did historically and therefore it is at much greater risk.

Various land uses have resulted in the reduction or removal of important native seed-bearing grasses and forbs. In many places off-road vehicle activity can result in serious structural damage to shrubs, stripping them of their value as wildlife cover, and soil disturbance can lead to accelerated erosion, particularly around washes.

Nevada's Other Cold Desert Shrublands and Grasslands harbor no federally endangered or threatened plant species and six state protected plants (Appendix G).

Trends

Utilization of grasslands by livestock, wild horses, and native wildlife can be so intensive that it impairs the site's natural ability to regenerate. This grazing pressure has resulted is loss of grasses and an increase in shrubs, especially snakeweed and rabbitbrush. Animals that rely predominantly on the herbaceous condition of these grassland types for survival are adversely affected.

Climate change effects occurring within grasslands and meadows include successional type conversions to shrub communities and tree encroachment. Warmer winters and earlier onset of the spring growing season accelerate invasion by cheatgrass, shortening historical fire return intervals and hampering vegetation recovery potential. Invasive and noxious vegetation are typically more fire prone than native vegetation resulting in increased fire cycles and intensity.

When lands are subjected to multiple fires over a short period of time (e. g., every five years), the native plant seed bank may become depleted and the ability to successfully reseed the landscape compromised.

Statewide expansion of mining, solar energy farms, military ranges and hazardous waste disposal sites are cumulatively reducing the acreage of cold, warm and hot desert shrublands. The acreage impacted by energy needs and waste dumping is especially pronounced around Nevada's highest density urban areas, such as the Las Vegas valley.

Benefits and Services

The major benefits of cold desert shrub habitat include open space recreation and aesthetic appeal, diverse wildlife and plant habitats and livestock grazing. The major benefits and services of natural grasslands in Nevada include:

- provides forage for wildlife and livestock
- mitigates drought and floods through high water holding capacity and delayed release of water from meadows
- cycles and moves nutrients
- detoxify and decompose waste
- maintains biodiversity
- generates and preserves soils and renews their fertility
- contributes to climate stability

Crested wheatgrass stands have been widely seeded in Nevada, beginning in 1946, when it was first planted in Arthur, Nevada (Ruby Valley) as a potential forage grass. Having proved successful there, it was widely planted across Nevada, aided by the development of commercially successful rangeland drills in the 1950s. Large areas of decadent sagebrush and burned lands were seeded to crested wheatgrass monocultures. These stands are important spring forage for deer and elk and year-around forage for livestock. Crested and Siberian wheatgrasses are commonly seeded alone, or in mixes with drought resistant native grasses, for post-fire restoration in landscapes with less than 10" of rainfall.

The major benefits and services of grassland agriculture in Nevada include the following:

- protects soil from wind and water erosion
- provides high quality, relatively inexpensive feed for livestock and wildlife
- provides wildlife habitat
- helps maintain soil fertility because it encourages higher levels of soil organic matter than row crops
- can serve as firebreaks when the plantings consist of species which stay green longer into the summer than does native vegetation (e. g., Siberian wheatgrass, forage kochia) and encroaching shrubs are mowed

Dependent Wildlife Populations

Intermountain cold desert shrub is the most important habitat in Nevada for several species of conservation priority, including pale kangaroo mouse and Loggerhead Shrike. Soils of this habitat tend to be loose and either sandy or gravelly and are often easy to dig. Blow sand tends to accumulate around the shrubby bases of the saltbushes, particularly shadscale. This creates hummocks of soil that lend themselves to burrowing and denning. The two most dependable herbivorous food staples are ricegrass and shadscale seeds, although forb seeds and leaf material will also be used when present. In the Great Basin, intermountain cold desert shrub is also the primary habitat of the long-nosed leopard lizard, and is an important feeding habitat for pallid bats, which pluck scorpions and other large invertebrates from the exposed desert flats. Loggerhead Shrikes attain high breeding densities in valley bottoms such as Lahontan Valley, where quailbush and four-wing saltbush create huge mature plants as much as 10 feet in diameter. These big shrubs serve as thorny redoubts protecting the shrike's nest found deep inside the most unreachable depths of the foliage. Bald Eagles winter in the valley bottoms, preying on jackrabbits, while Prairie Falcons feed primarily on rodents in the ground squirrel-cottontail size class. Intermountain cold desert shrub serves as an important support habitat for several sagebrush breeders, including Sage Thrasher, Sage Sparrow, and Brewer's Sparrow. Washes are prominent features within the intermountain cold desert shrub habitat type, and have unique attributes for certain terrestrial species, including endemic amphibians because of their function as a conduit for surface runoff and subsoil moisture. By retaining higher soil moisture than surrounding upland areas, they can serve as enhanced movement and migration pathways for these species and facilitate their distribution across the landscape, perhaps serving an important role in amphibian metapopulation maintenance.

Vertebrate species likely to abandon the salt desert shrub habitat with the loss of the shrub layer include Loggerhead Shrike and Sage Thrasher (nesting substrate), pale kangaroo mouse and dark kangaroo mouse (protective and thermal cover; food source), and long-nosed leopard lizard (protective and thermal cover). These species could experience small retractions in distribution across much of the northern range of the salt desert shrub habitat, with particular justification for monitoring in the Black Rock Plateau, Elko, and Humboldt regions.

Wildlife values of grassland and meadow habitats vary significantly among the different ecological systems bundled in this group, and among plant alliances and associations within each ecological system. Herbaceous dominated stands of ricegrass, needlegrass, and James' galleta often occur as mosaics of vegetation types within the cold and warm desert scrub landscapes. Grasslands are important to kangaroo mice and kangaroo rats as a primary food source while sandy soils are important to burrowing owls.

When higher elevation grasslands (i.e., meadows) are allowed to build up residual grass materials (like what occurs within a rested pasture), population numbers of montane voles and other rodents will increase, in turn attracting short-eared owls that nest on the ground under grassy hummocks. Mule deer and bighorn sheep feed on the forbs in subalpine meadows.

Hummingbirds heavily forage upon the abundant flowering plants characteristic of subalpine meadows. The mountain pocket gopher is found in the grasslands and meadows of the Sierra Nevada, often along the forest ecotone where loose soils facilitate burrowing.

Nevada's Other Cold Desert Shrublands and Grasslands harbor eight federally endangered or threatened vertebrate and invertebrate animal species, eight state endangered or threatened vertebrate and invertebrate animal species and one species designated protected in Nevada (Appendix G).

Warm and Hot Deserts

To the untrained eye, desert ecosystems may appear desolate and unproductive. However, the diversity in Nevada's deserts exceeds expectations hosting an estimated 2,500 plant species and 700 animal species. In fact, in productive years the region supports more endemic plants per square meter than any other location in the United States, serving as a hotspot for plant biodiversity as well serving as a hotspot for global bee diversity (nearly 700 species are identified). Additionally, the deserts support large mammals such as foxes and bighorn sheep, and top predators like mountain lions.

Figure 40. Mojave Mid-Elevation Mixed Desert Scrub Ecological System, showing a mosaic of Joshua trees and blackbrush in the Las Vegas Valley-Islands in the Sky Priority Landscape.

Large portions of Mojave Desert habitat are dominated by various creosote bush-white bursage plant associations that exhibit localized diversity within alluvial fans, well-drained sandy flats and bajadas. These alliances are found throughout the Mojave Desert at less than 3,000 ft elevation, intermixed with shadscale and Mojave yucca. Joshua trees, blackbrush and bitterbrush dominate mid-elevations (3,000-5,000 ft) with cacti throughout the low-mid elevation ecosystems.
Dry washes host a greater vegetative density than surrounding flats, including species like desert mesquite, catclaw acacia, and desert willow. Mesquite woodlands occur in regions of the hot desert where water availability from groundwater and subsurface flows is greater than in surrounding lands (particularly in southwestern Nevada, near Ash Meadows and Pahrump, and along the Virgin and Colorado River corridors).

We describe the various Ecological Systems that are included in Warm and Hot Deserts by using a combination of NDOW Key Habitats (NDOW 2012) and NatureServe Ecological

Figure 41. North American Warm Desert Wash Ecological System in Clark Co., Nevada.

Systems (NatureServe 2020b). Some of these habitats and ecological systems represent stable or unstable states within NRCS Ecological Sites (NRCS 2020) and University of Nevada Reno's State and Transition Models and Disturbance Response Groups (UNR 2020).

Fifteen diverse ecological systems are representative of the Warm and Hot Deserts Ecosystem, found primarily in Clark and Nye counties in Nevada (Appendix L). They include shrublands, scrub (i.e., dwarf-shrublands), chaparral, cacti and fan palms, along with distinctive habitats such as playas, dunes, badlands, cliffs, outcrops, washes and oases. They typically show floristic affinity to the Mojave or Sonoran Deserts. Three sparsely vegetated ecological systems on rocky soils are included in the Warm and Hot Deserts, but also occur in other Ecosystems. These are Inter-Mountain Basins Cliff and Canyon, Inter-Mountain Basins Volcanic Rock and Cinder Land and Sierra Nevada Cliff and Canyon. Because they harbor at-risk plant species which are primarily in Hot and Warm Deserts, they are listed here for convenience:

Due to the extreme environmental factors including the heat and aridity, desert landscapes lack well developed organic soil horizons, therefore soil and rock parent material are close to the surface. Desert plant communities have very high soil/site affinities, and plant community composition diverges drastically along elevational gradients - dominant shrubs may differ almost completely across assemblages. The exposed surface soils result in an incredible diversity across sites supporting wildly varying plant assemblages. Sites with unique soil features also produce a variety of endemic plant species and communities with high rates of endemism and site specificity. High endemism rates correlate with high plant species rarity. Host sites are often sensitive to disturbance. Due to the extreme environmental factors, restoration and mitigation after disturbance is slow, difficult, expensive, and largely impractical.

Conditions

Much of the habitat outside of the Las Vegas Valley is relatively intact but, expansion of the residential and industrial development that comes with the increasing urban populations in southern Nevada has resulted in destruction of intact desert habitats. Installation of large-scale solar energy infrastructure has disturbed thousands of acres of previously intact land. To date, approximately 70 percent of critical desert tortoise habitat within Clark County is under some form of protection from federal land management agencies, largely within defined areas of critical environmental concern.

Historically poor land management practices, including mismanaged livestock grazing, has resulted in the loss of some key functional groups (specifically grasses and herbaceous forbs) from some over-utilized systems (often lowland rangeland and valley bottoms). Impacts of groundwater depletion for human and industrial consumption along with developmental impacts on hydrology has affected plant communities throughout the region. Overgrazing from overpopulated feral and wild horses and burros is problematic, particularly at desert springs in wetlands and detrimentally impacts grass and forb production across the landscape.

Grazing exclusion across some sensitive hot and arid ecosystems has resulted in improved vegetative biomass and diversity. However, invasive species continue to spread throughout the desert facilitating wildfires in habitats poorly adapted to fires of the magnitude and intensity which have occurred over the past 20 years. Increasing prevalence of invasive grass fueled large (>5,000 acre) wildfires have negatively impacted desert ecosystems. In 2005 and 2006, exceptionally heavy fuel loads resulted in fires throughout southern Nevada burning over half a million acres. The shift to non-native grasslands resulting from those burns has persisted. Blackbrush, a former site dominant species in many of the burned habitats, is still largely absent from burn scars and is expected to require hundreds to thousands of years to recolonize. Fire scars across the desert landscape are often permanent features. As wildfires are increasing in magnitude and severity, impacts will be more pervasive across the desert ecosystems.

Habitats across southern Nevada are subject to increasing pressure from invasive plant species (the largest impacts from non-native annual grasses) which fuel large-scale wildfires. Effects from "megafires" resulting from the unprecedented fine fuel loads that are a result of the invasion of annual grasses are long lasting and potentially permanently disruptive.

The warm and hot deserts ecosystem harbors seven federally endangered or threatened plant species and 13 state protected plants (Appendix G).

Trends

Warming and drying southwestern climates are predicted to result in an expansion of creosote-bursage communities northward. Thermic and mesic blackbrush communities are predicted to lose 50 percent of their shrub abundance within 200 years (TNC 2011). Throughout southern Nevada, land development for urbanization is expected to impact nearly 20 percent of Clark County. Clark County has recently petitioned Congress for the release of an additional 42,000 acres of BLM land to be made available for development. Groundwater utilization that has changed aboveground flows and surface spring productivity has reduced the vegetative biomass of some regions. Additionally, development in some areas directly impacts sensitive and rare plant assemblages by changing the historic overland flow, surface sheet flow, and flow of tributary washes and springs thereby changing the water resources available for formerly downstream systems. Renewable energy infrastructure is also a large-scale land use change to hot deserts. Twenty thousand acres of land in Nevada were converted to solar energy farms as of 2018. As southern Nevada becomes increasingly urbanized, and solar farms surround the city, ecosystem functions are permanently lost.

Mesquite woodlands have seen a drastic decline in some regions of the state, particularly in Nye County (Beatty, Ash Meadows, and Pahrump areas). Some of the impacts are obviously human driven (direct cutting of trees, overuse and site disturbance), in some areas they are outcompeted by invasion of non-native saltcedar (tamarisk), and there is a region-wide decline in the health of mesquite trees (specifically screwbean mesquite) resulting from currently undiagnosed causes, potentially linked to water availability (Foldi 2015).

Benefits and Services

Hot and warm desert ecosystems host a wide variety of plant and animal species providing necessary food and shelter for animals along migratory routes. Mesquite hosts a variety of bird species and have edible seed pods that are an important food for many wildlife species and make a nutritious flour for human consumption. The great diversity of plants throughout the deserts also support a diversity of invertebrate life. Arid systems have some of the greatest bee diversity worldwide, with flowers in the desert supporting over 1,000 bee species in Nevada alone. The importance of bees has come into the spotlight in the last few years. Stable populations are necessary for agricultural success, and bees are responsible for pollinating three quarters of the species of flowering plants. Additionally, warm deserts have a rich history of cultural use, with historic and prehistoric resources throughout. Intact desert systems moderate water movement and erosion management and assist with fugitive dust control benefitting human health.

Dryland shrub ecosystems when undisturbed and productive (largely depending on management practices and water availability) serve as an effective carbon sink. Biological soil crusts present in large amounts are effective for carbon storage mechanisms. Closed basins specifically (like the Great Basin) function as carbon sinks. When intact, they sequester atmospheric carbon helping in the fight against rising atmospheric CO_2 concentration.

Dependent Wildlife Populations

Wildlife species depending on desert ecosystems include many birds, small and mid-sized mammals, and reptile species, including but not limited to: coyote, kit fox, bobcat, jackrabbit, cottontail, kangaroo rat, desert pocket mouse, snakes, lizards, Burrowing Owls, hawks, and Chukar. Priority species of concern in desert habitats currently threatened due to habitat loss include the desert tortoise and Black-chinned Sparrow. The desert tortoise is listed as threatened under the federal Endangered Species Act. Desert tortoises often place their burrows directly under creosote bushes, taking advantage of the substrate stability created by the creosote roots. Desert bighorn sheep depend on southern Nevada's mountain ranges for survival. Several species including Bendire's Thrasher and desert night lizard are associated specifically with Joshua Tree presence. The Black-chinned Sparrow has a very limited distribution in Nevada, found in the largely impenetrable shrubby stands of blackbrush and chaparral, often along the pinyon-juniper interface. Blackbrush habitats provide a necessary vegetative structure and cover for wildlife, especially bird species (WAPT 2012).

The warm and hot deserts ecosystem harbors 19 federally endangered or threatened vertebrate and invertebrate animal species, 17 state endangered or threatened vertebrate and invertebrate animal species, and two species that are designated protected in Nevada (Appendix G).

Urban and Community Forests

Nevada has been the fastest-growing state for five straight decades. In 2019, Nevada's population topped three million for the first time. Increasing population in Nevada and the western United States will continue.

In the fastest growing areas of Nevada (Metropolitan Clark County and the Sierra front), urban and community forests cannot keep pace with development. Environments in many of these new developments are becoming inhospitable for many tree species. Water is one of the most important issues in southern Nevada and conservation practices have had unintended negative impacts on tree health by eliminating irrigation of landscapes that support tree survival and growth. If the benefits and services of urban and community forests are to be realized in Nevada, a concentrated effort to not only plant, but to *grow* and maintain trees, will need to be part of all aspects of urban planning efforts. Increasing trees in urban areas will only be accomplished through local, NGO, state, and federal partnerships.

Urban and community forests are important to Nevada cities and towns as they provide many services that most people may not notice. Urban forests in Nevada are dynamic ecosystems that provide many important benefits to people and wildlife. Urban and community forests provide shade and wildlife habitat, control stormwater, help filter air and water, conserve energy, play a role in human health and wellness while adding beauty, form, and structure to urban design.

To date there is no comprehensive canopy analysis of the Nevada urban forest. However, some city tree inventories, and canopy studies are completed and offer a snapshot of the condition of select urban forests. There are currently no broad sweeping insect and disease epidemics in Nevada's urban forests, though in southern Nevada, experts are tracking the Aleppo pine blight. This issue causes decline and some mortality in pine species in the Las Vegas area. Forest health remains a constant concern and monitoring for future problems is always important, especially for emerald ash borer which is moving west across the United States. More tree inventories and analysis are needed to describe the current condition of the urban forest resource across the state. These inventories provide needed data to develop management plans and to quantify ecosystem services (such as stormwater reduction, clean air, clean water, and carbon sequestration) provided by trees to Nevada communities.

Conditions

Nevada's earliest settlers planted the first urban forests with tree seeds and cuttings brought from their homelands and from cuttings taken from Nevada's native cottonwood trees. With the coming of the railroad in the late 1860's and early 1870's, settlers began planting large, rooted trees delivered by train. Surviving trees continue to be the basis of the urban forests in older communities, providing shade, wind protection, and wildlife habitat. These forests and the younger generations of urban and community forests still suffer from a general lack of species diversity. This condition makes them particularly susceptible to insect and disease infestations that can become established and transmitted across the entire forest quickly, having catastrophic impacts that decimate large portions of a forest in a single event.

Many urban and community trees are in poor condition from neglect, improper care, pruning practices, and old age. The protection and proper care of community trees is a major concern. For the past several decades, urban and community forests in Nevada have experienced a steady decline in number of trees and overall canopy cover. The west was in a severe drought from 2013 – 2017 and many community trees died in Nevada from lack of adequate water. These effects have not been fully mitigated on the landscape and many areas are just starting to replace dead trees in their communities.

Southern Nevada relies on the Colorado River for 90 percent of its water supply and the Colorado River system is facing the worst drought in the basin's recorded history. The water level of Lake Mead, which serves as one of the river's primary water storage reservoirs, has dropped more than 130 feet since January 2000. The federal government is projecting a chance that Lake Mead water levels may fall below 1,075 feet in 2021, triggering the first-ever shortage of Colorado River water and possibly reducing the amount of water available to Nevada (SNWA 2019).

During droughts and water shortages, landscaping and community trees may become compromised if water resources are focused away from irrigating urban and community trees. In southern Nevada, it is paramount to find solutions to maintaining healthy trees and increasing canopy cover even in the face of severe drought.

Trends

Urban and community forests take time to grow and develop. However, with the continuing increase in Nevada's population, urban and community forests are being outpaced by the rapid expansion of the urban boundary. Many urban areas continue to see tree mortality due to drought and do not have the resources to replace these trees. In general, Nevada has been experiencing a trend of declining tree cover in the urban environment. The NDF Forest Health Program monitors for current and emerging insect and disease issues, paying close attention to insects and disease currently in Nevada while also monitoring for exotic, non-native pests that are known to be approaching Nevada. Mediterranean pine engraver (*Orthotomicus erosus*), a new exotic bark beetle was documented by the Nevada Department of Agriculture in 2015 in areas around Las Vegas. This exotic species has no natural predators and attacks planted Allepo and Mondell Pines, which are common in southern Nevada communities. The Emerald Ash Borer (EAB) is an example of a devastating pest that was first found in Detroit Michigan in 2002 and has been moving westward destroying ash species in its wake. NDF continues to monitor for EAB with no detections to date.

Figure 42. The Michael Jordan Arboretum at NDF's Northern Region Headquarters in Elko. This 2.2-acre grove provides nesting habitat for raptors, as well as serves as a regional showcase for trees available for sale to the public at the Washoe State Tree Nursery.

With climate trends and increasing urban sprawl, community and urban forests are more important now than ever. Many Nevada communities continue their excellent efforts of managing urban forests and maintaining their Tree City USA status. In southern Nevada, projections of population growth and increased temperatures, elevates the importance of well managed community forests and increasing urban tree canopy. The Nevada Urban and Community Forestry program provides support throughout the state by providing technical and financial support to communities.

Receiving recognition from the National Arbor Day Foundation under the Tree City USA program indicates the ability of a community to sustain and manage its urban forests. In 1990, only three Nevada towns had received Tree City USA distinction. The number increased to seven in 1995, nine by 2008, and now stands at 13 Tree City USA communities accounting for about 70 percent of Nevada's population.

Benefits and Services

With a warming climate, planting, growing and maintaining healthy community forests is imperative for healthy communities. A well-known Chinese proverb states: "The best time to plant a tree was 20 years ago. The second-best time is now." Benefits and services of urban and community forests are many and well-studied. Urban forests and trees have environmental, economic, human health, and social benefits. They are dynamic ecosystems that provide critical benefits to people and wildlife, while filtering air and water, controlling storm water, conserving energy, and providing wildlife habitat and shade. Trees and forests add beauty, form, and structure to urban design. By reducing noise and providing places to rest and recreate, urban forests strengthen social cohesion, motivate community revitalization, and add economic value to our communities (USFS 2019).

Dependent Wildlife Populations

Urban and community forests provide habitat for a wide array of wildlife species. Urban wildlife habitat can support habitat connectivity within ecological landscapes and serve as a refuge for species impacted by urbanization. Local land and water conservation projects can provide important urban wildlife benefits and connect our growing urban population with nature.

Some wildlife populations rely on urban ecosystems that provide food, water, cover, and nesting sites. Certain species (such as Falcons, Hummingbirds and swallowtail butterflies, to name a few) are well adapted to the mix of native, non-native, and exotic plants found in man-made gardens.

Key Issues, Threats and Strategies for Managing Nevada's Forests, Rangelands and Watersheds

Key Issues, Threats and Strategies for Managing Nevada's Forests, Rangelands and Watersheds

Figure 43. An NDF Natural Resource Specialist working with a landowner on developing technical guidance through a Stewardship Plan for a private property in the community of Lamoille.

The assessment of Nevada's natural resources led to the identification of eight key issues, threats, and opportunities to better manage Nevada's natural resources to provide sustainable benefits and services to human and wildlife populations. The eight key issues, threats and opportunities are presented below. Each of them can be cross-referenced to the USFS-State and Private Forestry national priorities and objectives in Appendix H. In each of the eight sub-sections below, the subjects are summarized and evaluated for intersections with and influences from climate change, plant and animal habitats under pressure, landownership and fragmentation, as well as invasive weeds. Furthermore, the primary causes of these key issues or threats are identified and explained. Values at risk and challenges posed by the issue are also identified and characterized. Finally, each section has a detailed set of goals and strategies that can be employed by identified programs and performance measures to gauge the impact of the strategies on the issue. All of this information was the result of extensive research performed by the writers including the use of geographic information systems and the associated datasets provided by cooperators that was used to analyze the available data, visualize spatial characteristics and summarize the data in the narratives.

#1 – Forest and Woodland Health

Overview

Forested lands comprise approximately 15 percent of Nevada's total area. The majority of these forestlands are pinyon-juniper woodlands (81 percent). Non-federal forestlands comprise approximately four percent of the total forestlands in the state. The relatively small percentage of the state occupied by forestland elevates this cover type's importance due to its relative scarcity. Healthy forests provide wildlife habitat, clean air and water, wood products, non-traditional forest products and recreational opportunities, all of which are of great benefit to the public. The fiber value of the tree resource is limited as a result of the management category, species composition, or the geographical separation from existing or potential markets.

Consequently, the investment of resources into management of the forest resource over much of the state is minimal. The consequence of this limited management is that much of the forestland is in poor condition. The undesirable conditions over much of the state include high stocking levels, poor species composition, low tree vigor and high levels of insects and disease.

The most productive private forestlands in the state are located along the eastern Sierra Front and used primarily for residential purposes. Private forestlands elsewhere, mostly pinyon-juniper woodland, are managed for mixed purposes. The majority of State forestland is located within the Lake Tahoe Basin and adjacent areas and is administered by the State Parks Division; management of these lands is interdisciplinary and involves several state agencies, including the Division of Forestry. Natural resource management goals for these lands focus on maintaining the health and function of ecosystems e.g. "ecosystem services." Forest products are a by-product of any treatment not a primary goal. Local governments own scattered forested acreage along the Sierra Front and manage them as park property. Federally owned forestlands are comprised of all forest cover types represented in the state.

High property values of forestland located near urban areas along the Sierra Front virtually eliminates the likelihood of these lands being held in large individual parcels. The financial incentive for sale and subdivision of these lands leads to forest fragmentation. Development impacts lead to individual tree decline. Furthermore, once the land is subdivided, the opportunity for significant management disappears due to fragmentation. Over-stocked forests and forests in decline from insect/disease impacts are at greater risk from high intensity wildland fires. These conditions allow fires to propagate more readily into stand replacing fires with long-term impacts to the watershed, forest habitat, and residential areas located within or nearby.

Climate Change Influence

Climate change poses a risk to Nevada's forestlands and urban forests, though the extent of impacts are currently unknown. Drought stress for mixed conifer forests and pinyon-juniper woodlands has caused longer bark beetle epidemics and overall loss of tree health due to lack of water. Climate change impact is very difficult to measure since it is an ongoing process and can only be predicted over the long term.

Plant and Animal Habitats Under Pressure

As forest health issues are a constant threat to the state's forestlands and pinyon-juniper woodlands, plant and animal habitats are under constant pressure as well. Loss from climate change, invasive species and weeds, development, wildfire, and abundant wild horses all play a role in the possibility of decreasing acreage, which in turn decreases habitat for native wildlife and plants.

Land Ownership and Fragmentation

Forestland ownership significantly influences the management of the resource. State, local government, and private ownership of forestlands are intermixed with federally owned forests and managed for a different set of values. In some instances, management options of varying stakeholder groups are incompatible with each other. This mixed ownership and fragmentation makes landscape level projects near impossible to implement. Development of private lands continues to increase this problem, and in general leads to limited management and a decline in forest health.

Invasive Weeds

Invasive weed species create forest health issues that are comparable to the issues facing the State's rangelands. Invasive species within forestlands out compete native grasses and forbs and change the composition of the forest understory depriving these ecosystems of key species and reducing species diversity. Additionally, invasive weeds can take over after wildfires decreasing the ability of native vegetation and trees to naturally regenerate. This is evident in burnt pinyon-juniper stands where the site is completely taken over by cheat grass (*Bromus tectorum*), with little to no native vegetation.

Primary Causes of Forest and Woodland Health Decline

- **Insect and disease species:** some are capable of large-scale outbreaks and widespread tree mortality; others do not cause direct mortality, but negatively affect tree health, which increases tree susceptibility to other lethal agents
    - **Exotic insect and disease species**
        - Present in Nevada: white pine blister rust, white satin moth, and Mediterranean pine engraver
        - Not yet present: balsam wooly adelgid and emerald ash borer.
    - **Native insect and disease species**
        - Present in Nevada: Dwarf mistletoe, Mountain pine beetle, fir engraver beetle, pinyon ips, subalpine fir mortality complex and defoliators such as pinyon needle scale, pinyon sawfly, Douglas-fir tussock moth, and western spruce budworm
- **Aspen decline:** attributed to diminished natural regeneration, succession to conifers, disease outbreaks, and browsing pressure from domestic and native ungulate wildlife

- **Lack of Pinyon-Juniper woodland management:** stands become overstocked, eliminating understory vegetation, and a decrease in disturbance resistance (partially due to the lack of disturbance or management)
- **Drought and a warming seasonal temperature:** extended drier conditions result in decreased tree vigor, increased susceptibility to insect and disease outbreaks, decreased regeneration potential and increased length and severity of wildfire seasons
- **Development:** cover type conversions and fragmentation are contributing to a decrease in forested landscapes where subdivision and development of land occurs; resulting in substantial loss of forested lands or reduction in forested parcel size, precluding efficient management and loss of ecological function

Values at Risk from Forest and Woodland Health Decline

Value	Issues and Impacts
Human Health and Welfare	• Many communities depend on forested areas for their benefits including shade and temperature buffering, recreation, clean air, and aesthetics. Decline/loss of these areas due to development impacts, exotic insects/diseases or high intensity wildland fire jeopardizes these values • Forested areas in Nevada have established open spaces surrounding them, which increases physical and mental health of visitors • Loss of forest cover in municipal watersheds jeopardizes the quality and quantity of the water resource and can increase the cost of providing drinking water
Local Economies	• Declining forest health affects local economies dependent upon forests for recreation and tourism • Treating forest health issues requires investment from landowners and downstream beneficiaries
Wildlife Resources and Habitats	• Habitat for forest dependent wildlife species can be lost for long periods when forest cover is lost from disturbances like wildland fire and large-scale insect outbreaks • Forest cover in watersheds and along streams essential to maintain water quality and temperatures that are important to breeding environments for fish and amphibians • Loss of riparian forest cover can eliminate essential habitat for certain wildlife species • Wildlife depend on horizontally contiguous forested tracts for functional habitat. Development of communities, infrastructure, and the occurrence of high intensity wildfire in forested areas poses the greatest threat of fragmentation of habitats;

Value	Issues and Impacts
	subdivision of large forested tracts poses difficult challenges to managing more urban parcels in the forest landscape effectively
Forest Vegetation Communities And Soils	• Forest health and sustainability is severely impacted by catastrophic or high intensity wildfire • Cover type change can occur in severe insect and disease outbreaks that often change into brush fields dominated by invasive weeds at the ground level; an ongoing problem in Nevada, especially where aspen is declining • Stability and conservation can be threatened when forest health declines and major insect or disease outbreaks cause large scale mortality events which removes the tree canopy cover and exposes unsecured soil • Fragmentation, soil disturbances and erosion within forested tracts from development and high intensity wildfires, can create long-lasting impacts to the function and value of the forested ecosystems
Water Quality	• Forests help maintain natural hydrologic systems and channel types (entrenchment ratios, width, depth ratios, temperature, slope, sinuosity, etc.)

Challenges posed by the Forest and Woodland Health Decline

- Economics are driving changes in landownership that increase forest fragmentation. High-appraised land values make conservation programs less competitive
- Tree mortality due to insect and disease outbreaks throughout the state, especially in remote areas will likely never have any treatments due to high cost, limited access, and various conflicting land management objectives and policies
- Increases in temperature and drought, which increase likelihood of high intensity wildland fire and are beyond the control of land managers
- The increase in size and severity of wildfires is causing additional difficulties in rehabilitating forests and woodlands that would be more fire resistant. Once an area is burned it often responds with annual invasive species growth and domination, which predisposes it to repeated wildfires. This is resulting in a loss of forests and woodlands across the state and therefore a loss of wildlife habitat, wood product inventory, recreation areas, and land values
- Lack of near-by markets and low product values make management of much of Nevada's forestland uneconomical

- Inadequate funding and staffing do not allow for comprehensive and strategically planned statewide forest health monitoring, which precludes gaining an accurate annual perspective on the scale, locations, and types of forest health issues affecting the forests in Nevada
- Forest health improvement treatments are often not a collaborative effort between landowners and land managers, decreasing the effectiveness of the treatments due to the lack of landscape scale management
- Landowners do not prioritize managing their lands especially in the urban interface, largely because of the lack of knowledge among landowners and necessary funding for management treatments
- Invasive and exotic insect and diseases will continue to be found within Nevada and contribute to increased tree stress and mortality across the state. The potential for large- scale outbreaks with corresponding large-scale losses of native trees is a very real possibility, which has occurred with the emerald ash borer in the central and eastern United States

Opportunities and Strategies to Impact Forest and Woodland Health

Goal 1-1: Cooperative management and collaboration to maintain resilient forests in Nevada
Strategy 1-1-1: Engage the public through collaborative education and media events to increase awareness of linkages between forest health, sustainable community water supplies, and the value of intact forest ecosystems to wildlife
Performance Measure 1-1-1: Amount of impactful conservation education events and PSA's that increase public knowledge and awareness
Contributing Programs: NDF Resource & Fire Programs, NRCS, NV Conservation Districts; University of Nevada-Reno/Las Vegas, NDOW
Strategy 1-1-2: Provide more landowner outreach to generate interest and support from communities in watershed and forest health conservation programs, projects, and education programs
Performance Measure 1-1-2: Percent increase in outreach activities that involve communities and landowners to participate in plans, on the ground projects, and conservation programs for sustainable management and engagement
Contributing Programs: NDF Forest Stewardship, Legacy & Forest Health Programs
Strategy 1-1-3: Support and participate in the Nevada and National Cohesive Strategies, Shared Stewardship, Resource Needs Assessments and other Local Work Group efforts to protect forest ecosystems statewide from destructive wildfire and other threats to resilient landscapes

Performance Measure 1-1-3: Number of active groups with deliverables achieved
Contributing Programs: BLM, USFS, NDF, private landowners, forest and woodland focused non-profits
Strategy 1-1-4: Collaboratively create, find and utilize mutually supported forest and woodland conservation mechanisms to reduce fragmentation and increase landscape scale management
Performance Measure 1-1-4: Increased acreage of collaborative projects
Contributing Programs: NDF Resource Program, BLM, USFS, LSR Grant Program, State Fire Assistance
Goal 1-2: Promote pro-active forest management for forest health statewide
Strategy 1-2-1: Provide public education and financial assistance to promote implementation of timber stand and woodland improvement projects for mixed conifer and aspen stand health
Performance Measure 1-2-1: Increase treated acres and decrease damaged acres on an annual basis
Contributing Programs: NDF Resource Program, NV Conservation Districts, NRCS
Strategy 1-2-2: Collaboratively seek and find realistic ways to manage pinyon-juniper for ecosystem health and sustainability
Performance Measure 1-2-2: Increase treated acres and decrease damaged acres on an annual basis
Contributing Programs: NDF Resource Program, NV Conservation Districts, NRCS, Pinyon-Juniper Partnership, NDOW, Land Management Agencies
Strategy 1-2-3: Further develop individual agency prescribed fire programs and encourage collaboration among all levels of government and NGO partners
Performance Measure 1-2-3: Increase in acres treated annually with prescribed fire
Contributing Programs: NDF Resource & Fire Programs, Nevada Prescribed Fire Alliance, The Nature Conservancy, TREX
Strategy 1-2-4: Research and develop markets and products that create value for wood and carbon-based by-products of forest and woodland restoration and management treatments
Performance Measure 1-2-4: Increase access and number of suppliers to active markets for products and tonnage of biomass utilized
Contributing Programs: NDF Resource Program, NDF Biomass Program, USFS, BLM, Pinyon-Juniper Partnership

Goal 1-3: Maintain monitoring and management of invasive insects
Strategy 1-3-1: Maintain monitoring for invasive insects and work with cooperating agencies to manage established threats in Nevada and apply management techniques at the landscape level
Performance Measure 1-3-1: Total amount of monitoring sites and percent of insect infestations treated
Contributing Programs: NDF Forest Health Program, USFS Forest Health Protection, Nevada Department of Agriculture
Strategy 1-3-2: Adapt monitoring systems, communication protocols, and data management systems as necessary to more accurately inform state-wide forest health assessments and treatment priorities
Performance Measure 1-3-2: Timely and accurate data within mutually accessible databases
Contributing Programs: NDF Forest Health Program, USFS Forest Health Protection, USFS Forest Inventory and Analysis Program, Nevada Department of Agriculture
Goal 1-4: Reduce conversion of forests and woodlands to non-forest and woodland uses
Strategy 1-4-1: Identify the areas at greatest risk of conversion, perform public outreach and protect areas to preserve forest and woodland cover type.
Performance Measure 1-4-1: Minimize the loss of land in forest and woodland cover types
Contributing Programs: NDF Resource Program, Nevada Conservation Districts, NRCS, Nevada Land Trust and other land protection NGOs

#2-Wildfire Hazards

Overview

The presence of wildfire on the Nevada landscape has been drastically altered over the past century. Wildland fires no longer occur with the same frequency, intensity, size, or time of the year as in the past. Wildfire regimes have deviated from historical patterns considerably within our dominant ecosystems in the following ways:

Figure 44. Fire crews creating a suppression line in preparation for igniting a backfire, designed to protect the community of Lamoille from the Range 2 Fire.

1) Forests and woodlands are experiencing less frequent and more destructive wildfires than historical norms. In the absence of fire, live and dead fuel have accumulated to levels that make the inevitable fire burn hotter than in the past.

2) Shrub and grasslands are experiencing fires much more frequently and at a larger scale and intensity than in the past, which destroys ecosystem functions and the ability of native shrub and grasslands to regenerate.

3) Human communities are more at risk than ever before due to the increasing development and expansion of the Wildland-Urban Interface (WUI). Damage to communities is becoming more common since many forms of infrastructure are now in the path of catastrophic wildfires. Additionally, population growth leads to more human activities in the wildlands and increased potential for human caused ignitions.

Climate Change Influence

The effects of climate change on wildfire related metrics are broad and dynamic. A changing climate influences the structure of fuels and their susceptibility to ignition, as well as fire behavior and intensity, once a fire starts. As the climate warms and ecosystems adapt, it is likely that the duration of the "fire season" across much of Nevada will increase—either starting earlier and/or lasting longer. Locations that were not previously as susceptible to wildfire may become more so and areas with more historically frequent fire return intervals could see more intense fire events with greater impacts to the landscape. Due to the aforementioned factors, it is likely that a warming climate will contribute to increased mitigation and suppression costs for all stakeholders in Nevada.

Plant and Animal Habitats Under Pressure

Landscape and ecosystem disturbances caused by wildfire can put additional pressure on plant and animal communities already stressed by climate change, urban development, and other factors. This reduces ecosystem and landscape resilience and produces additional negative impacts such as the encroachment of invasive species or the further listing of threatened and endangered species due to population reductions resulting from habitat destruction.

Land Ownership and Fragmentation

Wildfire is a transboundary risk that affects the landscape regardless of human defined geo-spatial delineations such as political divisions or agency boundaries. A mix of federal agencies manage much of Nevada's landscapes. Management of the non-federal lands requires close coordination, communication, and cooperation across all jurisdictional boundaries to ensure adequate mitigation of wildfire risk, effective fire suppression response and sustainable rehabilitation. Certain management designations such as Wilderness, can present unique suppression and management challenges that require further interagency cooperation to ensure adequate response. In these instances, limits to suppression resource type and tactics often exist. Heavy equipment usage is often restricted or completely prohibited. This can prove problematic to keeping fire growth minimal. Follow up on rehabilitation in wilderness or similarly designated areas may also be impacted with the potential for cascading impacts well outside designated boundaries if significant temporal delays occur in rehabilitation implementation. The wildfire scale, intensity, and frequency being experienced since the 1990's threatens to increase the pace and scale of landscape parceling; lands are becoming less productive and profitable for natural resource based economic uses. Ultimately, enterprises will subdivide these lands and sell them for the greatest profit possible while liquidating assets to alleviate financial hardships of struggling businesses. Another potential strategy to minimize residential sprawl and conversion of forests is to support legislation and grant programs (such as the Land and Water Conservation Fund grant) that would provide funding for local government and non-profit organization land acquisitions. By acquiring lands that can improve ownership patterns, management for wildfire risks would be more easily accomplished by working with fewer landowners, and partners with like-minded goals to manage these lands.

Invasive Weeds

While fire is a natural part of most of Nevada's ecosystems, the associated post-fire disturbance creates openings for encroachment and establishment by various invasive species. Timely and effective post-fire rehabilitation is critical to maintaining native species and preventing the establishment of invasive competitors.

Primary Driving Factors of Wildfire Hazards

- **Disruption to historical fire cycles:** Over time fire suppression actions have prevented fires from burning on historical cycles. Historic fire return intervals reduced fuel accumulations and allowed wildfires to burn in ways that were conducive to ecosystem maintenance rather than damaging to them.

- **Invasive plants**: Exotic vegetation like cheatgrass (*Bromus tectorum*) and medusahead (*Taeniatherum caputmedusae*) promote increased fire size and frequency by providing flammable carrier fuels between more widely spaced native bunchgrasses, shrubs, and trees that historically saw smaller and infrequent natural burns. Large, high intensity burns fueled by non-native species can result in undesired ecological transitions in arid communities. This can hinder the recovery of native vegetation, which results in plant communities dominated by exotic invasive species that form continuous landscapes of flammable fine fuels conducive to burning every few years.

- **Human activity:** Ignition sources are becoming more frequent as the population grows; there is more dispersed recreation in the wildlands as well as increased development in the WUI, both of which bring sources of ignition to WUI and wildland areas.

- **Climate change:** Climatic variation outside historic norms can increase the flammability of native vegetation by favoring herbaceous fuel growth as well as drying of woody fuels. Warm and dry winters have also increased the susceptibility of arid plant communities to fires during months traditionally considered "non-fire months". Over time, climatic variations may lead to further invasive species encroachment across all landscapes that can lead to increased fuel loading and ignition susceptibility. Also, the immense releases of carbon dioxide and other greenhouse gases into the atmosphere from wildfires increases the rate and intensity of climate changes that further exacerbates native vegetation flammability and loss of sequestered carbon in native plant communities.

Values at Risk from Wildfire Hazards

Value	Impact
Human Life and Health	• Loss of life during wildfire and in post-fire scenarios where dangerous conditions exist • Reduced health for smoke-vulnerable populations in fire prone areas
Private Property	• Loss of or damage to private property

Value	Impact
Vegetation Communities and Wildlife Habitats	• Health and sustainability are severely impacted through wildfire, especially catastrophic or high intensity wildfire • Above-ground carbon sequestered in vegetation biomass is emitted into the atmosphere through the combustion process
Soils	• Stability and conservation are threatened when wildfire removes the vegetative cover and exposes bare soil • Soil carbon stocks are reduced when sustainable perennial vegetation communities are removed by catastrophic wildfire and high frequency fire return intervals
Water	• Supply quality and quantity are negatively affected by removal of vegetative cover, soil erosion, and flooding throughout a watershed
Local Economies	• Local economies may suffer from a lack of inputs, revenues, or general activity due to the destruction of natural resources and/or developments that support local business and industry • Livestock grazing may be deferred for many years on grazing allotments after wildfires, eliminating income for ranches and having negative economic impacts on the agricultural sector • Municipalities, Volunteers, State, and Federal resources are spent suppressing fire rather than preventing fire-threatened resources in the WUI and other community needs
Quality of Life	• The occurrence of wildfire creates inconveniences and negative impacts to residents and visitors

Challenges posed by Wildfire Hazards

- Increases in wildfire frequency, size, and intensity are creating exponentially higher workloads and financial burdens on agencies and infrastructure responsible for wildfire suppression. The cost of these burdens is increased efforts to manage vegetation for fire risk reduction.

- WUI development is outpacing fire prevention and hazardous fuels management capabilities, and Community Wildfire Protection Plans have not been effectively updated for most communities, leaving many areas subject to devastating losses of private property and quite possibly human life.

- Access to wildfire incidents is often geographically challenging, exposing wildland firefighters to additional risks coupled with potentially increasing costs and suppression time. Additionally, management designations (e.g. Wilderness, Study Areas, etc.) can also impact access options for suppression resources on some Federally managed lands.

- Due to resource availability (or lack thereof), fire response agencies and cooperators can become quickly overwhelmed in rural areas of the state with high occurrences of wildfire.
    - Limited suppression resource availability can decrease the efficiency and effectiveness of suppression actions, particularly during initial attack, which in turn can result in uncontrolled fire growth, increasing overall costs and environmental impacts
- Proactive vegetation/fuels management activities are costly because biomass created from fuels reduction projects has little to no economic value making it hard to find a cost-effective means for disposal
- Wildfire decreases critical wildlife habitats, drives special status listings of dependent animals, in turn threatening current land use and management practices
- Wildfires that denude vegetation result in wind and water erosion of topsoil, reducing the site's ability to recover to desired vegetation communities and providing openings for invasive species encroachment.
- Runoff and associated erosion after wildfires can pollute and degrade water resources damaging riparian and wetlands negatively impacting proper watershed function.
- In a state with limited water resources, landscapes impacted by wildfire disturbance can leave communities without municipal drinking water, agricultural enterprises without water to grow crops or for livestock, as well as fish and wildlife without suitable habitats.
- Post-fire impact to local economies can be devastating. Popular recreation sites may remain closed due to persistent hazards. Grazing allotments may be rendered less productive or closed altogether for varying numbers of years. Iconic view sheds are altered. The critical public infrastructure necessary to conduct normal business may be damaged or destroyed. All the aforementioned impacts require expensive and lengthy remediation and rehabilitation, ultimately costing local economies considerable amounts of revenue and permanent loss of industry.
- Health impacts from wildfire can be widespread and persistent, due to the degradation of air quality affecting communities both in proximity to wildfire events as well as those further down wind. These health-related impacts contribute to an increase of the "total cost" of wildfire on communities.

Opportunities and Strategies for Agency and Cooperator Impact on Wildfire Hazards

Goal 2-1: Collaborate with other fire and natural resource management stakeholders to reduce the size, frequency, intensity, and costs of wildfire impacts in Nevada
Strategy 2-1-1: Protect existing assets and ecosystems from the destructive impacts of wildfire
Performance Measure 2-1-1: Reduction in acres burned and assets lost or damaged; Increase acres treated to reduce fuels and restore fire adapted ecosystems
Contributing Programs: NDF Resource & Fire programs, Rangeland Fire Protection Associations, Local Fire Protection Districts, Conservation Districts
Strategy 2-1-2: Support, participate in, and implement the Nevada and National Cohesive Strategies
Performance Measure 2-1-2: Reduction in acres burned and assets lost or damaged; Increase acres treated to reduce fuels and restore fire adapted ecosystems
Contributing Programs: NDF, USFS, BLM, NDOW, USFWS, Tribes, BIA, Local Fire Protection Districts Resource & Fire Programs, Living with Fire, Conservation Districts
Strategy 2-1-3: Adopt and participate in the Shared Stewardship Strategy for transboundary management of landscapes
Performance Measure 2-1-3: Signed and implemented shared stewardship agreement between Federal and State stakeholders. Number of agreement deliverables achieved.
Contributing Programs: NDF Resource & Fire Programs
Strategy 2-1-4: Implement interagency fire protection planning and cooperation for all phases of fire management
Performance Measure 2-1-4: Number of fire protection districts with interagency fire management agreements, guides and practices in place that identify areas of high risk and high frequency, improve and evaluate response capacity across the state.
Contributing Programs: NDF Fire program, RFPAs, WFPP, Local Fire Protection Districts and Federal fire cooperators.
Goal 2-2: Increase public awareness and involvement in proactive wildfire prevention activities
Strategy 2-2-1: Provide public education and outreach to educate home and landowners in the Wildland Urban Interface (WUI) focused on creating ignition resistant homes and communities
Performance Measure 2-2-1: Number of WUI public outreach events and material access points.

Contributing Programs: NDF Resource & Fire Programs, Living with Fire, Nevada Network of Fire Adapted Communities, Federal fire agency prevention programs
Strategy 2-2-2: Facilitate and support community ownership of wildfire threats and hazards, planning required and implementable mitigation
Performance Measure 2-2-2: Number of Fire Adapted Community Chapters. Percent of communities with a current and approved CWPP.
Contributing Programs: NDF Resource & Fire Programs, Local Fire Protection Districts, BLM and USFS Prevention Programs, Living with Fire, Nevada Network of Fire Adapted Communities
Strategy 2-2-3: Collaborate to provide and maintain a statewide coordination and tracking to facilitate fire-adapted communities' Community Wildfire Protection planning, implementation, and maintenance
Performance Measure 2-2-3: Existence of an adequately staffed, organized and equipped workforce capable of performing Fire Adapted Community chapter development and guidance. Percent of communities with current and approved CWPPs in place.
Contributing Programs: NDF Resource & Fire Programs, BLM and USFS Fire Management, Local Fire Protection Districts, Homeowners Associations, Conservation Districts, Community volunteers
Strategy 2-2-4: Collaborate in the delivery of fire prevention activities and events
Performance Measure 2-2-4: Number of individuals reached per annum with events or news releases.
Contributing Programs: NDF Resource and Fire Programs, BLM and USFS Fire Prevention Programs, Local Fire Protection Districts, Living with Fire
Strategy 2-2-5: Support the design, implementation, and enforcement of standards and codes for building construction and maintenance in the WUI (IBC/IWUIC)
Performance Measure 2-2-5: State and percent of municipal adoption of the International WUI Code adopt; similar amendments to existing building code(s).
Contributing Programs: NDF Resource & Fire Programs, Nevada Legislature, Department of Conservation and Natural Resources, Department of Public Safety-Fire Marshal's Office, Governor's Office, Local Fire Protection Districts, Counties and Municipalities.
Strategy 2-2-6: Collaboratively implement preparedness and pre-fire mitigation actions in WUI communities and wildlands that focus on creating Fire Adapted Communities
Performance Measure 2-2-6: Number of parcels with defensible space implemented; Number of Fire Adapted Communities Chapters created; Percent of hazardous fuel areas in a reduced condition.

Contributing Programs: NDF Resource & Fire Programs, Local Fire Protection Districts, BLM and USFS Fuels Management Programs, Contractors, Homeowners Associations, Nevada Network of Fire Adapted Communities, Living with Fire
Strategy 2-2-7: Collaboratively implement pre-fire mitigation actions in wildlands that focus on creating fire resistant and resilient landscapes (e.g. fuel breaks, targeted, prescribed and outcome-based grazing, etc.)
Performance Measure 2-2-7: Percent of landscapes effectively mitigated through treatments annually
Contributing Programs: NDF Resource & Fire Programs, Local Fire Protection Districts, Conservation Districts, Livestock Producers, BLM and USFS Fuels Management Programs, Living With Fire, UNR Range Management School, ROGER Collaborative Group, Great Basin Fire Science Exchange
Goal 2-3: Maintain effective suppression capacity and response across all landscapes
Strategy 2-3-1: Ensure that agency and cooperator personnel are properly trained and qualified for wildland fire suppression and prescribed fire operations
Performance Measure 2-3-1: Percent of relevant personnel meeting National Wildfire Coordinating Group (NWCG) and/or National Incident Management System (NIMS) standards
Contributing Programs: NDF Resource & Fire Programs, BLM and USFS Fire Programs, Local Fire Protection Districts, Rangeland Fire Protection Associations
Strategy 2-3-2: Ensure that agency and cooperator personnel are properly equipped for both wildfire suppression and prescribed fire operations
Performance Measure 2-3-2: Percent fulfillment of natural resource and fire management equipment needs
Contributing Programs: NDF Resource & Fire Programs, BLM and USFS Fire Programs, Local Fire Protection Districts, Rangeland Fire Protection Associations
Strategy 2-3-3: Establish a fully integrated interagency wildland fire communications system
Performance Measure 2-3-3: Maintenance of a Catalyst (Voice Over IP), shared frequencies, shared repeaters, adequate number and location of repeaters/dispatching center locations, and Continuity of Operations Plans implemented.
Contributing Programs: NDF Fire Program, Local Fire Protection Districts, BLM and USFS Fire Programs, Rangeland Fire Protection Associations, Interagency Dispatch Centers
Strategy 2-3-4: Create an efficient and effective network of protection resources, processes, and agreements enabling sharing of resources between cooperators

Performance Measure 2-3-4: Percent of applicable interagency agreements needed are in place and up to date (e.g. MOUs, Cooperative protection agreements, Good Neighbor Authority, Master Cooperating Fire Protection Agreement, etc.)
Contributing Programs: NDF Fire Program, Federal agency fire programs, Local Fire Protection Districts, Rangeland Fire Protection Associations
Strategy 2-3-5: Support Volunteer Fire Departments and Rangeland Fire protection Associations' capacities to assist with wildfire suppression and management activities state-wide
Performance Measure 2-3-5: Number of trainings and equipment provided annually
Contributing Programs: NDF Fire Program, Local Fire Protection Districts, Volunteer Fire Departments, Rangeland Fire Protection Associations, BLM Fire Program
Strategy 2-3-6: Support Interagency Type I, II and III Incident Management Teams with staff, equipment and fiscal support to ensure adequate complex fire management capacity is maintained.
Performance Measure 2-3-6: Percent of Type I, II and III teams ICS positions are staffed, and teams are supported fiscally. Percent of Teams available at full strength and capacity (I.e. equipment, staff) for suppression management when needed.
Contributing Programs: NDF Fire Program, Local Fire Protection Districts, RFPA, Federal land management agencies.
Goal 2-4: Improve collection, reporting, storage and utilization of wildfire related data
Strategy 2-4-1: Track accomplishments, demonstrate successes and document failures to ensure decision makers can make informed decisions on adjusting strategy and implementing effective actions
Performance Measure 2-4-1: Critical data and measures identified, data collection methods and responsible parties defined, database established and maintained, data applied to decision making environments and accomplishment reporting.
Contributing Programs: NDF Resource & Fire Programs, Federal agency fire and fuels programs, Local Fire Protection Districts, Non-Governmental Organizations involved in fire and fuels management, Conservation Districts
Strategy 2-4-2: Utilize scientifically based risk assessments in prioritization and decision making
Performance Measure 2-4-2: Percent of Community Wildfire Protection Plans and landscape scale risk assessments completed; Percent of priority projects implemented at the direction of assessments and plans.
Contributing Programs: NDF Resource & Fire Programs, Federal Fire and Resource Programs, Local Fire Protection Districts, Conservation Districts, NDOW Habitat Division

Goal 2-5: Prevent and manage exotic species invasions that respond to or drive wildfire risks and threats
Strategy 2-5-1: Ensure timely rehabilitation and restoration of fire disturbed landscapes, then monitor and report action successes and failures
Performance Measure 2-5-1: Percent of burned acres with rehabilitation actions applied; Percent of rehabilitated acres
Contributing Programs: NDF Resource & Fire Program, Federal ES&R/BAER (Emergency Stabilization and Rehabilitation /Burned Area Emergency Response) Programs, NDOW Habitat Division, Local Fire Protection Districts, Conservation Districts
Strategy 2-5-2: Encourage, support and participate in pre-fire mitigation actions where conditions will result in exotic invasions
Performance Measure 2-5-2: Percent of burned acres rehabilitated; Percent of hazardous acres mitigated
Contributing Programs: NDF Resource and Fire Programs, BLM and USFS ES&R, NRCS, Local Fire Protection Districts, NDOW Habitat Division

#3 – Urban and Community Forests

An urban or community forest refers to all the trees and shrubs found growing within a city or town and the wildlife that uses them. Areas include city parks, landscaped streets, and trees on public, private, and commercial sites within communities of all sizes. A sustainable urban and community forestry program relies on the support of local, state and federal government commitment mixed with active citizenry, non-profit support, university research partners, and a strong, educated population of green infrastructure professionals within the workforce. The protection and proper care of community trees is a major concern as Nevada has experienced a trend of declining tree cover in the urban environment over the last several decades.

Climate Change Influence

Urban forests can be useful both in mitigating climate change and in helping cities adapt to higher temperatures and other impacts of climate change, especially urban heat island effects. Urban trees reduce the amount of greenhouse gases in the air by sequestering carbon dioxide and by reducing the amount of energy needed to heat and cool buildings. These roles can be quantified at the scale of individual trees or entire cities (McPherson et al. 2005).

Mitigating the effects of increasing temperatures is critical in the Desert Southwest and Great Basin. However, these regions also have water supply and conservation issues that complicate the establishment and long-term care of urban and community forests. In Nevada, the places that need the benefits and services of trees and forests most are the places where it is the most challenging to grow them. Solving issues surrounding community tree establishment and care requires local, private, state, and federal partnerships.

Plant and Animal Habitats Under Pressure

The human population growth in Nevada is the main driver of permanent habitat loss, which puts pressure on native plant and animal species. As communities grow to accommodate increasing population, native habitat is lost. Large wildfires and invasive plant species are also altering habitats throughout the state. In the face of these changes, urban and community forests can play an important role in providing urban habitat for some plant and wildlife species. With purposeful, outcome-based planning and design, proper tree/plant selection, and a commitment to care and maintenance, urban and community forests can provide cover, shade, water, roosting sites, nesting sites, rest stops for migratory birds, and provide important edge habitat (ecotone) where the urban zone connects to the wildland.

Land Ownership and Fragmentation

Rapid population growth in Nevada is having significant effects on landownership and fragmentation. Nevada is one of the fastest growing states in the union, and this trend is predicted to continue. One of the more important effects of population growth on land ownership and fragmentation is the steady expansion of urban boundaries. Cities and towns in much of the state are turning wildlands into urban areas at ever-increasing rates, adding to habitat loss and fragmentation. Many of these newly developed areas are not adequately planted to reach comparable tree canopy coverage with other locations in the community or communities within the state. If they are adequately planted, it takes many years for the trees to develop into sizeable specimens that provide the values and functions expected from a mature size tree. Additionally, intensive management of these trees is required over the long-term to ensure that all trees remain healthy and locations remain suitable to support the growth of trees and sustainability of an urban forest.

Invasive Weeds

Invasive weeds, especially non-native annual grasses (cheatgrass, medusahead, red brome), are longtime issues affecting Nevada's ecosystems. Noxious weeds reduce biodiversity, alter hydrologic conditions, alter soil characteristics, change fire intensity and frequency, compete for pollinators, displace rare plant species, and replace complex ecosystems with simple ecosystems. Most invasive weeds in Nevada affect wildlands and rangelands and alter vast acreages of native wildlife habitat. Though urban areas also have invasive weeds, human presence and landscape care can have a positive effect on reducing and eradicating small infestations.

Primary Factors Driving the Lack of Urban and Community Forests and their Decline:

- **Population growth:** The rate of development of new community infrastructure is outpacing the establishment and care for urban forests. In many cases, growing communities are not addressing urban and community forests as part of the planning and design process.

- **Drought and Improper Irrigation**: Creates stress on urban trees, which can force an early decline and increased susceptibility to pests and diseases.

- **Insects and Pests**: Native insects and pests are cyclical in nature and usually abate themselves with changing conditions (e.g. bark beetles during drought). Non-native insects and pests pose potential severe outcomes for urban and community trees and forests. Many examples exist in the United States of exotic insects and disease outbreaks that have altered entire ecosystems (American Chestnut blight, Dutch Elm disease, and the Emerald Ash Borer). Nevada shares borders with states with a high introduction rate of pests and diseases, placing Nevada's forests at risk. Insect and disease detection are ongoing in Nevada.

- **Lack of Knowledge:** There is a lack of documentation and knowledge about urban tree failures in Nevada (Aleppo Pine Blight, Ash Dieback, storm occurrences) and insufficient research focused on understanding urban tree issues in Nevada.

- **Lack of Trained Tree Experts and Tree Workers:** Nevada has a poorly trained tree work force and a general lack of understanding best management practices for tree care and maintenance.

- **Community and Local Government Investment:** There is a general lack of community investment into planning, management, and enhancement of urban and community forests. There are many reasons, which include poor development design standards, a lack of understanding the importance of community forests, and too little or no available financial resources.

- **Climate Change:** The number of hot and very hot days are breaking records every year. This trend is pushing some tree species to their heat tolerance limits. Future tree selection needs to consider climate variation.

Values at Risk from Declining or Poorly Managed Urban and Community Forests

Values	Impacts
Human Health	• Trees increase quality of life, provide shade and cooling, improved air and water quality, visual and sound buffering, and a reduction in physical and mental stress
Local Economies	• Property values are higher in neighborhoods with thriving community forests • Higher sales in tree lined commercial areas positively impact consumer spending at businesses • Trees provide many important urban ecosystem services; if planned and maintained properly, benefits can far outweigh costs
Ecosystem Services	• Urban forests managed for their potential extent and health contribute climate change mitigation through carbon sequestration • Provide valuable wildlife habitats within otherwise uninhabitable developed environments • Reduce runoff rates and erosion of soils and increase water quality from storm water release events in urban environments • Increase air quality through filtering
Urban Livability	• Urban heat island effects are mitigated with healthy urban forests • Crime rates are lower and human health is better in forested landscapes • Create safer and more sociable neighborhoods • Attract living within and visiting Nevada communities

Challenges that Affect Community Forest Management and Conservation

- Planning departments have not consistently and proactively incorporated urban and community forestry concepts, practices, and planning into all phases and levels of community planning and design
- Securing sustainable funding for community forestry activities, especially in underserved communities
- Providing support and expertise to communities with limited urban and community forestry staff

- Lack of tree diversity in Nevada cities, towns and communities, creating the potential for a single pathogen to have significant effects on urban tree canopies
- Restoring urban forests by correcting mistakes from the past, such as poor species selection and inadequate/undersized planting areas
- Homeowner and community access to appropriate tree species
- Delivering tree care trainings in rural communities (large geographic area and not enough staff)

Opportunities and Strategies for Impacting Community Forests

Goal 3-1: Develop and maintain strong partnerships with key stakeholders that can contribute to urban and community forest design, establishment, and maintenance
Strategy 3-1-1: Increase connections and partnerships to collaborate on Urban and Community Forestry program development and implementation
Performance Measure 3-1-1: Number of communities and partners engaged in Urban and Community Forestry programming and planning
Contributing Programs: NDF Natural Resource and Camp Programs, NDF Urban and Community Forestry Program (NDF UCF), International Society of Arboriculture, Local Tree Boards and Urban Forestry Commissions, Conservation Districts, Local and regional urban and community tree councils/organizations
Strategy 3-1-2: Continue engagement with the Western Urban and Community Forestry (WUCF) Network to stay current with emerging issues and maintain peer education opportunities
Performance Measure 3-1-2: Number of WUCF and Partners in attendance at WUCF meetings
Contributing Programs: WUCF Network
Goal 3-2: Promote the role of urban and community forestry in human health and wellness, local economies, ecosystem services, and urban livability
Strategy 3-2-1: Expand opportunities and create connections for collaboration with the healthcare community
Performance Measure 3-2-1: Number of health entities engaged, and actions implemented
Contributing Programs: NDF Urban and Community Forestry, Health Care Institutions and Providers
Strategy 3-2-2: Develop and distribute education and outreach tools to improve and highlight the relationship between improved public health, wellness, and other values supported through urban and community forestry, and green infrastructure

Performance Measure 3-2-2: Number of tools developed and distributed, and number of people reached with educational tools
Contributing Programs: NDF Urban and Community Forestry, Health Care Institutions and Providers
Goal 3-3: Improve urban and community forest management, maintenance, and stewardship
Strategy 3-3-1: Support tree workers, arborists, and landscape industry workers through workshop sponsorships and technical instruction
Performance Measure 3-3-1: Number of workshops sponsored; Number of tree care professionals educated; Number of seat-hours of instruction
Contributing Programs: NDF Urban and Community Forestry Program, International Society of Arboriculture, Nevada Landscape Association, Desert Green, Nevada Shade Tree Council
Strategy 3-3-2: Work with partners in Urban and Community Forestry to develop and encourage engagement with comprehensive programs, policies, and resources for enhancing urban forestry stewardship (e. g. Encourage Tree City, Campus, Line, or Campus Health Care USA recognition)
Performance Measure 3-3-2: Number of entities enrolled, and percent of urban and community forests covered under Tree USA programs
Contributing Programs: NDF Urban and Community Forestry Program, International Society of Arboriculture
Strategy 3-3-3: Increase the number of ISA Certified Arborists, ISA certified Tree Worker Climber Specialists and ISA certified Tree Worker Aerial Lift Specialists
Performance Measure 3-3-3: Number and kind of ISA Certified Workers in Nevada
Contributing Programs: NDF Urban and Community Forestry Program, International Society of Arboriculture;
Strategy 3-3-4: Create and distribute tree selection, planting, and tree care resources
Performance Measure 3-3-4: Develop and provide education materials for distribution
Contributing Programs: NDF Urban and Community Forestry, Local Urban Forestry Programs, Local tree care professionals, nurseries, and retailers that provide technical guidance on species palettes, care strategies, values and benefits.
Strategy 3-3-5: Encourage and participate in local Urban and Community Forestry assessment and management planning efforts

Performance Measure 3-3-5: Percent of urban and community forests with updated assessments and management plans
Contributing Programs: NDF Urban and Community Forestry, Local Urban Forestry Programs and Tree Boards, Conservation Districts
Strategy 3-3-6: Develop comprehensive, statewide data sets (LiDAR, multi-spectral imagery) for use by partners for canopy analysis and tree inventories.
Performance Measure 3-3-6: Percent of urban and community forests with data coverage; Available viewing and download portals for stakeholder use
Contributing Programs: NDF Urban and Community Forestry, Federal, State and Local GIS Programs, Local Urban Forestry Programs
Strategy 3-3-7: Encourage and support Urban and Community Inventories and iTree Report production in all communities in Nevada
Performance Measure 3-3-7: Number of presentations made and Percent of urban and community forests that develop inventories and reports
Contributing Programs: NDF Urban and Community Forestry, Local Urban Forestry Programs
Goal 3-4: Diversify, leverage, and increase funding for Urban and Community Forestry activities
Strategy 3-4-1: Provide annual briefings to partners and stakeholders on the progress and value of urban and community forestry and opprtunities to invest with a purpose
Performance Measure 3-4-1: Number of briefings held resulting in new or continued financial contributors and contributions
Contributing Programs: NDF Urban and Community Forestry, Charitable Foundations, Community Business and Industry Groups
Strategy 3-4-2: Determine and communicate the value of urban forest products and services to inform decisions and investments in urban and community forests (e. g. iTree reports)
Performance Measure 3-4-2: Number of urban and community forests with inventories and iTree Reports produced
Contributing Programs: NDF Urban and Community Forestry, Local Urban and Community Forestry Programs
Strategy 3-4-3: Develop and connect to urban wood utilization programs for timber products, chipping and biomass

Performance Measure 3-4-3: Number of products with value identified; Amount of materials utilized; Value of utilized materials to economy
Contributing Programs: NDF Urban and Community Forestry, Nevada Network of Fire Adapted Communities, NDF Biomass Utilization, Local Tree Companies, Local Landfills
Strategy 3-4-4: Seek additional Urban and Community Forestry program funding through public and private partnerships and connections with related departments or programs at the federal, state and local levels.
Performance Measure 3-4-4: Total amount of external funding invested annually into Urban and Community Forestry Programs and activities
Contributing Programs: NDF Urban and Community Forestry, Nevada Network of Fire Adapted Communities, NDF Biomass Utilization, Local Urban Forest Departments, Conservation Districts
Goal 3-5: Increase public awareness and environmental education to promote urban and community forest stewardship
Strategy 3-5-1: Strengthen environmental education programs that focus on urban and community forestry through outreach materials highlighting the benefits of trees
Performance Measure 3-5-1: Number of outreach materials developed and number of people impacted through delivery of outreach
Contributing Programs: NDF Urban and Community Forestry, NDF Conservation Education, Local Urban Forestry Programs, Project Learning Tree
Strategy 3-5-2: Create and distribute tree selection, planting, and tree care resources
Performance Measure 3-5-2: Develop and provide education materials for distribution
Contributing Programs: NDF Urban and Community Forestry, Local Urban Forestry Programs, Local tree care professionals, nurseries, and retailers that provide technical guidance on species palettes, care strategies, values and benefits.
Strategy 3-5-3: Increase outreach and educational opportunities for underserved communities to increase urban forestry stewardship
Performance Measure 3-5-3: Percent of underserved communities served annually
Contributing Programs: NDF Urban and Community Forestry, Local Urban Forestry Programs, Tribes

#4 – Riparian-Wetland Systems

Overview

Riparian ecosystems are some of the rarest systems in Nevada (one percent of land area) yet they are some of the most productive and therefore important habitats in Nevada. Functioning riparian systems provide habitat and improve water quality through erosion control, buffering the impacts of flooding, and filtering pollutants in water bodies. Humans and wildlife alike are dependent on the health and availability of these systems as a direct water source. Nevada's economy is dependent upon available, clean water for human consumption, industrial processing, and agricultural production. Additionally, the recreation and tourism industry largely depend upon these systems to provide appealing environments for human and wildlife use. Reduction in water quantity due to poor management practices or changes in climate and weather may threaten those industries by making lands less productive and water costs exceedingly high.

Climate Change Influence

Impacts of climate change on riparian systems will be largely dependent on water quantity associated with snowpack throughout watersheds in upper elevations and latitudes, timing of precipitation, and the quantity of precipitation. Greater frequencies of extreme weather events could result in flooding that may benefit riparian systems by reintroducing some of the historic stochasticity in flows that was common before water systems were controlled. Unpredictable water flows could potentially mediate some of the increased channelization. Conversely, more prolonged droughts, as some models predict, will be catastrophic in smaller systems. Additionally, with warmer winter temperatures, earlier snowmelt may result in consistently lower flows throughout late spring and summer, which may be catastrophic to the vegetation by disrupting the phenological relationships of plants and animals. Agricultural producers would also be negatively impacted, forcing many out of business.

Plant and Animal Habitats Under Pressure

Riparian corridors are essential hosts for a wide variety of species. Degradation of riparian environments results in a loss of host tree species for many birds and insects, a loss of rare vertical structure across the landscape for species habitat, and water quality reductions associated with the loss of cover affecting a wide variety of aquatic species. Given the limited water resources in Nevada, and the relative isolation from one another compared to many other regions of the country, riparian and aquatic environments have a high rate of unique and endemic plant and animal species. Many species are dependent on unique geophysical or chemical characteristics of their environment, and the heterogeneous vertical vegetative structure is often a crucial component and one that is lost at many degraded sites.

Land Ownership and Fragmentation

Riparian corridors are linear in nature, and effects of upstream management is cumulative. Individual landowners may be able to take actions to manage water quantity, residency, and vegetation managed onsite, but all are affected by upstream activities. Upstream activities that may negatively affect the riparian health of downstream neighbors include inputs to water quality such as chemical inputs from runoff, livestock pollution, excessive erosion increasing sedimentation and reducing water clarity, and the introduction of weed species from lack of management upstream. Channelization on upstream lands may result in greater flooding risks downstream. In the past several years, communities have shifted focus to coordinated management, and we are seeing more examples of neighbors—private and federal—working together to coordinate goals and planning for improving the health of riparian systems on which so many depend.

Invasive Weeds

In the warm and hot desert environments, saltcedar significantly reduces water quality and quantity, outcompetes native plant species, often forming a dense monoculture, and drastically changes the vegetative structure of invaded areas changing wildlife use opportunities. Additionally, the heavy fuel loads presented within highly flammable saltcedar stands cause extreme fire behavior, often resulting in mortality of many native species during wildfire events. Saltcedar may be the most prominent invader, but other species commonly invade riparian habitats and may form dense thickets. These include overstory dominants, like Russian olive, and a wide variety of understory non-native invasive grasses, and forbs like perennial pepperweed, Russian thistle, halogeton, and a variety of thistles.

Primary Factors Affecting Riparian and Wetland System Health and Function:

Some of the primary factors that affect riparian-wetland function include use and management of water onsite, intensive recreation activities, grazing and overuse (predominantly by livestock and horses), water policy and allocated use, and land management practices including forest or vegetation management directly adjacent to watercourses. Impacts may be direct changes to watercourse structure (evidence by erosion and excessive trampling of streambanks or riparian vegetation, removal of stabilizing vegetation) and water quality degradation due to pollutants such as excessive nutrient input from agricultural activities, or pollutant laden runoff from urban surfaces. Riparian systems are sensitive yet resilient. Deforestation in naturally forested areas can be catastrophic to stream and riparian health. State laws mandating appropriate forestry practices exist for that very reason. Excessive control of water flows restricting natural flooding regimes along with poor land management resulting in erosion are factors that increase gullying which leads to the narrowing of the riparian channel, drop in groundwater, and loss of riparian structure and function. However, in many cases low-tech techniques may be used to improve riparian health, and ecosystem recovery and regeneration of desirable plants is relatively easy to achieve due to the ample resources found in the wet sites of a dry state.

Values at Risk from the decline of Riparian Wetland function:

Value	Issues and Impacts
Human Health and Welfare	• Recreation opportunities are highly correlated with access to shade and the aesthetic appeal of riparian forests • Communities are often located in areas with riparian resources because of their benefits to humans, including temperature buffering, recreation, water use and consumption, etc. • Recreation opportunities including fishing, boating (motorized and non-motorized), walking and hiking, and other public open space recreational resources provide many mental and physical health benefits • Recreational resources centered around riparian habitats on public and private lands facilitate community interactions
Wildlife Resources and Habitats	• Habitat for riparian dependent wildlife species (direct habitat for keystone species and endangered birds and fish; and riparian and wetland communities provide forage and habitat for ungulates and other mammals) • Enhanced productivity in riparian areas provide a diversity of food sources not readily available outside of the riparian zone • Forest cover along streams essential to maintain water quality and temperatures that are important to breeding environments for fish and amphibians
Local Economies	• Agricultural and ranching operations depend on functioning riparian systems for water table management, forage growth, and water supplies for livestock watering • Communities rely on riparian systems to supply drinking water, flood control, open space access to support tourism industries, and ancillary businesses • Rural recreation opportunities such as hunting, camping, fishing and hiking are a prominent business in Nevada and are dependent on healthy wildlife populations and habitats
Infrastructure	• Manmade resources are at risk when built near riparian systems that do not function effectively to absorb excessive runoff and flooding
Water Quality and Quantity	• Water sources for cities and towns across much of the state originate in high elevation forests, therefore watershed level protections benefit Nevada's population • Maintaining or restoring natural river systems and channel types (e. g. entrenchment ratios, slope, sinuosity, channel material, etc.) can increase hydrologic connection with floodplains and raise water tables that will expand or better irrigate riparian habitats

Value	Issues and Impacts
Unique Ecosystems	• Riparian dependent tree species like aspen, cottonwood, willows, and water birch are ecologically and culturally important and are typically found near water sources • Adverse effects from changes in water quantity, river and stream management, and displacement by invasive species (primarily saltcedar and Russian olive) which are ecologically damaging and magnify the wildfire risk to these sensitive systems

Challenges posed by the Conservation of Riparian-Wetland Systems

- Stream and river degradation throughout the state has resulted in the decline of riparian tree gallery stands leading to high decadence and low regeneration rates.

- The abundance and vigor of Nevada's riparian forests (especially those at low elevations) are declining and concurrently face conversion by exotic, invasive plant species. Invasion by species such as saltcedar and Russian olive is nearly ubiquitous along warm desert rivers (across public and private land). The enormous cost in both monetary and human resources necessary to battle the problem appears insurmountable.

- The linear corridors created by riparian systems cross many different land ownership categories and are influenced by management decisions throughout their watershed; therefore, effective riparian system management should involve stakeholders across the ownership categories.

- Wildfires that denude vegetation in watersheds result in degradation of stream channels (channelization and water quality implications) from post-fire erosion with rain events. Effective site stabilization and rehabilitation of these systems and adjacent uplands is imperative to speed recovery rates and reestablish functions.

- Riparian corridors have narrowed through the decades from water management efforts controlling the timing and amount of flows through channelization, land management practices facilitating gullying, and invasive species artificially stabilizing streambanks. The reduction in volume of tall trees and diverse plant communities (grasses, forbs, and shrubs) as the riparian corridor narrows reduces available habitat for wildlife and the effectiveness of ecosystem services typically associated with riparian corridors like water quality improvements through filtration, aesthetic and recreational enhancement, storage of organic matter and nutrients, and water temperature moderation.

- Uncertainty associated with climate change (regarding water quantity and timing of precipitation events) makes future planning difficult in sensitive systems. Additionally, while the linear features of streams and rivers allow for genetic flow of species along corridors, isolated springs and wetlands are isolated from species or genotypes of species that may be better adapted and more resilient to changing climate conditions.

- Nonpoint source pollution, pollution from diffuse human sources transported into waterways through runoff from rain events and snowmelt, is the leading cause of water quality degradation to Nevada's waterways, negatively impacting riparian and wetland health.

Opportunities and Strategies for Impacting Riparian and Wetland Systems

Goal 4-1: Improve the health of wetland plant communities through outreach and education
Strategy 4-1-1: Educate landowners about techniques to maintain healthy and functioning watersheds and waterways through the development and dissemination of best management practices for Nevada
Performance Measure 4-1-1: Number of education materials produced and disseminated; Number of landowners educated and/or provided technical assistance
Contributing Programs: NDF Resources Program, NDF Conservation Education, Conservation Districts, NDF Stewardship, County Natural Resources Programs, NRCS
Goal 4-2: Implement conservation and preservation practices through partnerships to improve riparian function
Strategy 4-2-1: Protect and enhance water quality, protect fish and wildlife habitat, maintain habitat connectivity by implementing management and restoration practices
Performance Measure 4-2-1: Number of projects planned; Percent of planned projects implemented; Number of conservation easements protecting riparian areas
Contributing Programs: NDF resource management, USFS, NRCS, Conservation Districts, USFWS
Strategy 4-2-2: Partner with and provide outreach to landowners and land users to promote sustainable land management practices that sustain healthy vegetation communities which are more resilient to problematic erosion and gullying
Performance Measure 4-2-2: Number of outreach materials developed, and events participated in; Number of landowners and users adopting suggested practices
Contributing Programs: BLM Range and Wildlife, Society for Range Management, Conservation Districts, NRCS, NDF resource management, USFS Range and Wildlife
Strategy 4-2-3: Facilitate public-private partnerships to prioritize and implement management strategies along riparian corridors that cross multiple landownership categories

Performance Measure 4-2-3: Number of project areas identified; Percent of project areas with engaged collaborative stakeholder groups
Contributing Programs: Conservation Districts, BLM, USFS, Private Landowners, NDF resource managers, NGO Conservation Organizations (e. g. The Nature Conservancy)
Goal 4-3: Use science-based strategies to improve riparian ecosystem function and expand riparian habitat through active project implementation
Strategy 4-3-1: Implement strategies to reduce invasive species establishment in riparian corridors and remove existing populations
Performance Measure 4-3-1: Number of invasive species reduction projects with riparian systems; Invasive species management projects implemented with success determination
Contributing Programs: Conservation Districts, BLM, USFS, Private Landowners, NDF resource managers, NGO Conservation Organizations (e. g. The Nature Conservancy, Cooperative Weed Management Areas
Strategy 4-3-2: Implement Early Detection Rapid Response (EDRR) actions, monitoring, and active EDRR education for landowners and communities.
Performance Measure 4-3-2: Number of EDRR sites engaged; Percent of EDRR sites successfully eradicated; Number of landowners educated
Contributing Programs: NRCS, CDs, CWMAs, local weed control entities
Strategy 4-3-3: Reconnect waterbodies with floodplains and implement practices to raise water tables where decreases result from land management practices or environmental degradation
Performance Measure 4-3-3: Number of restoration projects implemented and sustained
Contributing Programs: Conservation Districts, NRCS, Society for Range Management, "collaborative conservation" advocates like Intermountain West Joint Venture
Strategy 4-3-4: Re-establish native tree and other vegetation canopies along riparian corridors to restore effective riparian ecosystem functions
Performance Measure 4-3-4: Number of rehabilitation projects implemented and sustained
Contributing Programs: Conservation Districts, NRCS, Society for Range Management, "collaborative conservation" advocates like Intermountain West Joint Venture
Strategy 4-3-5: Support improvement of riparian health in urban and community settings.

Performance Measure 4-3-5: Number of landowner technical assistances or consultations performed; Percent of assists with recommendations implemented
Contributing Programs: NDF Natural Resources, Conservation Districts, Local Gov't, USFS, Arborist organizations, NDF Urban and Community Forestry
Strategy 4-3-6: Reduce abundance of encroaching conifers in riparian areas to increase groundwater availability along riparian zones and reduce loss of deciduous riparian species
Performance Measure 4-3-6: Number of restoration and management projects completed
Contributing Programs: Conservation Districts, Federal land managers, NRCS, Wildlife advocacy groups, NDF resource management
Goal 4-4: Improve the resiliency of riparian systems to wildfires and climate change
Strategy 4-4-1: Implement wildfire prevention activities in watersheds to sustain watershed functions and avoidance of catastrophic wildfire and post-fire erosion events
Performance Measure 4-4-1: Percent of watersheds with vegetation/fuels management plans; Percent of planned treatments implemented
Contributing Programs: NDF Fire and Natural Resources, NDF Forest Health, USFS, BLM, Conservation Districts, Local Water Purveyors
Strategy 4-4-2: Implement post-wildfire soil-stabilization and habitat restoration activities to improve vegetation recovery rates and reduce detrimental impacts to riparian systems
Performance Measure 4-4-2: Number of fire-impacted acres with soil-stabilization treatment needs; Percent of fire-impacted acres with soil stabilization treatments implemented
Contributing Programs: NDF resource management, local stakeholders
Strategy 4-4-3: Implement riparian health projects utilizing plant materials and techniques relevant for future climate projections
Performance Measure 4-4-3: Availability of plant palettes, seed sources, and plant materials specified for regional climate change resiliency; Vegetation treatment plans address climate change resiliency
Contributing Programs: NDF resource management, local landowners, Conservation Districts
Strategy 4-4-4: When possible, continue monitoring and reporting on riparian improvement efforts following established protocols and collaborate with partners to allow further evaluation of changes in vegetation communities resulting from a changing climate

Performance Measure 4-4-4: Number of project areas being monitored; Number of monitoring efforts per area; Data submissions to partners/databases compiling data; Use of established protocols
Contributing Programs: NDF resource management, USFS, BLM, USFWS

#5 – Sagebrush Ecosystems

Overview

Declines of sagebrush habitat in the millions of acres within Nevada from the vicious wildfire-cheatgrass cycle along with greater sage-grouse (GRSG) population declines have led to tremendous attention and effort to restore and protect sagebrush ecosystems at the local, state, and federal levels. Nevada Assembly Bill (AB) No. 461 (2013) recognized that restoration and maintenance of the sagebrush ecosystem is essential to wildlife, watersheds, biodiversity, and productivity in Nevada. Nevada Revised Statute (NRS) 321.592 created the Sagebrush Ecosystem Program (SEP) to establish and carry out activities to preserve, restore, and enhance sagebrush ecosystems on public and privately-owned land (with owner consent) across the state.

Figure 45. NDF fire crew installing a sagebrush carcass cache to create sagebrush establishment islands as part of an Emergency Stabilization & Rehabilitation of the Ibapah Fire on the Goshute Reservation.

Climate Change Influence

Some of the issues in the sagebrush ecosystem are already apparent as a result of climate change and others will become increasingly more prevalent. Main threats to the ecosystem relate to wildfire and cheatgrass. They include:

- Extended fire seasons through climatic factors and increased abundance of early curing cheatgrass
- Warmer nights during fire season and increasingly dangerous moisture and weather conditions
- Increased exhaustion for firefighters as extreme conditions increase
- Reduced persistence of snowpack, increased flashiness of runoff and soil moistures, and likely increased erosion
- Increasing boom/bust precipitation cycles which impact fuel loads and post-fire restoration success
- Increased soil temperature regimes especially in areas with cheatgrass present as well as in other areas that will increasingly favor cheatgrass
- Reduced spring precipitation that is less ideal for perennial grasses or fuel moistures
- Reduced carbon sequestration when conversion occurs from sagebrush to cheatgrass monoculture
- Increased aridity/temperatures pose significant challenges to restoration efforts

Plant and Animal Habitats Under Pressure

Sagebrush ecosystems and sage-grouse habitats continue to be under pressure from: wildfire and invasive grasses, exponentially increasing wild horse populations, and to a lesser degree, pinyon-juniper encroachment. Pinyon-juniper treatments in areas of encroachment are being implemented at continually greater scales in the state. Nevada's new Conservation Credit System is meant to reduce the impacts of anthropogenic disturbances over time by increasing the consistency and durability of compensatory mitigation requirements. However, despite much attention and effort, the vicious cycle of wildfire and increasingly more abundant cheatgrass continues to be an issue impacting habitats at increasingly large scales.

Land Ownership and Fragmentation

Land ownership is predominantly Federal with BLM typically managing greater amounts of lower and moderate elevation lands and the USFS managing some of the higher elevation lands. Outside of the checkerboard along the Interstate 80 corridor, privately owned lands often center around the mesic resources that were historically homesteaded and are surrounded by the public lands on which they are permitted to graze.

Invasive Weeds

Cheatgrass, a readily ignitable and often continuous fuel load, continues to grow in distribution and dominance in much of the state. Where ignition sources exist, more cheatgrass leads to more wildfire, and with cheatgrass proliferating post-fire, more wildfire leads to more cheatgrass. Areas with abundant perennial grasses are more resistant to its invasion and resilient in their recovery from low intensity fires, but many areas are depleted of perennial grasses and higher intensity wildfire can lead to losses of perennial grasses and native seedbanks. Recent research suggests grazing cheatgrass consistently in the fall can reduce the cheatgrass seedbank and leave conditions less favorable for seedlings (Perryman et al. 2020). Efforts are also planned to explore targeted grazing with the primary goal of reducing invasive grasses that increase fine fuels on BLM lands within the Great Basin (BLM 2020). Medusahead grass, a more recent arrival in the Great Basin, is less studied. However, it could be an even greater threat as it is speculated that it similarly leads to a wildfire cycle and cannot be grazed due to its high silica content.

Primary Factors Affecting Sagebrush Ecosystem Health and Function:

- Increasingly frequent, larger, and higher intensity wildfires
- Further loss of intact sagebrush communities and perennial grasses on the landscape
- Insufficient pre-suppression and restoration efforts that allow cheatgrass/wildfire cycle to perpetuate and grow

- Climate changes that cause increasing temperatures and aridity and shifts in community composition or site potentials to support sagebrush and bunchgrass communities
- More widespread and dominant cheatgrass monocultures
- Greater effort and costs expended on areas repeatedly burned with less ability for proactive efforts
- Exponentially increasing horse populations

Values at Risk in the Sagebrush Ecosystem

Value	Impact
Aesthetic Values	• Aesthetic values will ultimately be reduced with wildfire and post-wildfire habitat conversion
Recreation	• Reduction of habitat for big game species including pronghorn antelope, bighorn sheep, mule deer, and elk from wildfire and post-wildfire habitat conversion. • Loss of perennial fisheries when watersheds release water more quickly.
Ecosystem Services	• Conversion of sagebrush lands from wildfire to cheatgrass leads to reduced carbon sequestration in the Great Basin • Wildfire-cheatgrass cycles perpetuate increased levels of greenhouse gas emissions. • Watersheds release water at a more uncontrolled rate, increasing erosive processes, decreasing water quality, and changing timing and volumes of useable surface water resources
Economic Values	• Economic values are most likely to be impacted in the livestock and ranching industries, public utility industries, but potentially alfalfa farming, mining, outdoor recreation, tourism, and many others. These industries make up a significant portion of Nevada's economy.
Livestock Industry/ Ranching Heritage	• Loss of livestock or livestock carrying capacity • Reduction in forage values and productivity • Loss of range improvements and other infrastructure • Potentially inordinate post-fire management costs
Rural Communities	• Potential loss of utility of local lands, recreation and hunting opportunities, aesthetics, infrastructure, etc. with wildfire, post-habitat conversion, amplified wildfire risk, etc. • More difficulty in maintaining roads and public works post-wildfire

Value	Impact
Travel & Tourism	• Abundant roadside fires along the I-80 corridor and fires potentially elsewhere leading to increased negative media attention and negative experiences during Nevada travel
Utilities	• Loss of infrastructure from wildfires could significantly increase operational costs within rural Nevada for utilities to transmit and distribute power
Wildlife Habitat/ Biodiversity	• Reduction of sagebrush, perennial grass, and forb communities that are habitat for Greater Sage-grouse and other species from wildfire and post-wildfire habitat conversion • Potential loss of Lahontan cutthroat trout in some areas affected by wildfire. • Numerous other animal species as well as plant species impacted.

Challenges Posed by Non-Resilient Sagebrush Ecosystems

- Increasingly larger and more intense wildfires despite greater suppression resources and considerable effort
- Greater restoration needs with larger footprints add pressure to the already insufficient limited resources
- Restoration failures are common due to insufficient precipitation and rigid programs that fail to recognize restoration often takes years of partial successes strung together to achieve eventual success
- Seed availability is an issue
- When restoration fails and cheatgrass becomes more dominant after increasingly larger and more intense fires, larger fires often follow with more cheatgrass establishment and more wildfires
- Unsuccessful restoration due to inadequate funding is not yet recognized as a pathway to increasingly larger and more intense wildfires with even greater cost expenditures
- Most fires continue to be ignited by people; many of these situations are preventable through education and more prepared citizens
- Pre-suppression actions have yet to gain the momentum required especially outside of WUI areas due to the reactive nature of funding that focuses on the emergency response aspect of wildfire rather than pre-suppression efforts. Greater efforts aimed at fuel breaks, like that associated with Nevada BLM's fuel break EIS would

demonstrate the recognition that pre-suppression actions can reduce wildfire damage and overall costs to society.

- Pre-suppression and restoration actions have yet to be consistently successful at a massive scale due to a small workforce
- Perennial grasses are the key to resist invasive annual grasses and resilience after wildfire; changes in management strategies have not increased their presence where depleted whether in shrub states or cheatgrass-dominated areas
- Sagebrush is difficult to establish and requires many years to mature without fire; restoring historical fire regimes is a necessary part of any successful restoration effort
- Due to inadequate population management, dramatically increasing Wild Horse and Burro (WHB) populations are a tremendous ecosystem threat, especially in areas lacking resistance and resilience
- Wildfire exacerbates competition for forage among livestock, wildlife, and WHB
- Expanding pinyon-juniper remains an issue; recent efforts to address it have increased but more is needed
- Erosion is an issue post-fire and in degraded states
- Flashiness of post-fire watershed runoff results in damage to property and infrastructure
- These and other rangelands have historically been managed with low intensity. A greater recognition of the value of these lands, the costs and scale of their loss, and the need for increasingly focused, prioritized and extensive investments for their management is necessary.

Opportunities and Strategies for Agency and Cooperator Impact on Sagebrush Ecosystems

Goal 5-1: Improve wildfire prevention and suppression response and effectiveness within sagebrush ecosystems
Strategy 5-1-1: Continue and enhance efforts to suppress wildfire (e. g. collectively identify and fill geographic gaps in suppression capacity)
Performance Measure 5-1-1: Percent of initial attack success; Total acres burned in sagebrush ecosystems

Contributing Programs: Federal, State and Local Fire Programs and Protection Districts, Sagebrush Ecosystem Technical Team, Volunteer Fire Departments, Rangeland Fire Protection Associations
Strategy 5-1-2: Implement wildfire prevention and fuel reduction techniques in key locations to protect intact sagebrush ecosystems and areas with restoration treatment investments
Performance Measure 5-1-2: Percent of planned prevention and fuel reduction projects implemented.
Contributing Programs: Federal, State and Local Fire Programs and Protection Districts, Sagebrush Ecosystem Technical Team, Volunteer Fire Departments, Rangeland Fire Protection Associations, USFS, USFWS, and BLM ES&R, Rangeland Management, Fuels, Wildlife, Tribal Environmental, Sagebrush Ecosystem Program, NRCS-EQIP (Environmental Quality Incentives Program), Seeds of Success, Nevada Native Seed Strategy, NDF Operations, NDF State Nursery and Seedbank, Conservation Districts Program
Goal 5-2: Improve sagebrush ecosystems by increasing site resistance and resilience
Strategy 5-2-1: Maximize the implementation of restoration, rehabilitation, and other management projects that preserve and improve the resistance and resilience of sagebrush ecosystem lands
Performance Measure 5-2-1: Acres treated successfully within sagebrush ecosystems
Contributing Programs: USFS, USFWS, and BLM ES&R, Rangeland Management, Fuels, Wildlife, Tribal Environmental, Sagebrush Ecosystem Program, NRCS-EQIP (Environmental Quality Incentives Program), Seeds of Success, Nevada Native Seed Strategy, NDF Resources and Camps, NDF State Nursery and Seedbank, BLM Seed Warehouse, Conservation Districts Program, Nevada Department of Agriculture (NDA)
Strategy 5-2-2: Educate landowners and land managers on actions they can take and the availability of opportunities for assistance through Federal, State and NGO supported programs
Performance Measure 5-2-2: List of available supporting programs and contacts publicly available; Number of education events hosted; Number of people educated
Contributing Programs: UNR Cooperative Extension, NRCS PR/PIO (Public Relations/Public Information Officer), Nevada DCNR PIO, NDF Resources, Sagebrush Ecosystem Program, Conservation Districts Program, NDA, Pheasants Forever,
Goal 5-3: Educate the public as well as decision and policy makers on the importance and value of sagebrush ecosystems, the importance of successful pre-suppression and restoration actions, the wildfire-cheatgrass cycle, wildfire prevention, wildfire in general, livestock grazing as a potential management tool, and the critical need to find a reasonable pathway for wild horse populations to be reduced and maintained at Appropriate Management Levels (AML)
Strategy 5-3-1: Create unified messages and educational materials about these subjects in various distributable, consumable and understandable formats
Performance Measure 5-3-1. Number of unified messages and marketing products produced and used

Contributing Programs: USFS, BLM, USFWS, Tribes, NDF, DCNR, NRCS, Conservation Districts, NDOW sagebrush ecosystem experts and PIOs.
Strategy 5-3-2: Distribute, inform and educate the public and public officials using unified educational materials and messages produced
Performance Measure 5-3-2: Number of people engaged through media outreach; Number of key public officials briefed
Contributing Programs: Governor's Office, Legislature, Sagebrush Ecosystem Program, Federal, State and Local PIOs and Natural Resource Specialists, Local Environmental/Natural Resource Departments

#6 – Species Requiring Specialized Conservation

Overview

Nevada is among the top 10 states in the nation for both the diversity and the vulnerability of its biological heritage. The highly variable environments and many isolated mountain ranges, valleys, and unique landforms result in large numbers of unique species found nowhere else on earth. Maintaining the State's rich biodiversity is a challenge as the State's population grows and land-use pressures multiply. With early planning and responsible development, economic growth and our biological resources can coexist. Federal and state policies dictate protections for species at risk of extinction, and land managers coordinate to prevent further decline of at-risk species and the habitats they depend on. Various state-listed species are protected by Nevada Revised Statutes (NRS) and Administrative Codes (NAC), including: NRS 501/NAC 503 for wildlife, and NRS 527 for plants. Because the Nevada Department of Wildlife's Statewide *Wildlife Action Plan* details wildlife species requiring specialized conservation, the focus of this section is mostly on plants requiring specialized conservation efforts. Wildlife species and their habitats are, however, considered when it comes to prioritizing landscapes later in the document.

Since most plants do not migrate as readily as many animal species, they often become adapted to their specific local habitats, making them more vulnerable to short-term disturbances, fires, or rapid climate changes. When their habitat "islands" remain isolated long enough, they often diverge genetically into separate "endemic" species. About 150 such endemic plant species are unique to Nevada, growing here and nowhere else.

Two hundred eighty-five native Nevada plants, including most of our endemics, are considered vulnerable enough to extinction to be of conservation concern to the Nevada Division of Natural Heritage (NDNH 2020). Nine of these are already on the federal lists of endangered and threatened species, and 15 more are considered in danger of extinction in Nevada and have been placed on the state's list of fully protected species by the Nevada State Forester. The threats to these 15 are discussed in more detail in the following subsections.

Climate Change Influences

Plant species are vulnerable in Nevada to population declines, extirpations, or even extinction, due to narrow habitat niches or geographic isolation. When a plant population cannot respond rapidly enough to adverse pressures imposed by climate change, it may be out competed by species that can. A common example is a localized plant population limited in its upward mobility to higher, cooler and moister elevations. This might be due to one or a combination of factors: 1) already being at or near the highest elevation on a mountain range, 2) incompatible habitat to migrate to above its present habitat and 3) the population being overwhelmed by competition from lower (and sometimes higher) elevation species. For plants that are geographically isolated, they may lack effective dispersal mechanisms to colonize similar, but distant habitats. In another case, with the Las Vegas bearpoppy (*Arctomecon californica*) there is no higher elevation habitat to migrate to, because it requires soils with gypsum. Gypsum is found on sedimentary soils, laid down from ancient seas. Las Vegas bearpoppy is dependent on specific species of bees for pollination. The bees, which are presently under review as federally protected invertebrate species, may also be vulnerable to climate change. This illustrates the importance of studying other plants and their pollinators. The pollinators may require specific nectar plants or larval host plants, which may prove to be sensitive species.

Plant populations may also die out due to the various effects of prolonged droughts, with durations longer than Nevada's native flora has evolved under. Annual rainfall has become more cyclical, with more extended years of drought less frequently punctuated by years of high rainfall. Higher temperatures in winter limit the recharge of soil moisture. Higher temperatures in spring deplete soil moisture faster, which favors annual plants over perennial ones leading to extended fire seasons. Higher temperatures in summer can increase lightning strikes on dry vegetation, leading to more frequent and reoccurring wildfires. Some of the annuals replacing native perennials are invasive, as discussed below.

The Nevada Division of Natural Heritage (2020) applied the Climate Change Vulnerability Index (NatureServe 2020a) to identify and quantify the threats to plants and animals susceptible to climate change. Four plants are considered Extremely Vulnerable, meaning that "their abundance and/or range extent within Nevada makes them extremely likely to substantially decrease or disappear by 2050." These are: Goose Creek milkvetch, Ophir rockcress, gray wavewing and Rollins clover. Six plants are listed as Highly Vulnerable, meaning that their "abundance and/or range extent within Nevada is likely to decrease significantly by 2050." Fourteen plants are listed as Moderately Vulnerable, meaning that their "abundance and/or range extent within Nevada is assessed as likely to decrease by 2050". Despite the direct threat of climate change to their survival in the wild, only one of these 24 vulnerable plants have been listed to date as threatened or endangered by a state or federal agency. That plant is the Sunnyside green gentian, a Highly Vulnerable species listed as Critically Endangered by the state of Nevada.

Plant and Animal Habitats Under Pressure

Nevada critically endangered plant species are typically in more restricted and specialized habitats than those animal and invertebrate habitats identified as "Focal Areas" in the *Nevada Wildlife Action Plan*. That said, there is appreciable overlap between areas identified as having the highest plant biodiversity and broader "Wildlife Focal Areas" (see map in Appendix A).

Ash Springs National Wildlife Refuge is an outstanding example of a diverse wetland complex supporting many state and federal protected plant species. Elsewhere, isolated wetland habitats, especially vernal pools and hot springs, are not adequately protected in Nevada to ensure the perpetuation of their unique plant biodiversity. For example, Monte Neva paintbrush (*Castilleja salsuginosa*) is found on damp, open, alkaline to saline clay soils of hummocks and drainages on travertine hot-spring mounds in unprotected areas near Sunnyside, Nevada. Webber ivesia (*Ivesia webberi*) occupies shallow shrink-swell clay soils with a gravelly surface layer over volcanic bedrock, such as on Peavine Mountain near Reno. Williams combleaf (*Polyctenium williamsiae*) is also associated with ephemeral wetlands, occupying relatively barren sandy to sandy-clay or mud margins and bottoms of non-alkaline seasonal lakes perched over volcanic bedrock. Spring-loving centaury (*Centaurium namophilum*) occupies open, moist to wet, alkali-crusted clay soils of seeps, springs, outflow drainages, meadows, and hummocks. Wetland habitats include the perimeter of desert wetlands, on hard, seasonally moist, white, barren flats, washes, and knolls of calcareous alkaline soils. This is the habitat for Ash Meadows milkvetch (*Astragalus phoenix*), Ash Meadows sunray (*Enceliopsis nudicaulis* var. *corrugata*), Ash Meadows gumplant (*Grindelia fraxinopratensis*), Ash Meadows mousetails (*Ivesia kingii* var. *eremica*), and Ash Meadows blazing star (*Mentzelia leucophylla*).

Some Nevada critically endangered plant species primarily, if not exclusively, occupy unusual or spatially limited geological substrates. Two Nevada critically endangered plant species are found in the Mojave Desert in sand dunes, or in deep, sandy soils of the North American warm desert active and stabilized dune ecological system. These are threecorner milkvetch (*Astragalus geyeri* var. *triquetrus*) and sticky buckwheat (*Eriogonum viscidulum*). Las Vegas bearpoppy is an example of a gypsum obligate species found within the Intermountain Basins shale badland ecological system. Others, like Blue Diamond cholla (*Cylindropuntia multigeniculata*), are downslope from mineable gypsum deposits. Churchill Narrows buckwheat (*Eriogonum diatomaceum*) is specifically found in diatomaceous deposits of the Coal Valley Formation. Tahoe yellowcress (*Rorippa subumbellata*) is endemic to the shore zone of Lake Tahoe, where it occupies coarse sand and sandy soils of active beaches, stream inlets, beach dunes, and backshore depressions, generally within a few feet of the local water table.

Even critically endangered species in commonplace habitats can be highly localized and threatened with extinction. Sunnyside green gentian (*Frasera gypsicola*) is subject to grazing on open, dry, whitish, alkaline, often salt-crusted and spongy silty-clay soils on calcareous flats and barrens, in sagebrush/cushion-plant associations. Ute lady's tresses (*Spiranthes diluvialis*) is an orchid with characteristically small populations, in moist to very wet, somewhat alkaline or calcareous native meadows near streams, springs, seeps, lake shores, or in abandoned stream meanders. Obscure scorpionflower (*Phacelia inconspicua*) occurs in mountain big sagebrush, but on relatively deep, undisturbed, organic-rich soils on fairly steep, concave, N- to NE-facing slopes where snow drifts persist well into spring, on small, otherwise barren soil terraces in small shrub clearings. Amargosa niterwort (*Nitrophila mohavensis*) is on open, moist, heavily alkaline and salt-crusted, otherwise nearly barren clay flats in low drainage and seepage areas surrounded by shadscale and saltgrass vegetation.

While high elevation "islands in the sky" habitats are important refugia for many of Nevada's endemic plant species, there have been insufficient threats— to date— to include any species on the state critically endangered plant list.

Land Ownership and Fragmentation

Urban sprawl can at best, lead to protecting known populations as preserves, such as the Sloan Canyon National Recreation Area for Blue Diamond cholla. At worst, habitat disturbances associated with sprawl such as: fragmentation and edge effect from bulldozing, weed introductions, animal pests, litter, and trampling, will eventually eliminate populations. This appears to have been the case with the potentially extirpated Las Vegas catseye (*Cryptantha insolita*).

Fragmentation of populations, both urban and rural, may occur from road building, utility corridors, buried pipelines and wildfires. Habitat fragmentation from road construction threatens species like Steamboat buckwheat. There is an ongoing need for monitoring the cumulative losses (i.e. "cumulative effects") from such disturbances.

Some critically endangered plants associated with hot springs are protected by agreements with the landowners. For example, Sulphur Springs buckwheat (*Eriogonum argophyllum*), found at a single privately-owned site in Ruby Valley and Steamboat buckwheat (*Eriogonum ovalifolium* var. *williamsiae*) found partially on utility company property are protected with landowner agreement.

Invasive Weeds

Highly competitive species, whether officially recognized in Nevada as noxious or invasive, can overwhelm populations of Nevada's critically endangered plants. Sahara mustard, red brome and Mediterranean grass threaten species such as threecorner milkvetch and sticky buckwheat in the Mojave Desert. Cheatgrass invasion after fire threatens species such as Osgood Mountains milkvetch (Astragalus *yoder-williamsii*) in the Great Basin.

Primary Factors Impacting Species Requiring Specialized Conservation:

Climate change, fragmentation and invasive weeds have been previously discussed as primary factors impacting Nevada's critically endangered plant species. With 300 plant taxa of conservation concern, any of these threats may become severe enough to warrant inclusion on a list of threatened or endangered species. In addition, wildfires pose a major long-term threat to our native plant biodiversity. Proposed mining can threaten species known only from small areas wholly within proposed mines, such as Churchill Narrows buckwheat.

Large scale solar energy fields may cover thousands of acres at a single site. The need to reduce energy transmission distances between the site of the arrays and the end user (primarily cities in southern NV and California) results in targeted habitats primarily throughout southern Nevada. Landform constraints for implementing the structures, accessibility and large flat surfaces, target valley bottoms which may overlap with the limited distribution of sensitive and protected species like the desert tortoise and threecorner milkvetch that depend on these isolated habitats. Additionally, because transmission corridors spanning hundreds of miles are needed for energy distribution, the additional development along energy corridors often intersects sensitive species habitats and may cross areas specifically protected for sensitive habitat, as seen with various Areas of Critical Environmental Concern (ACEC) in southern Nevada. Additional infrastructure near highly populated and fast-growing regions with an increasing footprint adds pressure to species and habitats in high-impact areas that already have "Multi-Species Habitat Conservation Plans" to balance human and environmental needs.

Habitat degradation can arise from hydrologic changes and invasion of undesirable vegetation, such as in unprotected areas for Steamboat buckwheat. Widespread vegetation change has been linked to climatic change and the trend to warmer annual temperatures with erratic, ill-timed, or excessive and intense rainfall events.

Values at Risk from Species Requiring Specialized Conservation

Value	Issues and Impacts
Unique Species and Habitats	• Development and disturbance pressures can curtail habitat availability and population viability for rare or highly desirable species
Local Economies	• Increasingly rare and legally protected species and habitats create challenges and can restrict land use activities that are required to generate local revenues, jobs, and support economic activities
Nevada's Natural Heritage	• Development impacts can eliminate endangered plant species that have small, restricted habitats

Challenges Posed by the Species Requiring Specialized Conservation

- Species that are at risk of extinction are often cryptic with little natural history information and limited and patchy distribution of populations. Therefore, effective techniques for mitigating negative impacts of development or habitat disturbance are largely unknown. Additionally, locations of all populations across the landscape is rarely known, causing elevated risk of negative impacts.

- Coordination among multiple agencies and jurisdictions is necessary to alert and plan for habitat disturbance in a manner that will not cause additional threats to populations of species at-risk

- Public education about Nevada's at-risk species is limited and public engagement may be challenging in part due to the sensitive nature of data on rare plants and animals

- Pollinator insects and birds may require specific nectar plants or larval host plants. Research to date is revealing symbiotic relationships between at-risk plant species and at-risk invertebrate species.

- Conflicts exist between habitats where at-risk species live and development associated with Nevada's expanding population, existing and emerging energy infrastructure, and extracted mineral resources.

Opportunities for Agency and Cooperators Impact Species Requiring Specialized Conservation

Goal 6-1: Preserve Nevada's native plant and wildlife biodiversity and preclude legal protective species listings through effective stewardship of rare and unique populations and habitats
Strategy 6-1-1: Ensure land management and project implementation plans consider and mitigate impacts to rare and listed species
Performance Measure 6-1-1: Percent of plans that address/consider impacts of rare and listed species
Contributing Programs: Nevada Department of Wildlife, NDF Resource Program, DCNR-Division of Natural Heritage, DCNR Conservation Districts Program, Northeastern Nevada Stewardship Group, USFWS-Partners for Fish and Wildlife Program, Desert Conservation Program
Strategy 6-1-2: Seek to conserve lands with important habitats through promoting conservation easements and other natural resource protection measures
Performance Measure 6-1-2: Acres protected within conservation easements; Percent of identified species protected

Contributing Programs: NDF Resource Program, The Nature Conservancy of Nevada, Nevada Sagebrush Ecosystem Program, Eastern Nevada Landscape Coalition, USDA-Agricultural Conservation Easement Program, NDOW-Nevada Landowner Incentive Program, Nevada Conservation and Resource Protection Grant Program, county commissioners (e. g. , Churchill County Transfer of Development Rights), Rocky Mountain Elk Foundation, The Conservation Fund, Sierra Nevada Conservancy, Land and Water Conservation Fund, Eastern Sierra Land Trust, USDI-Bureau of Land Management
Strategy 6-1-3: Support the Nevada Conservation Credit System** that facilitates the exchange of debits and credits between entities that impact sagebrush ecosystems and entities that manage and conserve those habitats
Performance Measure 6-1-3: Credits added to the system; Uplift project acreages successfully implemented
Contributing Programs: NDF Resource Program, Sagebrush Ecosystem Technical Team, DCNR Conservation Districts Program, NDF Fire Program, NDF Conservation Camps
Strategy 6-1-4: Produce and distribute plant materials for critical habitat restoration projects
Performance Measure 6-1-4: Number of plants distributed; Number of plants successfully established onsite
Contributing Programs: NDF Resource Program, NDF Conservation Nurseries, Seeds of Success, Future Farmers of America, Grange, Northeastern Nevada Stewardship Group, Nevada Native Plant Society, NDOW Habitat Conservation, USFWS-Partners for Fish and Wildlife Program, DCNR-State Parks, DCNR-Division of Environmental Protection, USDI-Bureau of Land Management, USDA-Humboldt-Toiyabe National Forest
Strategy 6-1-5: Develop and update species status reports and use them to educate the public and public officials about species at risk
Performance Measure 6-1-5: Percent of status reports updated; Number of public or public officials educated
Contributing Programs: NDF Resource Program, US Fish and Wildlife Service-Ecological Services, Desert Conservation Program, Southern Nevada Conservancy, DCNR-Division of Natural Heritage, Nevada Native Plant Society
Strategy 6-1-6: Conduct adequate amounts of surveys, studies and research focused on increasing knowledge of the natural history, distribution, and habitat requirements of species at-risk
Performance Measure 6-1-6: Percent of target species habitats surveyed; Percent of target species reviews completed; Number of research projects completed
Contributing Programs: Nevada Department of Wildlife, NDF Resource Program, Desert Conservation Program, US Fish & Wildlife Service-Ecological Services, DCNR-Nevada State Clearinghouse, DCNR-Division of Natural Heritage, Nevada Native Plant Society-Margaret Williams Research Grant
Strategy 6-1-7: Provide environmental review of proposed development projects within critical habitats and provide technical review of research proposals to further knowledge of at-risk species

Performance Measure 6-1-7: Percent of proposed development projects and research proposals reviewed.
Contributing Programs: NDF Resource Program, Desert Conservation Program, US Fish & Wildlife Service-Ecological Services, DCNR-Nevada State Clearinghouse, DCNR-Division of Natural Heritage, Nevada Native Plant Society-Margaret Williams Research Grant
Strategy 6-1-8: Proactively review necessity of adding at-risk species to the state list of fully protected species
Performance Measure 6-1-8: Percent of target species reviewed and listing decisions made
Contributing Programs: Nevada Department of Wildlife, NDF Resource Program, Desert Conservation Program, US Fish & Wildlife Service-Ecological Services, DCNR-Nevada State Clearinghouse, DCNR-Division of Natural Heritage, Nevada Native Plant Society-Margaret Williams Research Grant

#7 – Water Quality and Quantity

Overview

Average annual precipitation in Nevada ranges from three to four inches in the southern desert valleys to over 40 inches at higher elevations throughout the State. Total precipitation averages approximately 9.5 inches per year making Nevada the most arid state in the Nation (Western Regional Climate Center, 2005). Of the total annual average precipitation, approximately 10 percent accounts for stream runoff and groundwater recharge. The remaining 90 percent is lost through evaporation and transpiration. Average lake surface evaporation rates vary widely across the state from less than 36 inches per year in the west to over 80 inches in the south (State Engineer's Office, 1973).

Infiltration, evapotranspiration, and water diversions for agricultural irrigation and drinking water uses reduce natural surface water flows. Nevada has few large rivers and streams compared to other states. Except for the Colorado River, Nevada's perennial streams are small by nationwide standards. According to EPA (EPA Watershed Assessment, Tracking & Environmental Results website), only about 10 percent (15,549 miles) of the rivers and streams in Nevada are perennial, however, this 10 percent of the streams carry most of the surface water flow in the state. The other 90 percent (126,257 miles) of the streams are considered intermittent or ephemeral. Additionally, 1,782 miles of manmade ditches and canals exist throughout the state. According to the best available estimates, Nevada has 1,070 lakes, reservoirs, and ponds with an approximate total acreage of 553,239 acres. A total of 136,650 acres of wetlands has been estimated.

Nevada defines water quality goals and standards in state statues with definitions in administrative codes 445A.11704 – 445A.2234 which specifies criteria for specific water quality standards for chemicals, nutrients, particulates, and biological agents in freshwater sources throughout the state. These standards give clear definitions of acceptable levels of influences for water quality in Nevada's surface water systems. Nevada Division of Environmental Protection's Bureau of Water Quality Planning (BWQP) is responsible for surface water planning and management activities in Nevada. The Bureau develops and revises surface water quality standards (WQS), monitors the chemical, physical, and biological quality of surface waters; assesses surface water quality, develops total maximum daily load standards when appropriate and supported by local efforts; and implements the Nonpoint Source Management Program to mitigate surface water pollution. State statutes also defines the beneficial uses and quality metrics to ensure water from specific sources throughout the state is available - and of sufficient quality -to be used for defined valued purposes such as livestock, irrigation, aquatic life and wildlife, recreation, municipal, domestic, and industrial supply, and extraordinary or aesthetic value.

Climate Change Influences

With the occurrence of climate change, Nevada has observed higher variability in weather patterns, droughts, snowfall, rainfall and hot/cold temperatures. Depending on the net effect climate change will have, the state could see a gradient of potential outcomes. If we continue to have years with above average precipitation like 2018 and 2019, we will also see increased fuel loading on landscapes, areas becoming more prone to large, destructive fires, and more loss of habitat and ecosystems throughout the state. If we begin to see a decline in the amount of rain/snow the state receives during the water year, we could also see an already arid state become more inhospitable for plants and animals. Either scenario can pose threats to existing water quality and quantity, but as the climate is always changing so must our management efforts to reflect realities.

Plant and Animal Habitats Under Pressure

Water quality and quantity has profound effects on plant and animal habitats. The greatest threat is the cumulative effects of drought. While much of Nevada's flora and fauna have adapted to survive in temporary drought conditions, prolonged low water years strain many plant and animal species. With drought and drier conditions increasing, potential for wildfires increases. While wildfires are a natural and often required processes, large high intensity fires threaten Nevada's sagebrush ecosystems, including the riparian areas which provide habitat for many of the state's native species. Furthermore, after wildfires occur encroachment of non-native cheatgrass ultimately alters the fire regime and the once contiguous sagebrush ecosystems become diminished and fragmented. Drought also impacts the rates, extent, and overall mortality of insect and disease outbreaks on forests and rangelands. The vegetation's ability to resist and recover from these outbreaks is greatly diminished during droughts as their defense mechanisms are highly reliant on adequate water availability.

Land Ownership and Fragmentation

Given the fact that a portion of the state's surface water supply originates outside the state's boundaries, our ability to influence the quantity of water available for beneficial use is limited. Efficient use and storage of the state's surface and groundwater will help maximize the benefit of this scarce resource. Water quality can be influenced by conditions along an entire reach of a stream. Where headwaters exist in the state, vegetation management is minimal, and the most significant concern is wildland fires and the resulting impacts on water quality and quantity. Along lower reaches of a stream, wildland fire along with other issues become concerns. Invasive weeds, un-managed grazing, non-permitted releases and non-engineered development all pose threats to the maintenance of quality and quantity.

Figure 46. Crews constructing beaver dam analogs on streams which can benefit from storage of water.

Invasive Weeds

As discussed above, invasive and noxious weeds threaten Nevada's landscapes by outcompeting native plant species. With interspersed openings and fire disturbed soils, invasive weeds begin growing under low-water conditions before natives can reseed. Extended droughts will only exacerbate the invasive weed problem by creating higher potential for large fires and limited chances of reseeding.

Primary Factors Reducing Water Quality and Quantity

Primary factors that reduce water quantities is the amount of precipitation in the form of rainfall and snow received each year. A secondary factor is the amount of water diverted from natural stream flows for irrigation purposes. Primary factors reducing water quality are agricultural return flows, development, urban runoff directly into waterways, and stream zone degradation. These factors pose the risk of non-point source pollution across landscapes. Many of the development and human related influences on water quality are regulated and actively monitored by the Nevada Division of Environmental Protection (NDEP) Bureau of Water Quality Program. NDEP maintains a web-map portal that visualizes water quality monitoring stations, issued permits, and regional flood control districts for public use.

Values at Risk for Water Quality and Quantity

Value	Issues and Impacts
Potable Water	• Drinking water is a severely limited resource in Nevada and is essential for human health and welfare; water supply easily impacted by disturbances and pollution • Climate change threatens the security of the state's water supply by altering the amount, timing and form of the precipitation received
Clean Water	• Agricultural return flows create a significant source of pollution • Urban runoff creates non-point source pollution
Wildlife Habitat	• Both point and non-point source pollution negatively impact fish habitats
Local Economies	• Decreases in water quality or quantity will decrease economic activity in every sector
Infrastructure	• Loss of vegetative cover increases sedimentation and subsequent lifespan of water storage facilities • Point and non-point source pollution increase the costs associated with water treatment

Challenges Posed by the Conservation of Water Quality and Quantity

In 2016, the Nevada Division of Environmental Protection (NDEP) issued a Strategic Plan for 2016 to 2020. Three of the Division's 11 goals pertain to water. Goal 2 "Clean Water" seeks to protect the waters of the state from the discharge of pollutants and contaminants to protect groundwater, preserve beneficial uses of surface water and maintain healthy aquatic habitat. Goal 3 "Safe Drinking Water" seeks to protect the health of the citizens and visitors of Nevada by ensuring that public water systems provide safe and reliable drinking water. Goal 5 "Environmentally Responsible Mining" seeks to ensure that Nevada's mining industry complies with State regulatory programs for the protection of surface and groundwater resources, general pollution control, and reclamation of disturbed lands.

Within NDEP, the Bureau of Water Pollution Control (BWPC) serves a regulatory function by issuing permits to discharge to surface and/or groundwater and ensure compliance with water pollution control laws. The BWPC is funded solely through federal grants primarily from the U. S. Environmental Protection Agency. Budget cuts at the national level have resulted in a reduction of stream miles monitored and assessed, fewer approved water quality standard actions, and fewer water quality improvement projects being implemented. With shrinking resources, the bureau has had to be strategic with limited non-point source grant funds.

NDEP's Bureau of Safe Drinking Water (BSDW) implements source water assessment, planning, and protection to ensure Nevada's public water systems comply with state and federal drinking water standards, Goal 3, by enforcing the sampling and monitoring requirements for water quality, as well as enforcing requirements for water treatment and corrosion control.

The Bureau of Mining Regulation and Reclamation within NDEP is responsible for Goal 5, which regulates fluid management, closure and reclamation at mining operations. It is the mission of the Bureau to ensure that Nevada's waters are not degraded by mining operations and that the lands disturbed by mining operations are reclaimed to safe and stable conditions to ensure a productive post-mining land use.

The Bureau of Water Quality Planning (BWQP) also under NDEP is now responsible for surface water planning and management activities in Nevada. The Bureau develops and revises surface water quality standards (WQS); monitors the chemical, physical and biological quality of surface waters; assesses surface water quality through the Integrated 303(d) /305(b) report and other mechanisms; develops TMDLs when appropriate and supported by local, grass roots efforts; implements the Nonpoint Source Management Program to mitigate NPS pollution in surface waters; and issues 401 certifications. BWQP interacts both internally and externally to ensure coordination with relevant programs.

Cooperating land managers readily use operating funds or apply for and use NDEP project funds to address the NDEP Strategic Plan goals. Most land management activities result in fluctuations in nonpoint sources (NPS) of pollution. Through effective planning, implementation of NPS pollution control projects, environmental education and outreach to the public, and other local, state and federal agencies these pollutants can be reduced. Proposed projects supported by NDEP help reduce pollutants by managing ecological conditions and practices in various ways, include, but are not limited to: 1) carbon loading from sheet erosion over bare soils and streambank erosion into waterways; 2) restoring native vegetation in wetland and riparian areas to increase filtration of sediments and contaminants and to provide shade; 3) prevent channel erosion, and maintain stream habitat features; 4) planting vegetation that stabilizes stream banks, restores, and maintains water quality and quantity to support native fish and wildlife; 5) balancing habitat health with the economic and social needs of rural and urban communities; 6) construction of beaver dam analogs to control stream erosion and raise local water tables in specific locations across Nevada.

Opportunities for Agency and Cooperators to Impact Water Quality and Quantity

Goal 7-1: Protect water quality and quantity in urban and community environments
Strategy 7-1-1: Ensure urban and community environments have adequate green infrastructure water quality and quantity conservation practices implemented
Performance Measure 7-1-1: Percent of communities evaluated for BMP codes, enforcement and monitoring; Percent of communities with adequate BMPs in place; Increase in percent of adequacy year over year; Percent of communities meeting water quality standards upstream, within and downstream of the communities
Contributing Programs: NDF Resource and Urban and Community Forestry Programs, municipalities, Nevada Rural Water Association, EPA, DCNR- Division of Environmental Protection, Conservation Districts, Tribes,
Strategy 7-1-2: Use of water efficient landscapes occupied by low water use vegetation
Performance Measure 7-1-2: Percent of landscapes meeting water efficient vegetation criteria; Percent converted from non-efficient to water efficient vegetation annually
Contributing Programs: NDF Resource and Urban and Community Forestry Programs, municipalities, Nevada Rural Water Association, Water Purveyors, Conservation Districts, Tribes
Goal 7-2: Maintain Nevada's watersheds by performing necessary management that builds ecosystem community resistance and resilience and soil stability in the inevitable occurrence of disturbances (e. g. wildfire, drought, insects and diseases, etc.)
Strategy 7-2-1: Collaborate with the Nonpoint Source Water Pollution Management Program, Source Water Protection Program, and local source water protection teams to identify priority areas, create plans, and implement protection strategies.
Performance Measure 7-2-1: Percent of drinking water sources with current Source Water Protection Plans. Percent of land management actions that employ necessary nonpoint source pollution management strategies.
Contributing Programs: NDF Resource and Fire Programs, DCNR Conservation Districts Program, DCNR Division of Environmental Protection, Nonpoint Source Pollution Management Program, Source Water Protection Program, Local Fire Protection Districts, Water Purveyors, Local large acreage landowners, County Natural Resource Departments, local source water protection teams
Strategy 7-2-2: Implement proactive watershed management practices that maintain adequate vegetative cover, reduce soil erosion, and fuel loading conducive to reducing non-point source pollutants
Performance Measure 7-2-2: Percent of watersheds proactively managed; Number of treatment acres performed annually; Water quality and quantity for managed and non-managed watersheds

Contributing Programs: NDF Resource and Fire Programs, DCNR Conservation Districts Program, DCNR Division of Environmental Protection, USDI-Bureau of Land Management, USDA-Humboldt-Toiyabe National Forest, Bureau of Indian Affairs, Tribal Natural Resource Departments, Local Fire Protection Districts, Water Purveyors
Strategy 7-2-3: Restore rivers, streams and other riparian area, flood plains and wetlands to proper functioning condition to increase groundwater recharge, reduce sedimentation of water supplies, and increase seasonal water flows
Performance Measure 7-2-3: Percent of river/stream miles or acres of wetlands assessed for proper functioning condition; Percent increase in proper functioning condition
Contributing Programs: NDF Resource, USDI-Bureau of Land Management, USDA-Humboldt-Toiyabe National Forest, Bureau of Indian Affairs, Tribes, Conservation Districts, Nevada Rural Water Association, UNR Cooperative Extension, DCNR- Division of Environmental Protection
Strategy 7-2-4: Rehabilitation of wildland fire-impacted and abandoned agricultural lands to stabilize soils that will decrease erosion and sedimentation in riparian and wetlands areas
Performance Measure 7-2-4: Percent of erodible watersheds rehabilitated annually; Water quality and quantity of rehabilitated and non-rehabilitated watersheds
Contributing Programs: NDF Rehabilitation, DCNR Conservation Districts Program, DCNR Division of Environmental Protection, BLM and USFS Emergency Stabilization and Rehabilitation, NDOW Habitat Division, Sportsman NGOs
Goal 7-3: Increase agricultural water use efficiency and runoff or tail water quality
Strategy 7-3-1: Create riparian buffers along agricultural fields and other working lands to trap sediments and filter pollutants
Performance Measure 7-3-1: Percent of riparian miles or wetland areas with adequate riparian buffers
Contributing Programs: Conservation Districts, NRCS, NDF Resource Program
Strategy 7-3-2: Increase irrigation efficiency to conserve water supplies and reduce agricultural return flows that decrease water pollution
Performance Measure 7-3-2: Percent of acres under water efficient production practices; Return flow quality and quantity
Contributing Programs: Conservation Districts, NRCS, Farm Services
Goal 7-4: Create and distribute a unified message and education to the public and public officials about the importance of watershed protection and water resource conservation

Strategy 7-4-1: Increase wildland fire prevention education and messaging to reduce the number of human-caused wildland fires
Performance Measure 7-4-1: People reached annually through messaging; People educated annually; decrease in the number of fires caused by humans each year
Contributing Programs: NDF Fire Program, BLM Fire and Prevention, USFS Fire and Prevention, Local Fire Protection Districts, County CERT Programs, Living with Fire
Strategy 7-4-2: Increase water resource conservation education and messaging to increase water use efficiency and decrease impacts to water quality
Performance Measure 7-4-2: People reached annually through messaging; People educated annually; Water use efficiency in rural and urban environments; Water quality parameters
Contributing Programs: NDF Resource and Urban and Community Forestry Programs, municipalities, Nevada Rural Water Association, EPA, DCNR-Division of Environmental Protection, Conservation Districts

#8 – Climate Change Mitigation

Overview

Mitigating climate change has been ordered by the Governor and will begin to influence natural resource and fire management practices throughout the state in a few years. Within Nevada there are opportunities to mitigate climate change by reducing carbon emissions and sequestering atmospheric carbon in environmental sinks through strategic land management. While ecosystems have natural processes that emit GHGs and sequester carbon, they can be altered by the type of management actions implemented. It is important to note that this includes urban ecosystems as urban and community forests in Nevada provide many services in relationship to climate change including, energy conservation, heat island effect reduction, and carbon sequestration and storage.

There is not a full inventory and analysis of the carbon cycles within Nevada's ecosystems, but there are some obvious points of emission such as wildfire. While wildfire is a necessary ecosystem function for many vegetation communities to persist in Nevada, there are also scenarios where wildfires are unnaturally large and severe. The two primary causes of this are the statewide invasion of exotic annual grasses and the buildup of excessive fuel loads from suppressing natural fire cycles over the last century. Historically, the low to moderate intensity fires typical in Nevada released less carbon than today's extremely severe fires.

The scale of vegetation and land use management in Nevada is insufficient to compared to that which is necessary to restore ecological conditions to historical norms. Management is largely focused on acute needs, which precludes landscape scale approaches and the creation of highly vigorous, resilient and resistant vegetation communities. If landscapes were managed for high vigor, the amount of carbon accumulated through photosynthesis would be increased and more stable over time. The water efficiency of the carbon storage increase in the plants would also be increased. Taking this sequestered carbon and converting it into a long-term storage sink may be done by harvesting the carbon and using it for a productive purpose (e. g. building materials, forage, biochar, etc.) or burning the site when it has lower fuel loading which will return a portion of the carbon to the soil.

Climate Change Influences

As climate change moves toward the predicted states of warmer, rainwater dominated precipitation, the occurrence of wildfires that emit more carbon and release less into soil sinks will increase. The trends of wildfires in Nevada are apparent, since the mid-1980s fires have burned increasing acreage annually. Current and predicted climate conditions will exacerbate this trend because of longer seasons with suitable fire weather and increasingly grass-dominated landscapes that create fine fuels capable of carrying fires more readily. The predicted climate trends are for more increasing temperatures and aridity which will likely result in less overall plant production, which equates to a precipitous decline in carbon capture from the atmosphere and potential sequestration from plant material use or carbon deposition in the soil.

Cities are typically hotter than surrounding rural areas. With most of Nevada's population living in cities, these urban heat islands have serious health effects on numerous people during the hottest months of the year. Climate change is predicted to make these urban heat islands even worse. Heat is the number one weather-related killer in the U. S., and the hottest days are associated with dangerous ozone pollution levels that can have serious health impacts. Urban forests and vegetation are also at risk from increasing temperatures and if specific species heat tolerances are exceeded, some species will no longer be able to survive in those areas.

Plant and Animal Habitats Under Pressure

Unchecked climate change threatens the current state of all populations of plants and animals and their suitable habitats. As Nevada warms, per climate predictions, it is likely that the highest and lowest elevation species will be impacted the greatest. This is due to the reality that the coolest and wettest conditions that exist at the tops of the mountain ranges will cease to exist at their current levels, leaving species with nowhere to migrate. Likewise, as species migrate upslope or north in latitude to follow suitable climatic and other environmental conditions, the lowest elevations will experience conditions that don't current exist on the landscape. This will open ecological niches that do not have localized species adapted to fill. These open niches will be highly susceptible to invasion by exotic species.

Land Ownership and Fragmentation

Landownership may have an impact on climate change mitigation due the landowner's ability to support or finance climate change mitigation activities. Climate change is a global issue and has the potential to require activities that create a disproportionate need to invest in land management activities on a property that exceed what the property can produce monetarily. For instance, cities or companies may need to offset their carbon emission by paying for land management treatments that sequester or reduce emissions from wildfire. At this juncture, there is not a carbon market in Nevada to support these activities, so government funded initiatives are the only mechanism to support these kinds of endeavors. Fragmentation only complicates and makes land and fire management more expensive and logistically challenging. Treatments become smaller and moving from parcel to parcel to implement treatments increases the cost per acre.

Invasive Weeds

Invasive weeds, particularly exotic annual grasses make climate mitigation activities even more challenging. These plants fuel uncharacteristically large and frequent wildfires that release large amounts of GHGs into the atmosphere. Creating the conditions that built soil carbon reserves becomes almost impossible if the sites burn on a three to five-year return interval. Additionally, these grasses burn so frequently that woody vegetation and deep-rooted perennial grasses don't re-establish on sites. These species are responsible for pre- and post-fire deposition of soil carbon. Until these species and the resulting wildfire conditions are curtailed, the carbon sequestration potential of Nevada's rangelands cannot be realized.

Primary Factors Influencing Climate Change Mitigation

There are several factors that influence land manager's ability to mitigate climate change through carbon emission reductions and sequestration tactics:

- Number, size and severity of wildfires
- Exotic annual grasses that drive increasing wildfires
- Harvesting of plant materials before burning for productive uses
- Land use practices

Values at Risk because of Climate Change

Value	Issues and Impacts
Potable Water	• Water quantity and quality is likely to become less reliable because of earlier snow melt, rain-dominate precipitation, and warm air temperatures

Value	Issues and Impacts
Local Economies	• Recreation and tourism will likely slow for hotter portions of the year • Agricultural production will be reduced for farms and rangeland grazing operations • Cost of living will increase with increased power consumption to condition air during hotter portions of the year
Wildlife Habitat	• Habitats will have altered suitability for specialized populations
Infrastructure	• Infrastructure is engineered for climactic, hydrological and other conditions that have been relatively consistent and predictable yet will change and therefore create a new set of conditions that will challenge the integrity of the construction and design (e. g. culverts)
Urban Livability and Human Health	• Urban Heat Island Effects: Temperatures in urban areas could rise to levels that threaten human health, strain energy resources, compromise economic productivity, and stress the urban forest beyond some species heat tolerance (loss of urban vegetation and trees)

Challenges Posed by the Mitigation of Climate Change

There are many challenges to mitigating climate change through land management activities, including:

- Public awareness of the scale and scope of the impacts of predicted climate changes
- Public support for investing in climate change mitigation activities
- Public support for changing management of public and private lands to be compatible with climate change mitigation objectives
- Lack of an established carbon market in Nevada or in the US to drive investments from outside entities
- Legacy land uses may not be compatible with the need to change uses for a new set of values

Opportunities for Agency and Cooperators to Mitigate Climate Change

Goal 8-1: Increase carbon sink and sequestration activities associated with wildland fire and natural resource management practices (e. g. rehabilitation, restoration etc.).
Strategy 8-1-1: Use appropriate plant species for restoration and rehabilitation projects and scale up markets, businesses, and facilities that produce the required plant materials
Performance Measure 8-1-1: Acres and pounds of successfully seeded lands in perennial vegetation

Contributing Programs: NDOW Habitat Rehabilitation, BLM Emergency Stabilization and Rehabilitation, NDF Rehabilitation, Conservation Districts
Strategy 8-1-2: Enhancing water use efficiency of plants growing through appropriate land management practices
Performance Measure 8-1-2: Season length of vigorous growth of perennial plants
Contributing Programs: NDOW Habitat Division, BLM/USFS Rangeland Management and Fuels Monitoring, NDF Forestry and Fuels
Strategy 8-1-3: Restore, rehabilitate, and manage soils to control erosion and increase soil quality
Performance Measure 8-1-3: Percent of degraded or susceptible sites restored or reclaimed
Contributing Programs: NDOW Habitat Rehabilitation, BLM Emergency Stabilization and Rehabilitation, NDF Rehabilitation, Conservation Districts
Strategy 8-1-4: Harvest and utilize forest and rangeland biomass products (including urban and community forests) for producing items or supporting practices that store carbon (e. g. construction materials, biochar, etc.)
Performance Measure 8-1-4: Total tons of carbon removed and stored
Contributing Programs: NDF Biomass Utilization, NDF Logging Permitting, BLM/USFS Stewardship Contracting, BLM and USFS Fuels
Strategy 8-1-5: Maintain or increase the extent of forest and/or woodland ecosystems, including urban and community forests, to protect existing carbon stocks
Performance Measure 8-1-5: Acres of forest or woodland cover; percent increase or decrease annually
Contributing Programs: NDF Natural Resources, BLM Forestry, Fire and Fuels, USFS Fire and Fuels, Local Government Planning
Strategy 8-1-6: Promote, support, and increase urban reforestation and management
Performance Measure 8-1-6: Percent canopy targets for communities are set, met, and maintained
Contributing Programs: NDF Urban and Community Forestry, Municipalities, Counties, NACO, American Forest Foundation
Goal 8-2: Reduce greenhouse gas emission from land use and management activities while preserving ecological processes

Strategy 8-2-1: Prevent wildfires from occurring more frequently and severely than ecosystem norms
Performance Measure 8-2-1: Percent of lands with high levels of deviation from fire frequency and fuel buildup norms. Percent of fires burning under low, medium and high severity conditions.
Contributing Programs: NDF, USFS, BLM, BIA, USFWS Fire, Fuels, and Prevention Programs, Local Fire Protection Districts
Strategy 8-2-2: Increase the use of fire surrogates for land management
Performance Measure 8-2-2: Reduction in carbon emissions achieved through fire surrogate practices
Contributing Programs: NDF, BLM, USFS Fire and Fuels, NDOW Habitat Division, NRCS
Goal 8-3: Facilitate the creation and participate in a carbon market and incentivize participation in existing programs that support carbon management as part of their objectives and outcomes (including urban and community forests)
Strategy 8-3-1: Provide an inventory of the emissions from ecological processes under various land management scenarios
Performance Measure 8-3-1: Total emissions expected and realized under land management options
Contributing Programs: DRI Research Laboratory, The Nature Conservancy, USGS
Strategy 8-3-2: Provide an inventory of carbon sinks
Performance Measure 8-3-2: Number of sinks identified, their current and potential capacity
Contributing Programs: DRI Research Laboratory, The Nature Conservancy
Strategy 8-3-3: Provide incentives for partners and cooperators engaging in programs that result in marketable carbon, carbon sequestration or less carbon emissions
Performance Measure 8-3-3: Number of programs with incentives. Number of cooperators taking advantage of incentives. Percent reduction in emissions and/or increase in sequestration
Contributing Programs: Nevada Office of Energy, Legislature, Department of Conservation and Natural Resources
Goal 8-4: Create and distribute technical and educational materials to inform policy development, management decisions, and the public
Strategy 8-4-1: Scale down climate change predictive models to determine regional trends and impacts in the State

Performance Measure 8-4-1: Scaled down predictive models for each climate region in Nevada
Contributing Programs: DRI Research Laboratory, The Nature Conservancy, USGS, USFS Climate Center, Nevada Climate Office
Strategy 8-4-2: Create climate change susceptibility models to inform land user and manager decisions and actions.
Performance Measure 8-4-2: Publicly available susceptibility models for all climate regions that address priority species, habitats, ecological processes and/or land uses.
Contributing Programs: DRI Research Laboratory, The Nature Conservancy, USGS, USFS Climate Center, Nevada Climate Office
Strategy 8-4-3: Create and make a comprehensive menu of climate change mitigation tools and techniques available for natural resource, land, and fire managers
Performance Measure 8-4-3: Publicly available and comprehensive menu of climate change mitigation tools and techniques
Contributing Programs: DRI Research Laboratory, The Nature Conservancy, USGS, USFS Climate Center, Nevada Climate Office, Great Basin Fire Science Exchange

Priority Landscape Areas Needing Management in Nevada

Priority Landscape Areas Needing Management in Nevada

Scope and Approach

A variety of federal, state, local and NGOs provide services and assistance in the areas of natural resource and fire management throughout the state. The missions of these partners involve coordinating and cooperating to ensure that threats to natural resources and the public are addressed in a way that is not inhibited by political and jurisdictional boundaries. Therefore, the priority landscapes analysis was performed in consideration of the key issues and threats across all lands in Nevada. This capability was achieved through stakeholder engagement and using their analyses and planning documents (Appendix F) to aid in the determination of key issues, threats and values. as well as the selection of the data layers used for the GIS analysis.

Analysis Data Layers

Twenty-nine geospatial data layers were selected for the analysis based on the threats, values and collaborative opportunities associated with the goals and strategies identified in the Strategy Section of this plan. Table 6 lists these layers and provides their association with each of the Key Issues and Threats from the Strategy Section of this plan. There was no suitable dedicated climate change mitigation or susceptibility layer available for use, though many other layers play a role in that key issue. Additional descriptions, individual maps, and development information for these layers can be found in Appendix A.

Table 8. Geographic information system layers used in the priority landscape determination analysis and applicable to identified key issues and threats.

Category & Layer Name	**Forest and Woodland Health**	**Wildfire Hazards**	**Urban and Community Forests**	**Riparian Wetland Systems**	**Sagebrush Ecosystem**	**Species Requiring Specialized Conservation**	**Water Quality and Quantity**	**Climate Change Mitigation**
LANDSCAPE THREATS								
1 - Annual Grasses (NLCD 2016)	●	●			●	●	●	●
2 - Forest and Woodland Insects & Disease (USFS 2010-2019)	●	●		●			●	
3 - Geothermal Potential (NBMG 2009)						●		
4 - Mineral Development Potential (NDM 2020)	●			●	●	●	●	
5 - Noxious Weeds (EDDMaps 2019)	●	●		●	●	●	●	
6 – Pinyon-juniper Priority Treatment Areas (NDF 2020)		●		●	●		●	
7 - Section 303d - Impaired Waters (EPA 2014)	●	●	●	●	●		●	
8 - Solar Energy Production Potential (NREL 2019)						●		
9 - West Wide Wildfire Risk Assessment (Sanborn 2013)	●	●	●	●	●	●	●	●
10 - Wild Horse Appropriate Management Level (Henning 2017)	●			●	●		●	
LANDSCAPE VALUES								
1 - Biomass Potential (NBMG 2020)	●	●		●	●		●	●
2 - BLM & USFS Grazing Allotments AUM Density (BLM 2019, USFS 2019)	●			●	●		●	
3 - CWPP Communities (NDF 2005, Updated In 2020)		●	●					
4 - Developed Recreation Opportunities (USFS 2019, BLM 2019, NPS 2019, State Parks 2004)	●	●		●	●		●	
5 - Forests to Faucets (NASF 2011)				●			●	
6 - Mule deer migration corridors (NFWF 2019-2020)	●	●		●	●			
7a - Nevada Active Mines and Energy Producers (NBMG 2019)	●	●		●	●	●	●	
7b - Solar Power Producers (Doe 2019) – *Joined with The Nevada Active Mines & Energy Producers Data Set Listed Above.*	●	●		●	●	●	●	
8 - Threatened & Endangered Species (NBMG 2017)						●		
9 - Wetland Map of Nevada (DRI 2018)				●			●	

Category & Layer Name	Forest and Woodland Health	Wildfire Hazards	Urban and Community Forests	Riparian Wetland Systems	Sagebrush Ecosystem	Species Requiring Specialized Conservation	Water Quality and Quantity	Climate Change Mitigation
10 - Wildland Urban Interface Areas (USFS 2017)		●	●					
11 - Urban Areas (NLCD 2016)			●					
COLLABORATIVE OPPORTUNITIES								
1 - BLM Sagebrush Project Planning Areas (BLM 2015)		●		●	●	●	●	
2 - Ecosystem Resistance & Resilience (USFS 2014)	●	●		●	●			●
3 - Nevada Crucial Habitat Assessment (NDOW 2013)	●			●	●	●	●	
4 - Sage-Grouse Priority Habitat Management Areas (SETT 2019)					●			●
5 - Section 602 - Forest Insect and Disease Areas (USFS 2014)	●	●					●	●
6 - USFS Fuels Projects (USFS 2020)	●	●		●	●	●	●	
7 - Wildlife Action Plan Focal Areas (NDOW 2017B)	●			●	●	●		

Priority Landscapes Analysis

The GIS (Geographic Information System) analysis used during the production of this plan, which influenced the assessment, used the 29 layers shown in Table 8. These layers are associated with each key issue, threat, value or collaborative opportunity, which are also tied to each of the three USFS-SPF national themes and Cohesive Strategy Tenets within the Strategies section of this document. GIS was used to overlay and analyze each of the weighted layers to produce a cumulative key issues and threats concentration map. The concentration levels were classified into five categories (Figure 47). The areas shown in purple represent the highest priority areas and represent geographic areas where data layers created the most overlap. All urban and community areas were classified outside of the analysis as high because of the need to manage urban forests and wildfire hazards within and around these areas to protect human life and enhance local economies as a priority. Riparian and wetland areas were also classified as high outside of the analysis because of their importance in serving basic needs for human and wildlife populations and their vital support of economic activities in the state. Additional information about the weighting of these layers and analysis performed can be found in Appendix A.

To view the priority landscape analysis layers in greater depth, please visit the following web address: NDF FRWAP Data Portal.

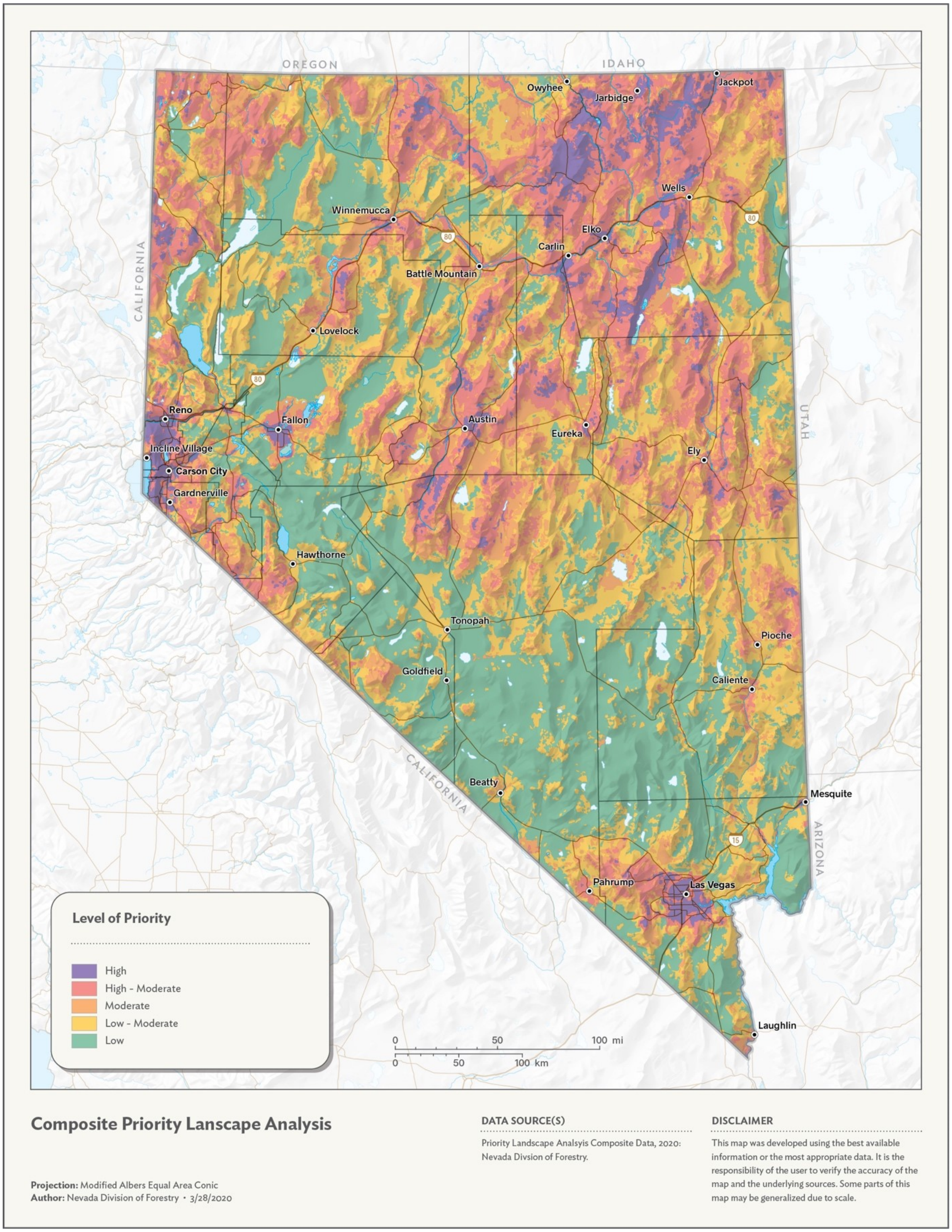

Figure 47. Statewide GIS analysis of Key Issues and Threats layers.

Priority Landscapes Designations

Using the priority landscapes GIS analysis, 22 Priority Landscape Areas were digitized based on the highest concentration of threats, values, and collaborative opportunities. Logical geographic feature extents, including but not limited to discrete hydrological units, geologic features, and major ecosystems were used as guides in developing the areas (Figure 48 and Table 9).

Based on the landscape scale of the priority areas, there are no discrete boundaries depicting where a landscape begins and ends. Rather, the landscapes are generalized areas where our analyses showed it was important to focus resources. The areas have many of the same issues, threats or resource values leading to their designation; however, any project specific planning will require a more detailed analysis to inventory the actual resource issues, concerns, and required management actions.

While it is recognized that this is a required State plan and that statutory obligations and USFS-SPF eligible activities of the State are somewhat limited to non-federal lands, this analysis honors the shared stewardship approach of not prioritizing by political or jurisdictional boundaries. Rather, the analysis was threat, value, and interagency collaborative opportunity focused only.

The results of this GIS analysis and the priority landscape designations will help focus the outreach and management efforts of Local, State, Federal and NGO efforts within these priority landscapes for the next five years.

Table 9. List of designated priority landscapes and land ownership composition.

Priority Landscape	Acres	% Local & Private	% State	% Federal
Amargosa-Lower Sand Springs-Pahrump	1,595,402	9. 15%	0. 00%	90. 85%
Central Basin and Range	6,646,785	5. 15%	0. 00%	94. 85%
Lahontan-Carson Sink	1,077,177	20. 46%	0. 23%	79. 31%
Lake Tahoe Basin	58,885	37. 79%	0. 95%	61. 26%
Las Vegas Valley-Islands in the Sky	1,238,876	26. 51%	0. 18%	73. 31%
Meadow Valley Wash	1,523,611	2. 71%	0. 17%	97. 12%
Moapa-Mead-Virgin	1,249,185	4. 65%	3. 94%	91. 41%
Montana-Quinn-Kings	351,286	7. 98%	0. 00%	92. 02%
North Fork-Middle Humboldt	2,523,278	47. 94%	0. 01%	52. 05%
North Washoe-Sheldon	3,245,429	6. 32%	0. 00%	93. 68%
Northeast Elko	2,721,978	23. 79%	0. 00%	76. 21%
Owyhee-Bruneau-Jarbidge	2,345,745	22. 40%	0. 00%	77. 60%
Pahranagat Valley	431,730	2. 98%	0. 00%	97. 02%
Piute-Eldorado	591,563	6. 38%	0. 44%	93. 18%
Ruby-Cortez	2,923,194	31. 60%	0. 00%	67. 02%
Santa Rosa-Paradise	1,606,025	21. 94%	0. 00%	78. 06%
Sierra Front-Pyramid-Pine Nuts	1,911,676	43. 78%	0. 55%	55. 67%
Steptoe-White-Snake	5,235,511	4. 62%	0. 29%	95. 10%
Walker	1,353,100	5. 08%	0. 94%	93. 98%
White-Silver Peak	613,609	4. 71%	0. 06%	95. 23%
Wilson-Snake	827,107	3. 86%	0. 00%	96. 14%
Winnemucca-Lower Humboldt	1,745,032	45. 25%	0. 94%	53. 81%

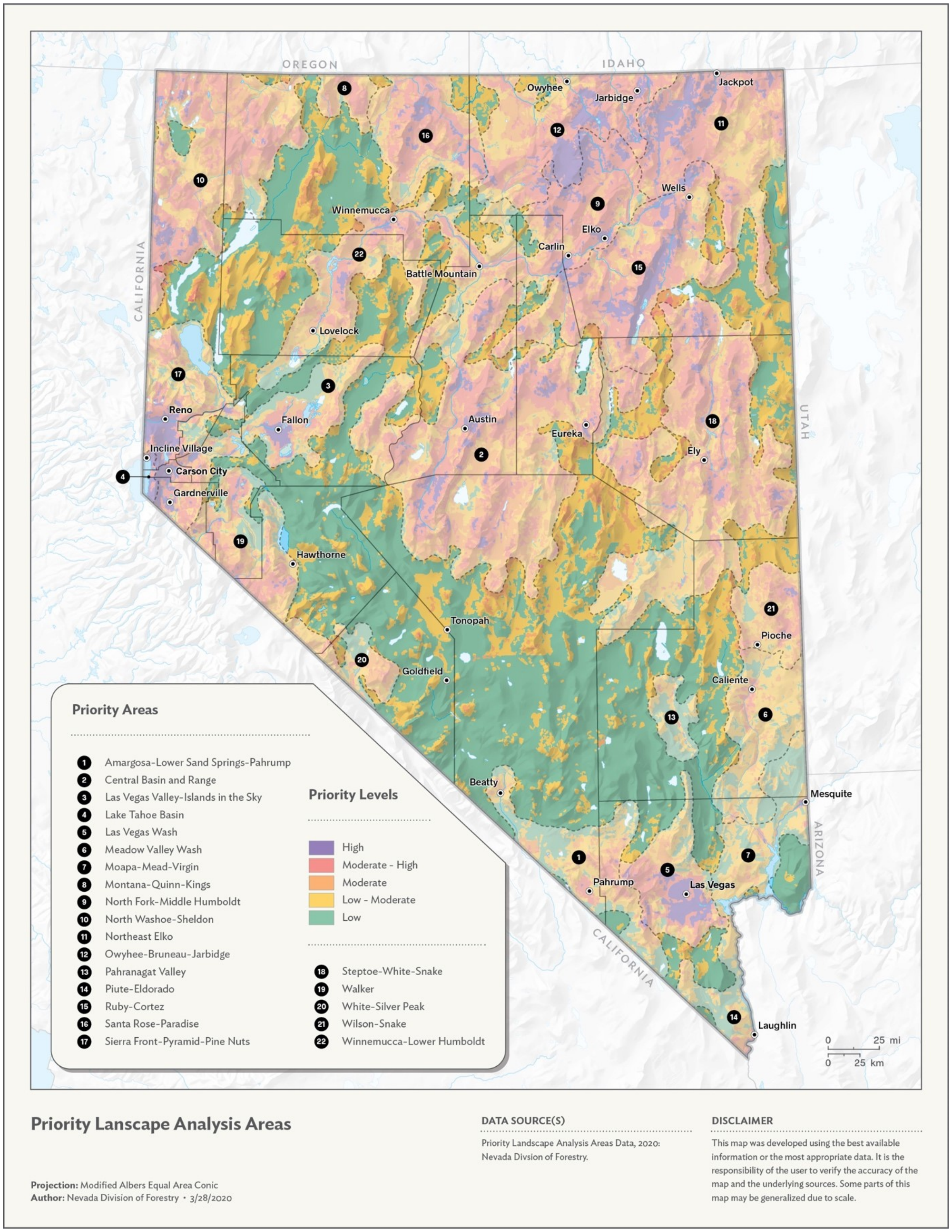

Figure 48. Priority landscapes designated through the use of threats, values and collaborative opportunities analysis layers and other physical features.

Priority Landscape Descriptions

The following sections provide an overview of each of the 22 Priority Landscape Areas. Each has a map depicting the boundary of the area, color-coded to priority levels across its landscape. The list of stakeholders represents the major landowner groups and land managers within the area. Existing plans used to guide resource management decisions and the major resource groups that collaborate with the stakeholders and public at large are also listed. Table 10 provides an analysis of the specific goals and strategies implemented within these areas, or which need to be addressed to optimally manage the landscape. Some goals are universal to the 22 priority landscapes, such as Goal 2.1 to "collaborate with other fire and natural resource management stakeholders to reduce the size, frequency, intensity and costs of wildfire impacts in Nevada." In some cases, entire issues, like #3 Urban and Community Forests, may not have any goals or strategies identified because of the lack of cities and communities within the priority landscape area.

Amargosa-Lower Sand Springs-Pahrump

The Amargosa-Lower Sand Springs landscape runs along the southwestern border of Nevada and California, from the Ivanpah Valley south of Pahrump north through the Amargosa desert, covering the west side of the Spring Mountain range and valley lowlands through the Desert National Wildlife Refuge. The landscape is largely composed of hot desert shrublands, dry lake beds, and salt flats, with pockets of unique geologic features such as free standing and inset sand dunes. Higher elevation environments transition from desert shrub through mixed conifer communities. The landscape encompasses the northern section of the Spring Mountain range, with peaks just shy of 10,000 feet elevation, and the Mount Stirling Wilderness Study Area which hosts the region's only Elk herd. The Amargosa River, abundant springs in the Ash Meadows National Wildlife Refuge, and perennial streams such as Cold Creek, Carpenter Canyon, and Trout Canyon in the northern Spring Mountains provide rare riparian habitats. Many of these riparian environments host an abundance of rare and endemic species of plants and animals (and often support small human settlements and a variety of land uses). The southeast border of the landscape is shared with that of the eastern side of the Spring Mountains component of the "Las Vegas Wash–Sky Island" landscape, highlighting the significance of the entire spring mountain ecosystem.

The largest town in the region, although unincorporated, is Pahrump, with a population exceeding 36,000. The town of Beatty is located along the Amargosa river, with private ranches and conservation easements following the river valley north from the town. Amargosa Valley is a sparsely populated valley along a highway that serves as an access point to Death Valley. Sandy Valley is the southwestern-most populated community nestled into the valley adjacent to the southern edge of the Spring Mountains. A few residents occupying the nearby living ghost town of Goodsprings. Trout Canyon in the western Spring Mountains also supports a small community of year-round and secondary residences.

Stakeholders: Private and family ranches and landowners, Ash Meadows National Wildlife Refuge, Bureau of Land Management, the Nature Conservancy, USFWS Partners for Fish and Wildlife Program.

Existing Plans: Nye County Wildfire Protection Plan, BLM Resource Management Plan, Humboldt-Toiyabe National Forest Land and Resource Management Plan.

Resource Groups: Southern Nye County Conservation District, Conservation District of Southern Nevada, Red Rock Audubon Society.

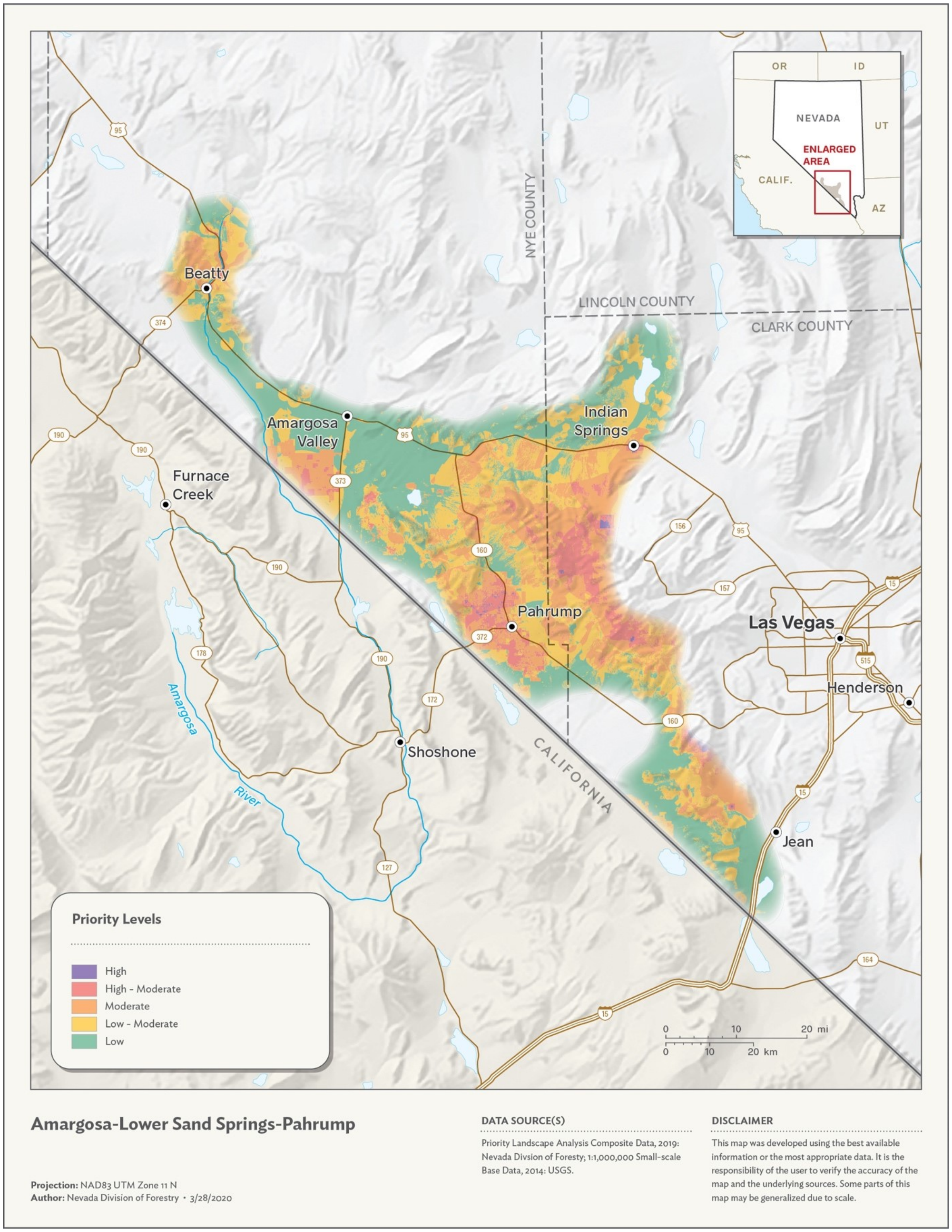

Figure 49. Map of the Amargosa-Lower Sand Springs-Pahrump priority area

Central Basin and Range

The Central Basin and Range priority landscape exemplifies Nevada's rich legacy of boom and bust gold and silver mines, with a remoteness that makes it ideal habitat for wildlife, such as the Greater Sage-grouse, elk and pronghorn. Settlements are so few and far between that one can almost drive an entire day without seeing another vehicle. Thus, the title "The Loneliest Road in Nevada" for US 50, the only east-west highway crossing over the 10,000 square mile landscape. Or, one can find solitude exploring vast wilderness areas, such as the Clan Alpine Mountains on the far northwestern side of the priority landscape area. Additional BLM wilderness areas within this landscape include the Augusta Mountains, Desatoya Mountains, Simpson Park, Antelope Range and Rawhide Mountain. Three major mountain ranges in this landscape are managed by the Humbodt-Toiyabe National Forest, each with large wilderness areas. They include the Monitor Range (Table Mountain Wilderness), the Toquima Range (Alta Toquima Wilderness) and the Toiyabe Range (Arc Dome Wilderness). Additional mountain ranges include: Louderback, Antelope Ridge, Buck Mountain, Diamond Mountains, Mountain Boy Range, Whistler Mountain, Sulphur Spring Range, Roberts Mountains, Antelope Range, Hot Creek Range, Simpson Park Mountains and Shoshone Mountains. Family owned ranches predominate in the valleys, relying on water rights from mountain fed streams and springs. The major valleys include, from east to west: parts of Newark, southern Diamond, southern Garden, Denay, Kobeh, Antelope, Little Smoky, Little Fish Lake, Antelope, Monitor, Grass, Big Smoky, Carico Lake, middle and lower Reese River, eastern Ione and Smith Creek. A Priority Mule Deer Migration Corridor runs along the far eastern extent of the priority landscape area. It extends north and south east of Newwark Valley, between Big Bald Mountain and Buck Mountain.

There are no incorporated towns within this landscape. Unincorporated towns include (with 2018 population estimate): Eureka (734), Manhattan (140), Austin (167), Kingston (123), Carvers/Round Mountain/Hadley (1,868 in 2014), and Crescent Valley (367). Living ghost towns include Belmont, Ione and Tybo. Belmont attracts summer season residents. Berlin is a ghost town in the Shoshone Mountains, occupied solely by the staff of Berlin Ichthyosaur State Park, which is Nevada's remotest state park. The upper Reese River Valley is home to the Yomba Shoshone Tribe of the Yomba Reservation, with membership of 192 in 1992, approximately 100 of which live on the reservation. Miners and their families living in Carvers, Round Mountain and Hadley inhabit a cluster of settlements next to Round Mountain Gold Mine, hence the larger population versus other towns in this landscape. These communities lie along the only continuous, paved, north to south route through this landscape, Nevada Rt. 376 south of Austin and Nevada Rt. 305 north of Austin.

Stakeholders: Private ranches, private landowners, Bureau of Land Management, US Forest Service, Nevada Department of Wildlife

Existing Plans: Nevada Wildlife Action Plan, Humboldt-Toiyabe National Forest Land and Resource Management Plan, Nevada Greater Sage Grouse Conservation Plan, White Pine Conservation District Resource Needs Assessment

Resource Groups: Eureka, Tonopah, White Pine, Big Meadow, Lander County and Lahontan Conservation Districts, Tri-County Weed Control

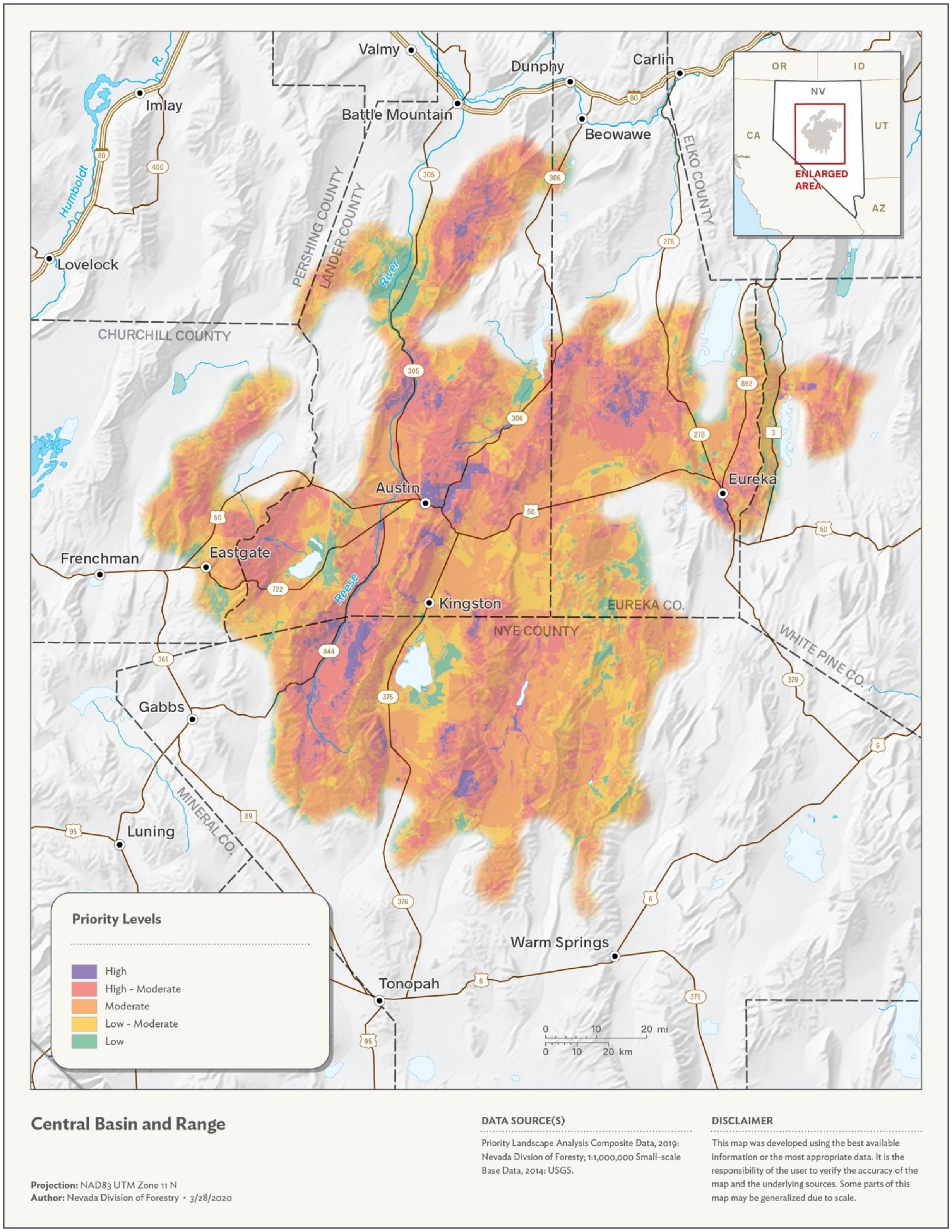

Figure 50. Map of the Amargosa-Lower Sand Springs-Pahrump priority area

Lahontan-Carson Sink

The Lahontan–Carson Sink area is in western-central Nevada in Lyon and Churchill counties with Fallon being the only populated center and dispersed ranches throughout. The largest bodies of water in the area include the Lahontan Reservoir, the Carson Sink (the seasonal wetland/lake that is the terminus of the Carson River), the Stillwater Point Reservoir, and the Stillwater Marsh. Mountain Ranges, from northeast to southwest, include the Stillwater Mountains, the Stillwater Range, the Lahontan Mountains, the Bunejug Mountains, the White Throne Mountains, the Dead Camel Mountains, and the Desert Mountains. Valleys, flats, and basins, from northeast to southwest, include Alkali Flat, Salt Wells Basin, Lahontan Valley, Turupah Flat, and Churchill Valley.

Stakeholders: Bureau of Land Management, Bureau of Reclamation, Department of Defense, Nevada Department of Wildlife, Paiute-Shoshone Tribe, State of Nevada Parks, US Fish and Wildlife Service, Private landowners

Existing Plans: Humboldt-Toiyabe National Forest Land and Resource Management Plan, Nevada Greater Sage Grouse Conservation Plan, Nevada Wildlife Action Plan

Resource Groups: Big Meadow, Dayton Valley, Lahontan, and Stillwater Conservation Districts

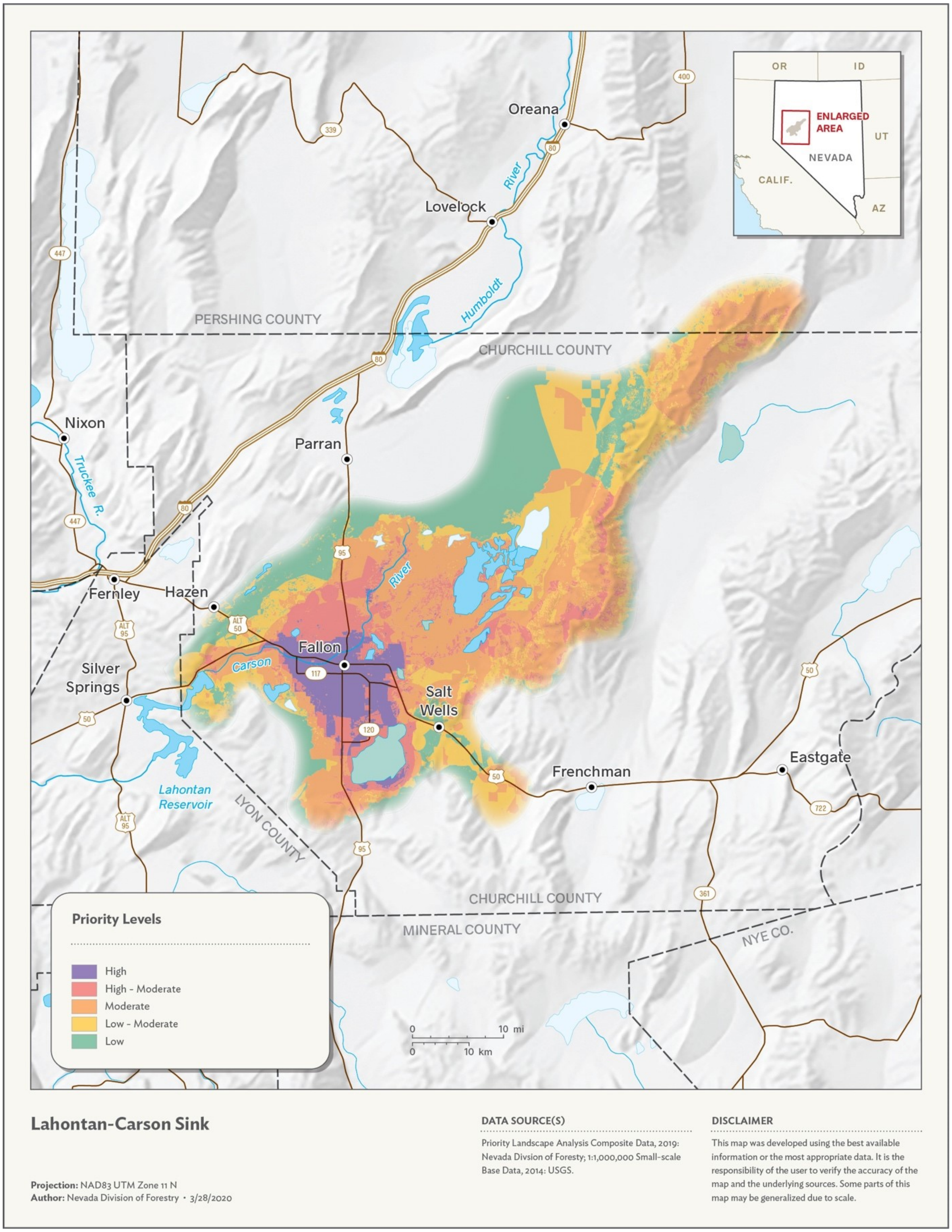

Figure 51. Map of the Lahontan-Carson Sink priority area

Lake Tahoe Basin

The Lake Tahoe Basin is in western Nevada along the California border. It covers Washoe, Carson City, and Douglas counties and is made up of part of the Carson Range and Lake Tahoe. Populated areas include Incline Village on Lake Tahoe's northeastern shore, Glenbrook and Zephyr Cove along the southeastern shore, and Stateline on the southern part of Lake Tahoe. Lake Tahoe has only one outlet, the Truckee River which is the main source of agricultural and drinking water for the cities of Reno and Sparks. The Truckee River ends at the terminal Pyramid Lake.

Stakeholders: General Improvement Districts (Incline Village, Roundhill, Kingsbury, Zephyr Cove, Marla Bay, Skyland, Cave Rock, Logan Creek), Nevada Department of Wildlife, Nevada Division of State Lands, Nevada Division of State Parks, Nevada State Public Works, North Lake Tahoe Fire Protection District, Private Landowners, Tahoe Douglas Fire Protection District, Tahoe Regional Planning Agency, US Forest Service

Existing Plans: Carson City Community Wildfire Protection Plan (CWPP), Carson Range Multi-jurisdictional Fuels Reduction and Wildfire Prevention Plan, Douglas County CWPP, Lake Tahoe Nevada State Park Vegetation Management Plan, Nevada Wildlife Action Plan, Humboldt-Toiyabe National Forest Land and Resource Management Plan

Resource Groups: Carson Valley Conservation District, Nevada Tahoe Conservation District, Tahoe Fire and Fuels Team, Tahoe Fund, Tahoe Network of Fire Adapted Communities, Tahoe Regional Planning Agency, Washoe Storey Conservation District, Washoe / Storey County Weed Management Area, Nevada Tahoe Conservation District

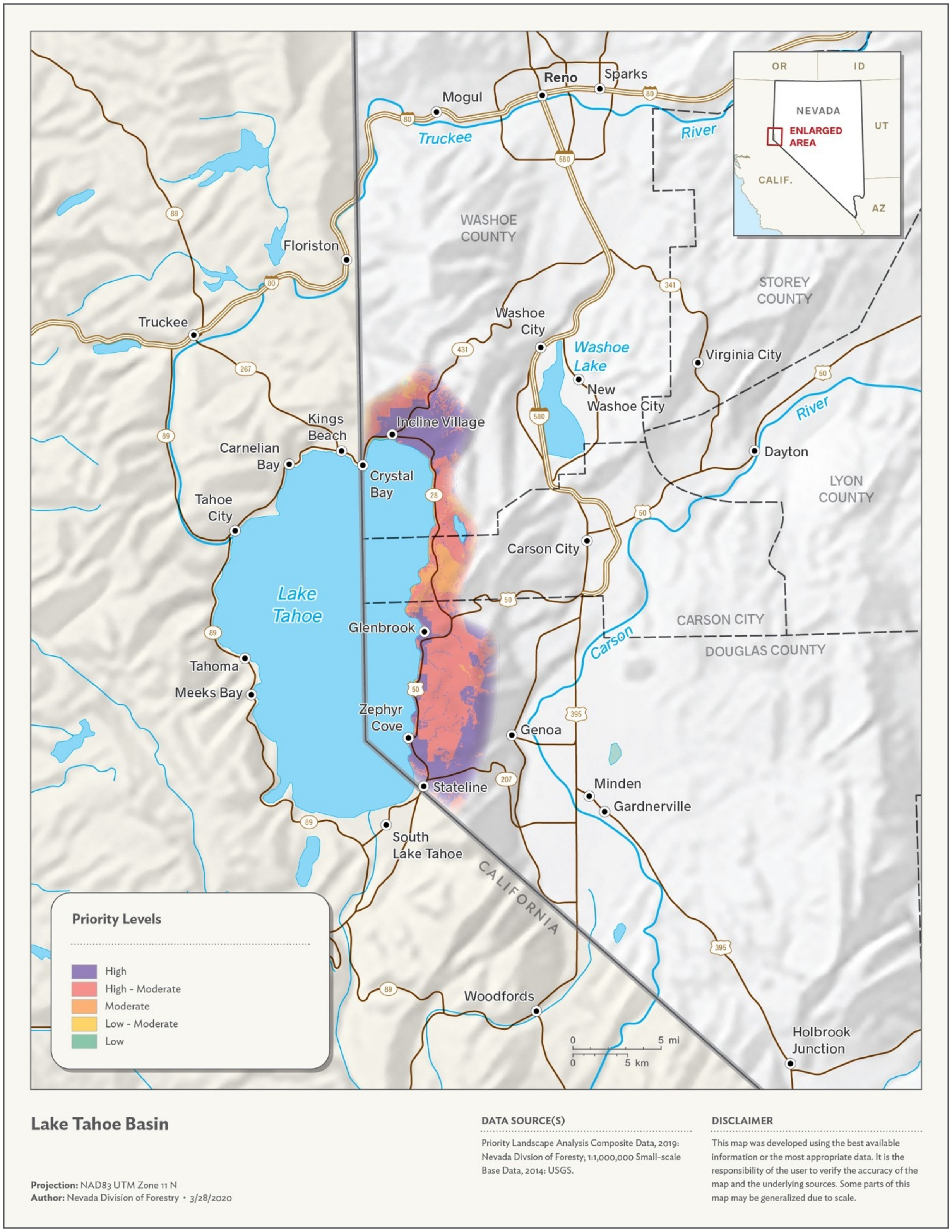

Figure 52. Map of the Lake Tahoe Basin priority area.

Las Vegas Valley-Islands in the Sky

The Las Vegas Valley–Islands in the Sky landscape includes the Las Vegas Valley, which supports over three-quarters of the state's human population. Beyond the valley, historically the source of multiple springs and ephemeral stream flows into the Colorado River resulting from drainage from the Spring and Sheep mountain ranges, the landscape includes surrounding habitat west toward the Colorado River basin (the formal "Las Vegas Wash"), south including the Sloan Canyon National Conservation Area, west including the east side of the Spring Mountain range, and north through the Sheep range of the Desert National Wildlife Refuge (the largest wildlife refuge in the contiguous United States). Charleston Peak, the high point of southern Nevada at 11,919 feet, and the surrounding mountainous region functions as the region's "island in the sky", supporting many unique and endemic plant and animal species in this range that is surrounded by the southwestern United States driest desert. Historically, the Las Vegas Wash proper served as the output from the hydrographic basin captured in this landscape, with runoff from precipitation and snowmelt flowing into the Colorado River. In modern times, the Las Vegas wash perennially delivers treated wastewater, stormwater, and urban runoff into Lake Mead.

The Las Vegas Valley contains the cities of Las Vegas, Henderson, and North Las Vegas, with a variety of unincorporated communities including Blue Diamond, Paradise and Summerlin, among others. Boulder City, established with the building effort for Hoover Dam in the 1930's, lies in the southeast section of the landscape with communities nestled in the Spring Mountains including Mountain Springs and Mt. Charleston in Kyle Canyon. Kyle Canyon and Lee Canyon are popular and accessible recreational and residential sites nestled in mixed conifer forests in the shadow of Charleston Peak.

Stakeholders: Private landowners, city and regional municipalities, Bureau of Land Management, USFWS, US Forest Service, Las Vegas Valley Water District, Southern Nevada Water Authority.

Existing Plans: Clark County Multi-Species Habitat Conservation Plan, BLM Resource Management Plan, Las Vegas Wash Comprehensive Adaptive Management Plan, Las Vegas Wash Wildlife Management Plan, Humboldt National Forest Land and Resource Management Plan, Southern Nevada Conservation District Resource Needs Assessment

Resource Groups: Las Vegas Wash Coordinating Committee, Conservation District of Southern Nevada, Regional Open Space Trails Group, Desert Wetlands Conservancy, Red Rock Audubon Society, Southern Nevada Conservancy, Friends of Red Rock Canyon, Friends of Nevada Wilderness, Partners for Fish and Wildlife Program, Lincoln County Conservation District.

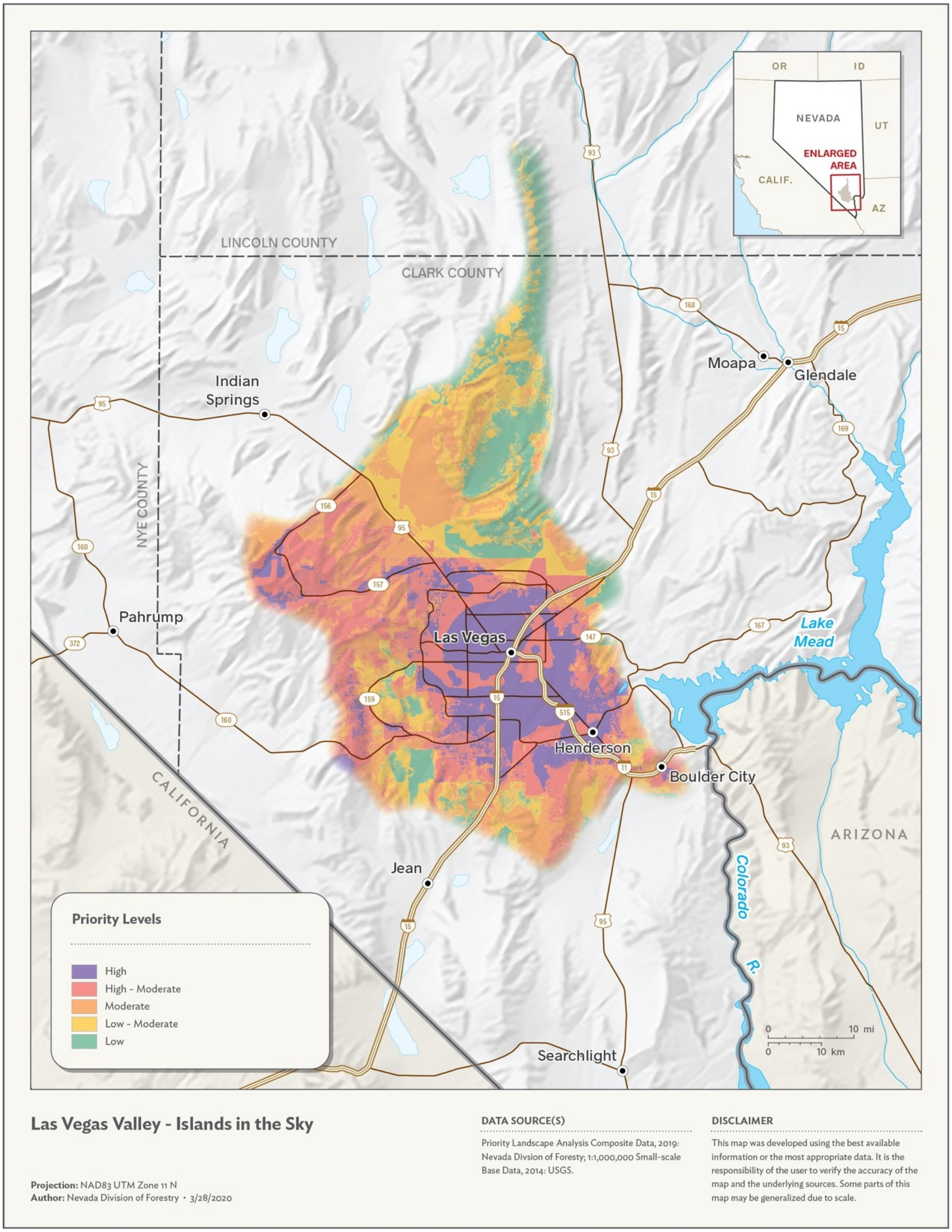

Figure 53. Map of the Las Vegas Valley-Islands in the Sky priority area

Meadow Valley Wash

Meadow Valley Wash is a perennially flowing major north-south wash system running over 80 miles from the confluence with the Muddy River in Moapa Valley at the Mormon Mesa up to north of Panaca, Nevada where the ecosystems transition to Great Basin vegetation. Most of the land is owned by BLM, with 97 percent of the landscape federally managed. The landscape typifies the transition between Mojave Desert and Great Basin encompassing the transition zone between northern Mojave Desert and Great Basin ecosystems – a unique and narrow strip with dramatic cliffs, iconic communities and limited ranges like Joshua tree or blackbrush communities. The system stretches from the far eastern Mojave Desert with the town of Moapa on the southern tip to the landscape north of the town bounded by Kane Spring canyon and the Mormon Mountains, encompassing the Tule Desert. The Clover mountains and Delamar mountains reach up to 7000 feet; Rainbow Canyon and broad valleys divide the ranges that encompass a rich cultural history for native peoples and European settlers. Higher elevations into the Clover Mountains Wilderness area feature ponderosa and aspen forests rare to southeastern Nevada, and perennial streams support a rich riparian life. Rainbow Canyon, south of Caliente is a scenic backcountry byway experience. Meadow Valley wash features wetlands and seeps throughout its extent. Due to the north-south alignment and waterway supporting riparian habitat throughout, the wash supports significant wildlife habitat and serves as an important migration corridor for riparian and Mojave Desert species.

Human populations are limited in this region that is almost entirely federally owned, and nearly entirely rural. The towns of Panaca and Caliente share the northern part of the landscape with a small and scattered population of some residents that reside in former pioneer settlements or living ghost towns (such as Barclay), and people spread across rural ranches and farms. The southern range of the landscape skirts across the north end of the Moapa Valley community.

Stakeholders: Private landowners, Bureau of Land Management, USDA-Natural Resources Conservation Service, Nevada Division of Wildlife

Existing Plans: Southeastern Lincoln County Habitat Conservation Plan, Lincoln County Resource Needs Assessment, Meadow Valley/ Clover Creek Watershed Management Plan, Condor Canyon Habitat Management Plan

Resource Groups: Lincoln County Conservation District, Lincoln County Local Area Working Group, Audubon Society, Tri-county weed, Lincoln County Coordinated Resource Management Steering Committee, USFWS Partners for Fish and Wildlife Program, Conservation District of Southern Nevada

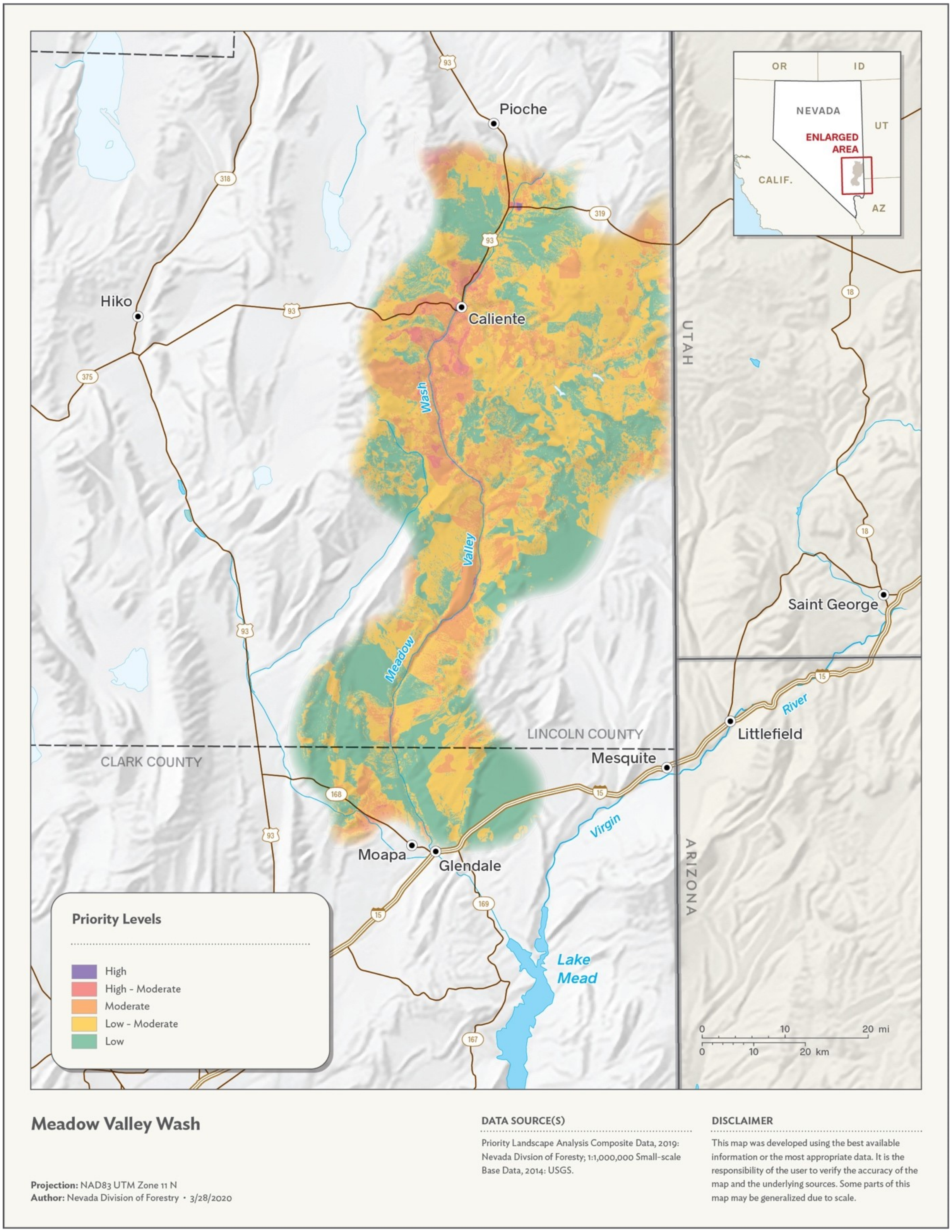

Figure 54. Map of the Meadow Valley Wash priority area

Moapa-Mead-Virgin

The Moapa-Mead-Virgin landscape encompasses the largest two tributaries of the Colorado River, that feed into man-made Lake Mead, which out-flows into the flooded Colorado River basin. The landscape ranges from the southern-most section of Nevada's border with Utah, southeast toward Las Vegas with the boundary as the state line that bisects the Colorado River as it runs south along the Nevada-Arizona border. Parks and protected natural areas make up much of this landscape, including the northernmost section of Lake Mead National Recreation area, Valley of Fire State Park with its iconic red sandstone formations, the Muddy Mountain and pinto valley wilderness. Most of this landscape is comprised of low elevation Mojave Desert plant communities. A great diversity of landforms and exposed surface geological features with varying soil composition results in diverse and varied plant communities throughout the region and supports an abundance of state critically endangered plant species that favor exposed windswept sand deposits. Wildlife, including the iconic bighorn sheep and desert tortoise, depend on intact habitat throughout much of the region. Riparian corridors (often forested with willows, cottonwoods, and invasive saltcedar) along the Virgin and Muddy River serve as vital habitat for migrating species including federally threatened birds such as the Southwestern Willow Flycatcher and Yellow-Bellied Cuckoo. Virgin Peak, the regional high point at just over 8000 ft supports mixed conifer forests dominated by fir, pinyon-juniper, and cypress. Elevation of this magnitude with perennially flowing springs provides an essential respite for wildlife during tough summer months.

Just to the northeast of Las Vegas, the Moapa-Mead-Virgin landscape is home to rural communities throughout the Moapa Valley including the unincorporated town of Moapa, Overton, and Logandale; all historically dependent on the Muddy River for agricultural development. Closer to the Utah border and nestled on the north banks of the Virgin River is the City of Mesquite (population approximately 21,000) and town of Bunkerville. Ranching and farming operations are active components of the local economy tied to the water resources provided by the Virgin River. Easy access to public lands and wilderness makes this region a hub for outdoor recreational opportunities.

Stakeholders: Bureau of Land Management, Moapa Valley Paiute Tribe, City of Mesquite, Clark County Desert Conservation Program, US Fish and Wildlife Service, Nevada Department of Wildlife, National Park Service.

Existing Plans: Clark County Multi-Species Habitat Conservation Plan, City of Mesquite Wildfire Protection Plan, Conservation District of Southern Nevada Resource Needs Assessment, Virgin River Integrated Watershed Plan, U. S. Bureau of Land Management/National Park Service Riparian Restoration Plan, Virgin River Integrated Watershed Plan.

Resource Groups: Virgin River Conservation Partnership, Virgin River Coalition, Partners in Conservation, Friends of Nevada Wilderness, Friends of Gold Butte, Nevada Off-Highway Vehicles Program, Virgin River Coalition, Conservation District of Southern Nevada, Lincoln County Conservation District

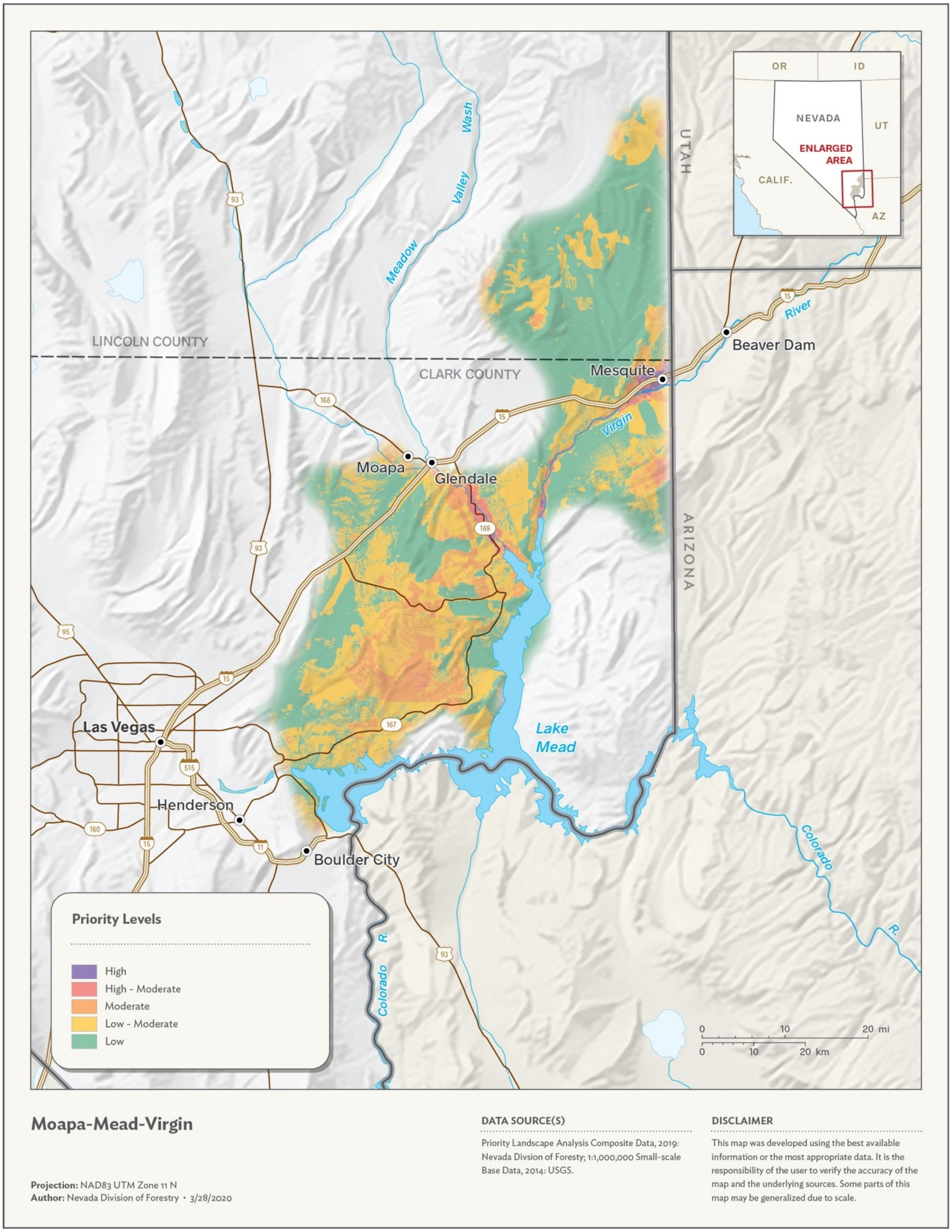

Figure 55. Map of the Moapa-Mead-Virgin priority area

Montana-Quinn-Kings

Montana-Quinn-Kings area is in northwestern Nevada along the Oregon border. This is a remote area with a few ranches interspersed. Mountain ranges, from north to south, include the Bilk Creek Mountains, the Granites, the Montana Mountains, and part of the Double H Mountains. A portion of Kings River Valley is included in this area. The Kings River is a tributary of the Quinn River and included in the Quinn watershed. The Quinn River drains into the Black Rock Desert.

Stakeholders: Nevada Department of Wildlife, private landowners, US Forest Service

Existing Plans: Humboldt-Toiyabe National Forest Land and Resource Management Plan, Nevada Greater Sage Grouse Conservation Plan, Nevada Wildlife Action Plan

Resource Group: Quinn River Conservation District

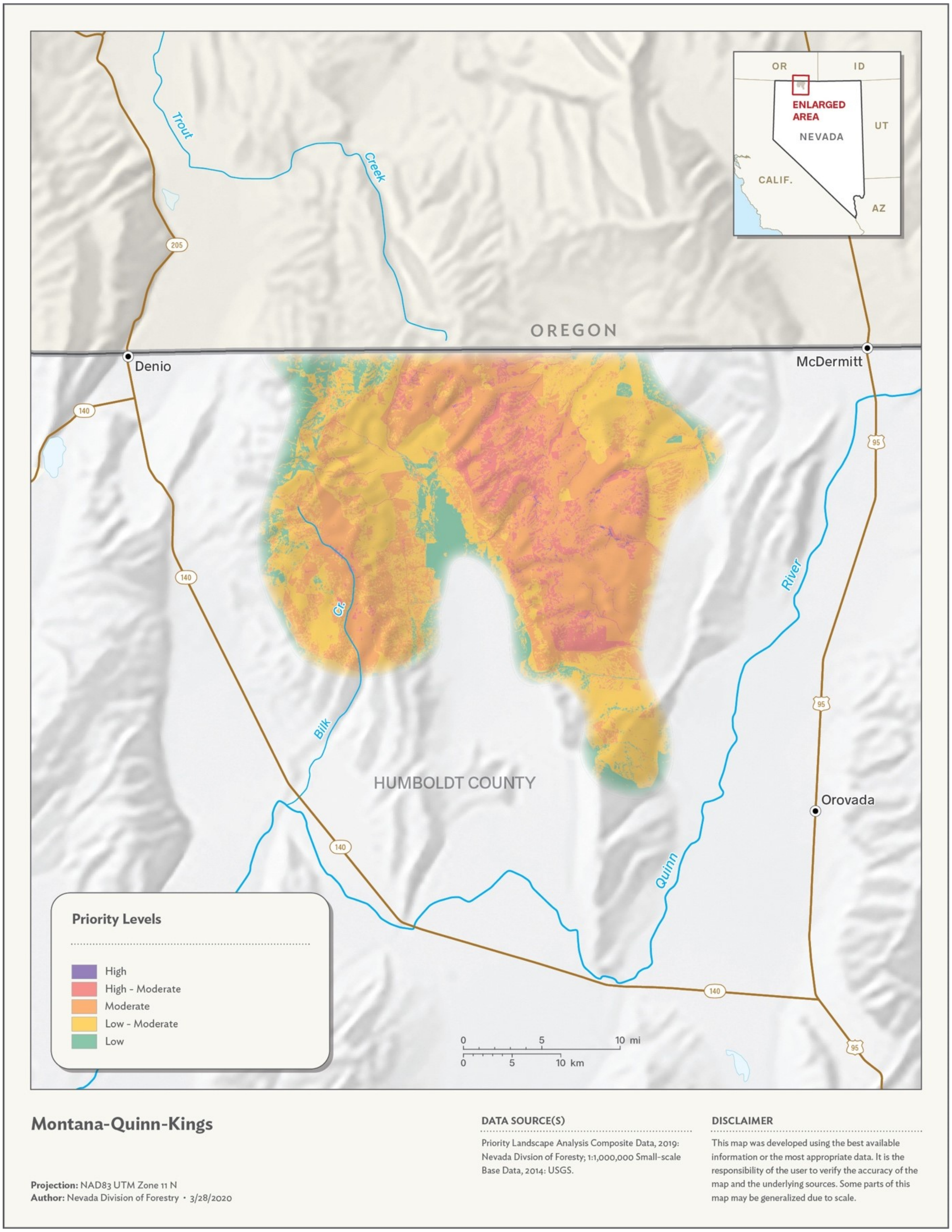

Figure 56. Map of the Montana-Quinn-Kings priority area.

North Fork-Middle Humboldt

The North Fork-Middle-Humboldt priority landscape represents the watershed of the North Fork of the Humboldt River, plus valleys and uplands along the Humboldt River from Elburz downstream to Emigrant Canyon and Osgood Mountains. It is nearly surrounded by other priority landscapes, which differ by not including a major river and including higher elevation watersheds. The North Fork-Middle-Humboldt priority landscape encompasses the many mountains and valleys characteristic of the Great Basin, but do not always have typical north-south orientation. East of the North Fork of the Humboldt River is sage-steppe vegetation with volcanic peaks and the ash plains, including the endemic plant rich Sunflower Flats. In the south the volcanic lands transition into the Adobe Range. West of the river are the eastern slopes of the Independence Mountains. The river valley itself is curiously unnamed, despite having rich wet meadows. The south boundary is characterized by the Humboldt River and the mountains and ridges immediately south of it, such as the Elko Hills, Grindstone and Buckskin Mountains, Emigrant Pass Ridge, Argenta Rim and Antler/North/Long Peaks (i.e. the "Battle Mountains"). Valleys within this landscape lie both to the north and south of the Humboldt River. To the south are the northern Crescent Valley, Whirlwind Valley and non-flowing stretches of the most northern extent of the Reese River Valley. Major valleys to the north of the Humboldt River include Boulder Valley, Argenta Marsh and Red House Flat. Mountains and hills north of the Humboldt River include the Osgood Mountains, the southwestern extent of the Sheep Creek Range, the Tuscarora Mountains (a. k. a. Carlin Trend), the far southern extent of the Independence Range and the Adobe Range.

Along the Humboldt River are the towns of Elko, Carlin, and Battle Mountain. Unincorporated towns along the river corridor include Ryndon, Osino, plus the smaller settlements of Palisade, Beowawe, Valmy, and Whiterock. There are many privately owned "railroad sections" within 50 miles of the Humboldt River, which complicates public land management. Major land ownership includes the Humboldt-Toiyabe National Forest, Bureau of Land Management, plus both corporate owned and family ranches. Two major examples of corporate ranches are Horseshoe Ranch north of Beowawe and IL Ranch near Argenta. They are owned by Nevada Gold Mines and operated as their Elko Land and Livestock Company subsidiary. They provide mitigation for large open pit gold mines. The Humboldt River is a Clean Water Act 303(d) listed impaired river. This stretch of the Humboldt River is historically important as part of the California Trail and the route for the first transcontinental railroad.

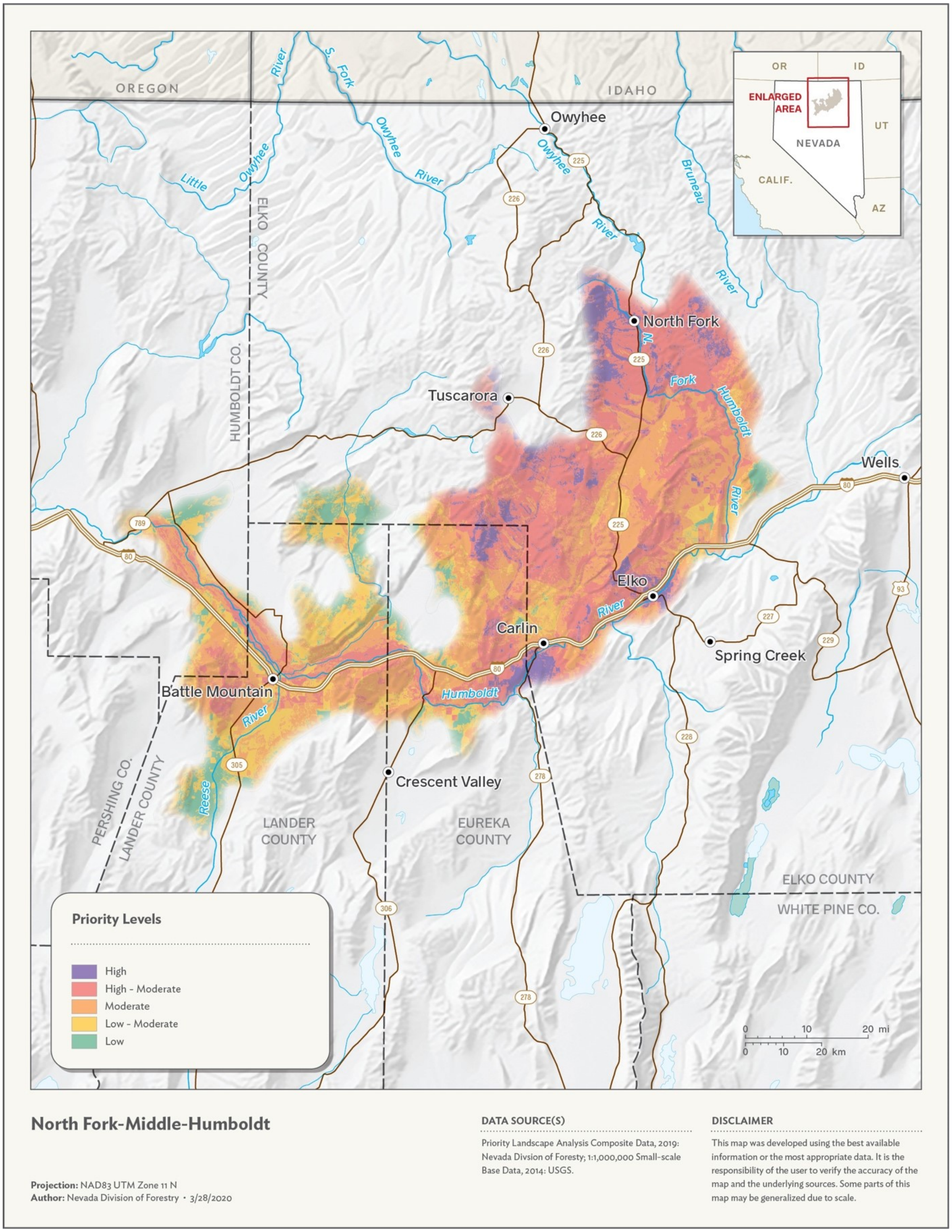

Figure 57. Map of the North Fork-Middle-Humboldt priority area

Stakeholders: private and corporate landowners, Bureau of Land Management, Nevada Department of Wildlife, US Forest Service

Existing Plans: Humboldt-Toiyabe National Forest Land and Resource Management Plan, Nevada Greater Sage Grouse Conservation Plan, Nevada Wildlife Action Plan

Resource Groups: Humboldt Watershed Cooperative Weed Management Area, Northeastern Nevada Stewardship Group, Eureka, Jiggs, Owyhee, Lamoille, Starr Valley, and Paradise/Sonoma Conservation Districts, The Nature Conservancy – Nevada Chapter, Trout Unlimited

North Washoe-Sheldon

The North Washoe-Sheldon priority landscape is notable for its low level of habitat fragmentation over vast areas of mixed sagebrush and juniper savanna. This remote area, from Black Rock Desert to where Nevada borders Oregon and California, has strong floristic affinities to the Columbia Plateau of Idaho and Oregon. The two most common landforms include narrow canyons that empty into rolling valleys with no drainage outlets to the ocean, and broad flat volcanic tablelands that end abruptly in vertical cliffs. There are no towns and the only paved road (Nevada Rt. 140) crosses the northeastern part of the nearly 895 sq. mi. Sheldon National Wildlife Refuge. Ownership is predominately Bureau of Land Management and US Fish and Wildlife Service. Most of this priority landscape provides critical habitats for species endemic to sagebrush-steppe, including pronghorn antelope, mule deer, greater sage-grouse, pygmy rabbit, migratory birds, desert fishes, and a range of rare plants and invertebrates.

North Washoe-Sheldon is a 5,083 sq. mi. priority landscape which also includes parts of the Black Rock Desert - High Rock Canyon Emigrant Trails National Conservation Area (including the North Black Rock Range Wilderness) and the High Rock Canyon wilderness complex. The southwest extent of the landscape is Black Mountain, continuing north along the California state line to encompass, Duck Lake, Coppersmith Hills, Hays Canyon Range, and the intermittent lake complex of Cook, Alkali, Holy and Mosquito Lakes. It excludes the south end of Long Valley and Fortymile Creek. Along the Oregon border the area encompasses, west to east, Long Canyon, Catnip Mountain, Sage Hen Hills, Gooch Table, southwestern Big Spring Table, McGee Mountain, Bog Hot Valley and the Pueblo Mountains and valley. The eastern boundary includes the Pine Forest, Rock and Black Rock Ranges. The southeastern extent is defined as the southern extent of the Black Rock Range, west to South Donnelly Peak and south to include the south end of Granite Range. Then west again the area perimeter crosses Buffalo Creek near Chimney Rock, through the Buffalo Hills to the north end of Black Mountain at the California state line.

Stakeholders: Bureau of Land Management, Nevada Department of Wildlife, private landowners, US Forest Service, US Fish and Wildlife Service

Existing Plans: Humboldt-Toiyabe National Forest Land and Resource Management Plan, Nevada Greater Sage Grouse Conservation Plan, Nevada Wildlife Action Plan

Resource Groups: Vya, Quinn River, Big Meadow, and Washoe/Storey Conservation Districts

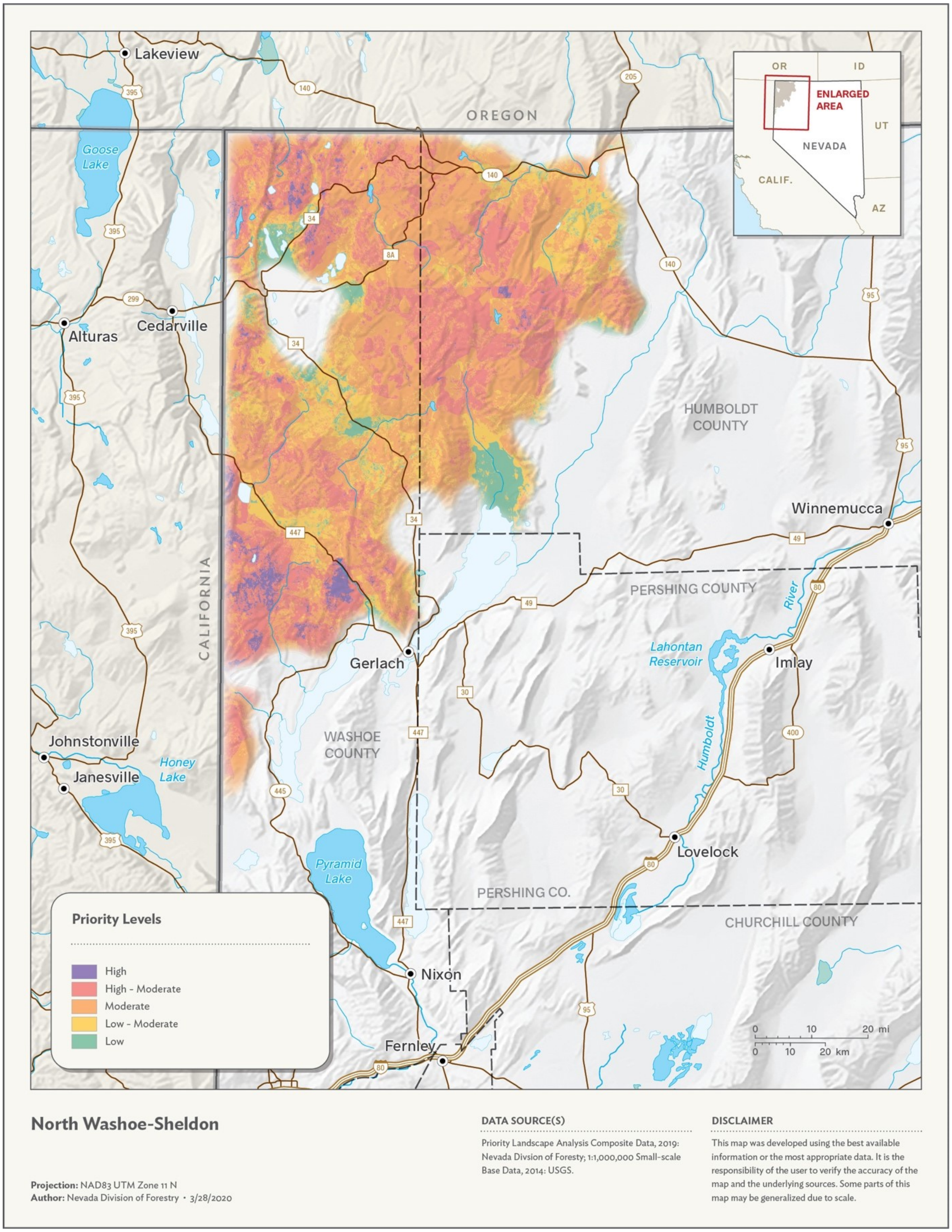

Figure 58. Map of the North Washoe-Sheldon priority area

Northeast Elko

The Northeast Elko Priority Landscape lies south of the Nevada-Idaho state lines from Elk Mountain in the Jarbidge Mountains east to Jackpot and ultimately the northeastern corner of Nevada. It then extends south to Nevada Highway 233 in the Tecoma Valley. The boundary skirts the unincorporated town of Montello and a montane extension continues south from Oasis on Interstate 80 in the Goshute Valley to US Highway 93A to include the Toano Range and Goshute Mountains. Another southerly extension begins at Oasis and includes the Pequop Mountains and their alluvial fans. North of Oasis the priority landscape includes many minor mountain ranges and isolated peaks, including the Windermere Hills, Ninemile Mountain, and Murdock Mountain. This watershed drains into the Tecoma Valley Depression, which has one major feeder stream named Thousands Spring Creek. Further north, the priority landscape includes more minor ranges and peaks, such as the Delano Mountains, Deadline Ridge and Gollaher Mountain. These have a major drainage named Goose Creek, which flows into Utah. South of Jackpot is the Salmon Falls Creek headwaters, which drains the Granite Range to the east and Snake Mountains to the west. Dividing this watershed is US 93. In the far western part of the priority landscape is the O'Neil Basin to the north and Mary's River to the south. The Humboldt River forms the southwestern boundary and while the western edge is framed by the Jarbidge Mountains. A priority mule deer migration corridor crosses the priority landscape from O'Neil Basin to the Pequop Mountains and Toano Range. Wildlife crossings have been constructed where these corridors intersect US 93 and Interstate 80.

Only one unincorporated town, Jackpot, lies within this priority landscape. The valley rangelands usually receive more than 10 inches of precipitation and support modest family and large corporate ranches, which typically have productive wet meadows in their ownership. Advocacy for maintaining economically sustainable ranching to support rural lifestyles is very prominent in this landscape. It is also an area for collaborative stewardship, where natural resource professionals are welcome to share and practices ideas with ranch owners and managers to make their private rangelands and allotments more productive. Major wildfires since 2017 include the Delano, HD Summit, and Grouse Creek.

Stakeholders: Family and corporate ranches, "railroad section" absentee small tract landowners, Bureau of Land Management

Existing Plans: Stewardship Alliance of Northeastern Elko County Stewardship Plan, Resource Needs Assessment (Northeast Elko Conservation District)

Resource Groups: Stewardship Alliance of Northeastern Elko County, Elko Association of Conservation Districts (Northeast Elko, Ruby Valley, Starr Valley, and Clover Valley Conservation Districts), Shoesole

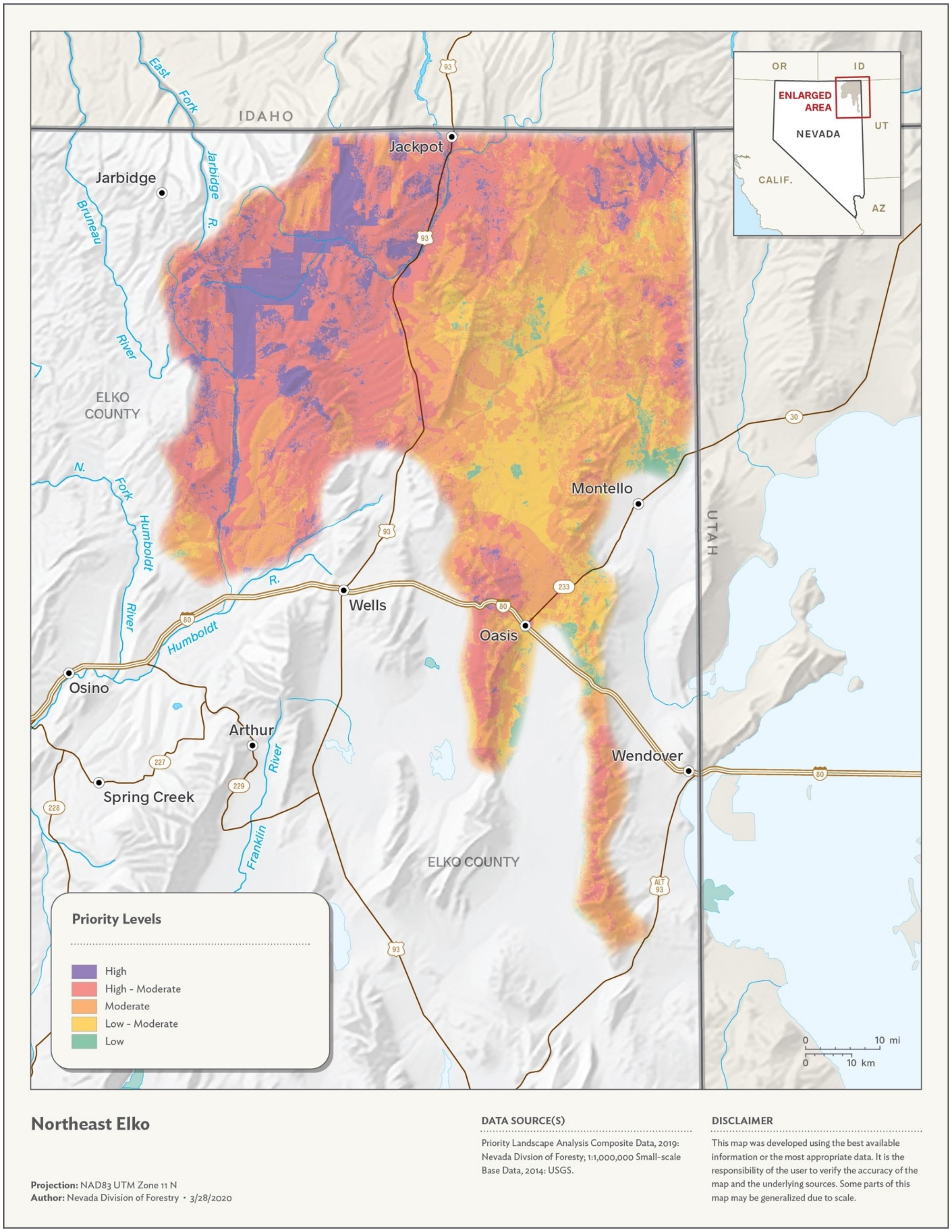

Figure 59. Map of the Northeast Elko priority area

Owyhee-Bruneau-Jarbidge

The Owyhee-Bruneau-Jarbidge priority landscape encompasses the watersheds of the Owyhee River and South Fork of the Owyhee River south of the Nevada-Idaho state line. This includes the vast Owyhee Desert west of the Duck Valley Indian Reservation to the Little Owyhee River and the Jarbidge Mountains to Elk Mountain, far east of the reservation. At Elk Mountain, the priority landscape boundary runs southwest to include the higher montane areas of the Jarbidge Mountains, with the Stag Mountains delineating the southern extent. The boundary continues northwest to encompass the upper Bruneau River watershed to approximately Mt. Ichabod, where it tends westerly to the eastern side of the Independence Mountains. Thence south, encompassing the Independence Mountains to Taylor Canyon, where it tends northwest to encompass Independence Valley. Near McCann Creek Mountain, it runs south to include the Tuscarora Mountains to just past Sugarloaf Butte. Thence, the boundary runs southwest to Antelope Creek, where it turns northwest to include Willow Creek Ridge, Squaw Valley and Castle Ridge. Finally, the boundary continues northwards through the Owyhee Desert to the state line at the Little Owyhee River.

Only three towns are included within the landscape area: Tuscarora, Mountain City and Owyhee. Tuscarora and Mountain City are living ghost towns with no services beside U. S. Post Offices. Wild Horse Reservoir State Recreation Area is a small park along the east shore of Wild Horse Reservoir, a Bureau of Indian Affairs controlled irrigation water supply reservoir for the Duck Valley Reservation. Land ownership is primarily Humboldt-Toiyabe National Forest, Bureau of Land Management and large ranch holdings, including the Petan Ranches and the IL Ranch, owned by Nevada Gold Mines and operated as Elko Land and Livestock Company. Independence Valley is the nexus for multiple family ranching operations, which utilize the public lands as grazing allotments. Ormat operates a geothermal plant in Independence Valley. Two huge wildfires occurred in this priority landscape since 2018: the Martin Fire, which impacted the Owyhee Desert area and the South Sugarloaf, which burned the northern Independence Mountains, east across the Owyhee River to the Bruneau River. Many priority mule deer migration corridors cross these and previously burned lands. Shrub restoration on these burns is critical because deer can starve crossing landscapes, they habitually traverse, only to find no browse at their destinations.

Stakeholders: Private and corporate ranches, US Forest Service, Bureau of Land Management, Bureau of Indian Affairs, Wild Horse State Recreation Area

Existing Plans: Humboldt-Toiyabe National Forest Land and Resource Management Plan, Nevada Greater Sage Grouse Conservation Plan, Nevada Wildlife Action Plan

Resource Groups: Elko Association of Conservation Districts (Owyhee, Duck Valley, Northeast Elko, and Starr Valley Conservation Districts)

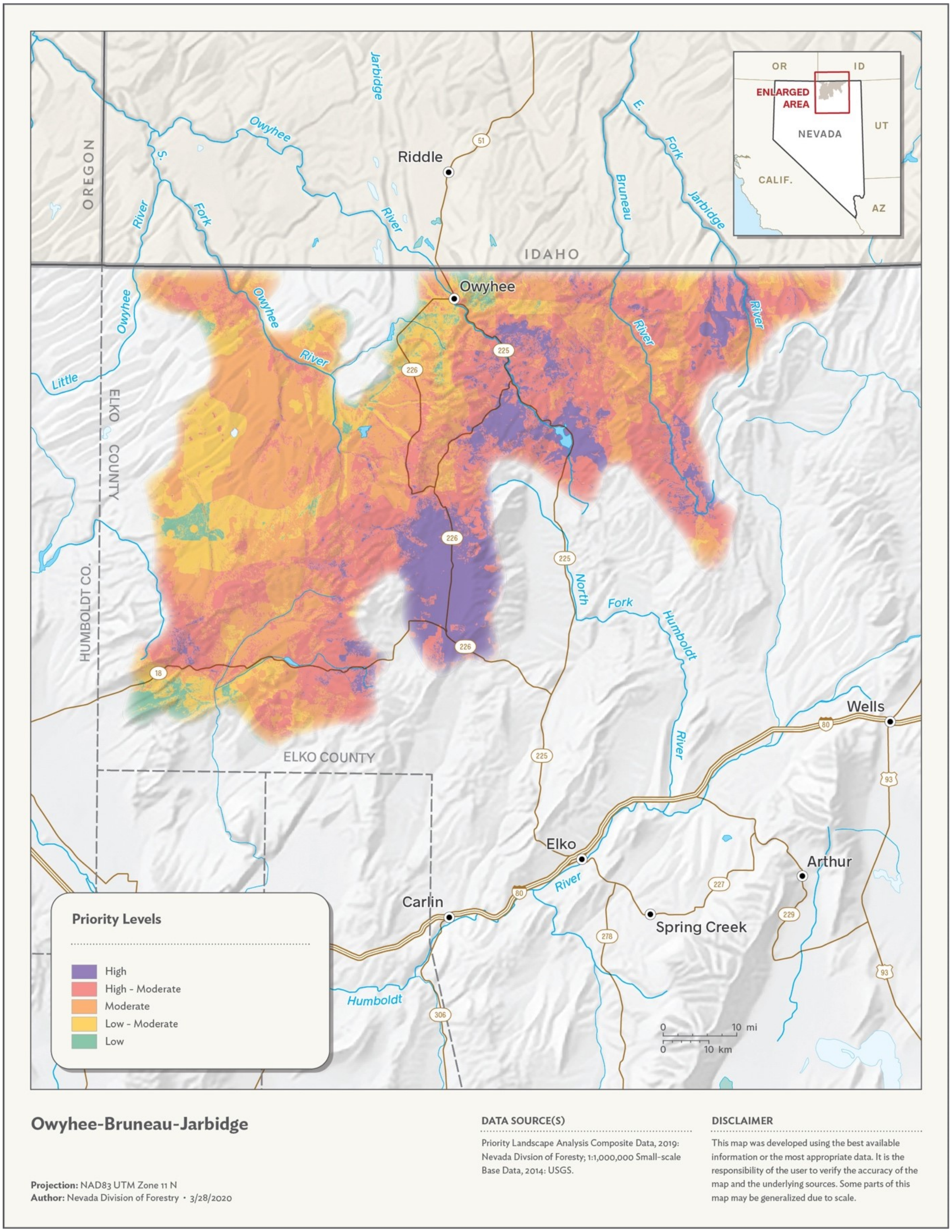

Figure 60. Map of the Owyhee-Bruneau-Jarbidge priority area

Pahranagat Valley

Located entirely in southeastern Lincoln County, the Pahranagat Valley extends from the north side of the Mt. Irish Wilderness and the Pahranagat Range following the valley bounded by the Pahranagat range on the west and the Hiko and Pahroc ranges forming the eastern borders of the landscape. The Pahranagat Valley National Wildlife Refuge (5,382 acres), and the Key Pittman Wildlife Management Area (1,332 acres) link together managed water bodies (lakes, marshlands, cottonwood galleries, and surrounding desert shrub dominated landscapes) with a series of privately-owned ranches which fall along the “pacific flyway”, one of the principal migratory routes in the western United States. Rich valley bottom lands and conservation areas are dependent on water discharged from carbonate rocks within the Pahranagat Valley, largely originating from Hiko, Crystal, and Ash Springs, making watershed management and protection of the associated recharge zones a top priority for effective land management. The valley and series of open waters, including springs, are considered “important bird areas”, hosting habitat that supports critical migratory bird pathways, endemic fish and spring snails and threatened Southwestern Willow Flycatcher habitat. These riparian corridors (supporting imperiled willow and cottonwood forests) and surrounding higher elevation landscapes provide ample recreation opportunities, have significant archaeological resources representing thousands of years of human use (exemplified by the Mt. Irish archaeological district), and support an abundance of recreational opportunities and wildlife habitat for migratory birds, deer, reptiles, small mammals, and endemic fish and spring snails. Small unincorporated communities dot the valley, including Alamo, Ash Springs, and Hiko.

Stakeholders: Private ranches and landowners, US Fish and Wildlife Service, Nevada Department of Wildlife, Bureau of Land Management, Lincoln County Conservation District, Natural Resources Conservation Service, Local Area Work Group

Existing Plans: Lincoln County Resource Needs Assessment, Southeastern Lincoln County Habitat Conservation Plan, Lincoln County Wildfire Protection Plan

Resource Groups: Lincoln County Conservation District, Audubon society, Tri-County Weed, Pahranagat Valley Cooperative Weed Management Area, Pahranagat Valley Cooperative Weed Management Area

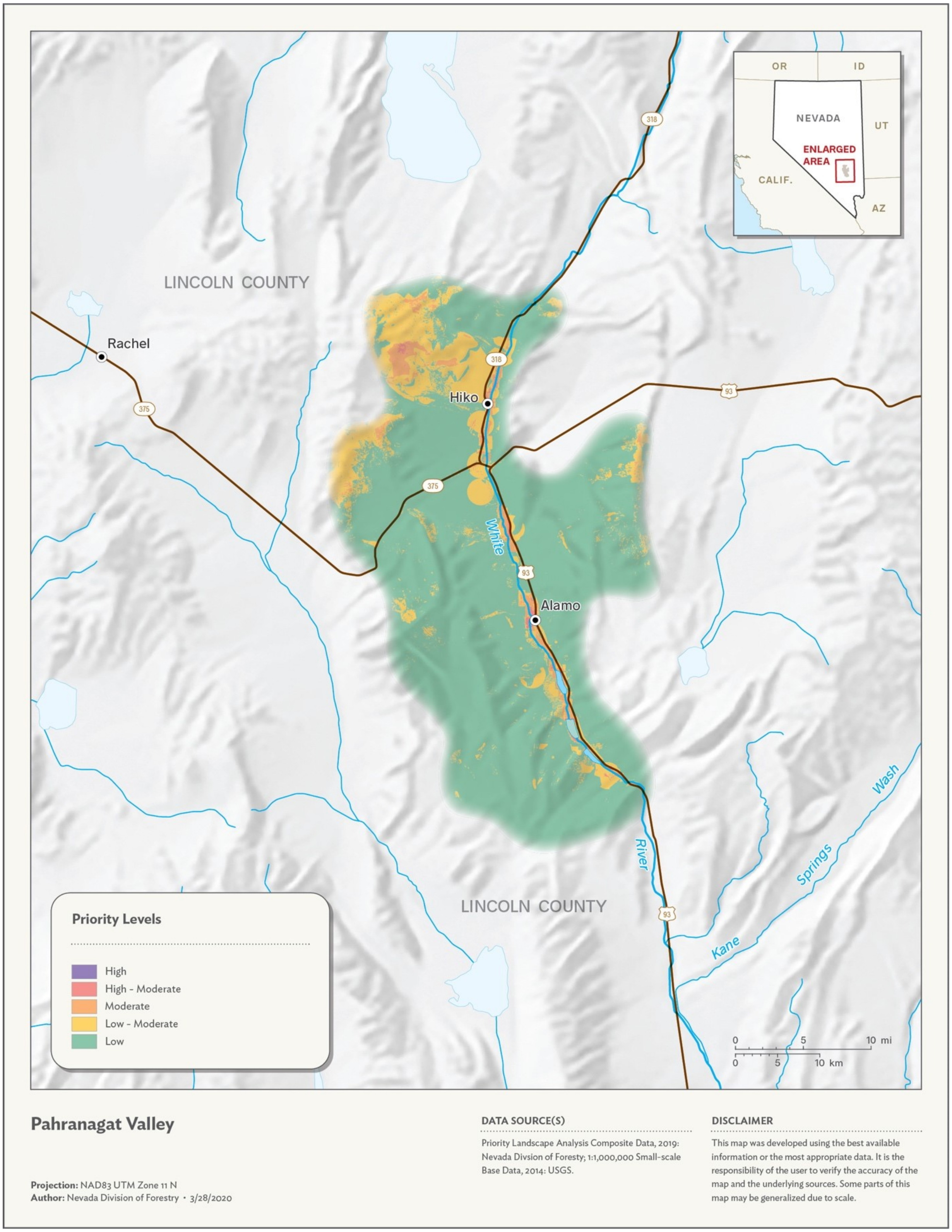

Figure 61. Map of the Pahranagat Valley priority area

Piute-Eldorado

The Piute-Eldorado landscape follows the Colorado River corridor south from the Hoover Dam (on the Nevada-Arizona border) encompassing the Eldorado Wilderness, Wee Thump Joshua Tree wilderness, Piute Valley, the McCullough mountains with the South McCullough wilderness areas, and the Nevada portion of the New York Mountains. Lake Mead National Recreation Area straddles the Colorado River, managing the lands surrounding the Colorado River valley which contains crucial riparian and aquatic habitat as well as steep and diverse mountain habitats supporting a wide variety of wildlife species between the Hoover and Davis Dams. South of Davis Dam lies the town of Laughlin, Nevada and Bullhead City on the Arizona side leaving the Colorado River corridor developed for much of the riverfront. State park and conservation easements preserve some of the remaining undeveloped riparian habitat on the southernmost tip of the state, providing crucial stopovers for species along the Colorado River migratory route. This southern tip of Nevada and the craggy granitic mountains that typify the Spirit Mountain Wilderness – a culturally significant site of human creation according to Pai tribal beliefs with abundant archaeological resources. The diverse environments range from low elevation desert shrublands to higher elevation pinyon-juniper woodlands support species unique to much of Southern Nevada along the transition zone from Sonoran to Mojave deserts. The western portion of the landscape hosts phenomenal Joshua tree woodlands. Small unincorporated communities such as Nelson and Searchlight are in sites historically rich with mining resources. Laughlin, with a population of approximately 7,000 is the southernmost town in Nevada, thriving on the casino industry economy with visitors taking advantage of the Colorado River resources for recreational opportunities.

Stakeholders: Tribal governments, Nevada State Parks, Bureau of Land Management, Bureau of Reclamation, Southern Nevada Water Authority, Local municipalities

Existing Plans: Southern Nevada Multispecies Habitat Conservation Plan, Lower Colorado River Habitat Conservation Plan, Lake Mead Exotic Plant Management Plan

Resource Groups: Lower Colorado River Cooperative Weed Management Area, Conservation District of Southern Nevada, Eastern Mojave Conservation Collaborative

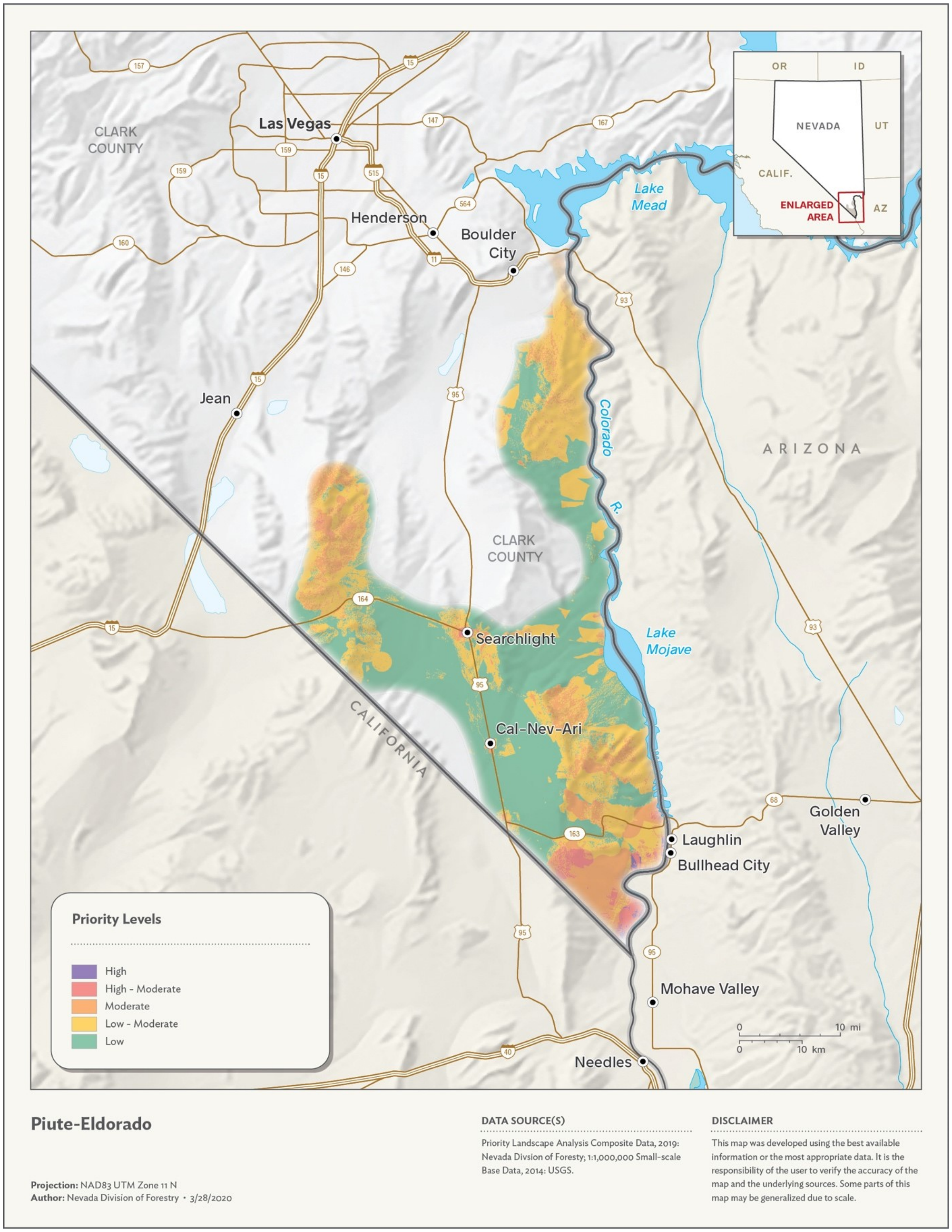

Figure 62. Map of the Piute-Eldorado priority area

Ruby-Cortez

The Ruby-Cortez priority landscape encompasses lands from the upper Humboldt River at Elburz east to Wells and the southern end of the Snake Mountains, thence south to the Clover Valley, to include the East Humboldt Range. At the southeastern extent of the boundary, there is a spur to the northeast which includes the southern half of Spruce Mountain and the southern end of the Pequop Mountains. The southwest boundary includes Ione Butte and the Franklin Lake part of Ruby Valley. Thence south, to include the Ruby Lake National Wildlife Refuge, as well as the privately-owned marshes and meadows adjacent to it. The Ruby Mountains lie entirely within this priority landscape. The southern boundary includes the far northern end of Long Valley, then west across Big and Little Bald Mountain to Huntington Valley. The southwestern boundary runs along the west side of Huntington Valley, excluding the Diamond Range. Near Red Rock Summit, the southern boundary circles around the northern end of Diamond Valley, dips south to Bald Mountain, then includes a major part of Pine Valley and the Bald Mountain extension of the Toiyabe Range. The western boundary runs north along the western side of the Cortez Mountains to Palisade, where it continues northeast across the Pinion Range and Elko Hills to the Humboldt River at Elburz. A priority mule deer migration corridor runs along both sides of the Ruby Mountains, interspersed with stopovers and winter range. The Rabbit Creek drainage have pockets of major winter range between Lamoille and Elburz.

Wells is the only incorporated town in this priority landscape. Lamoille and Spring Creek are unincorporated towns with Spring Creek being a notable population center equal in population to nearby Elko. It is one of the nation's largest homeowners' associations, along with the adjacent subdivisions outside Spring Creek Association jurisdiction. Spring Creek is northwest of Lamoille and south of Elko Mountain. Like Wells, it has a full range of services, including a post office. Jiggs, Ruby Valley, and Deeth have rural post offices to serve local ranching communities in the Huntington, Ruby and upper Humboldt River valleys, respectively. South Fork State Recreation Area is included within this priority landscape and is the fourth most visited park in Nevada's State Park system. The Ruby and East Humboldt Mountains are part of the Humboldt-Toiyabe National Forest system, which extends across Nevada. A large mine is in operation at Big Bald Mountain. Significant wildfires since 2017 within this priority landscape include: Echo, Rabbit Creek, Range 2, Owl Creek, Oil Well, Silver State, Corta, Cherry, Emigrant and County Line Fires.

Stakeholders: Private landowners, Spring Creek Association, Nevada Department of Conservation and Natural Resources (Division of Environmental Protection, Division of State Parks), Nevada Gold Mines, US Forest Service, Bureau of Land Management, FFA, Elko County Fire Prevention District, Elko Parks & Recreation

Existing Plans: Elko County Community Wildfire Protection Plan

Resource Groups: Humboldt Watershed Cooperative Weed Management Area, Northeastern Nevada Stewardship Group, Friends of the Ruby Mountains, Northeastern Nevada Sage-grouse Local Area Working Group, Elko Association of Conservation Districts (Jiggs, Clover Valley, Starr Valley, Northeast Elko, Ruby Valley and Lamoille Conservation Districts), Eureka Conservation District, Lander County Conservation District, White Pine County Conservation District.

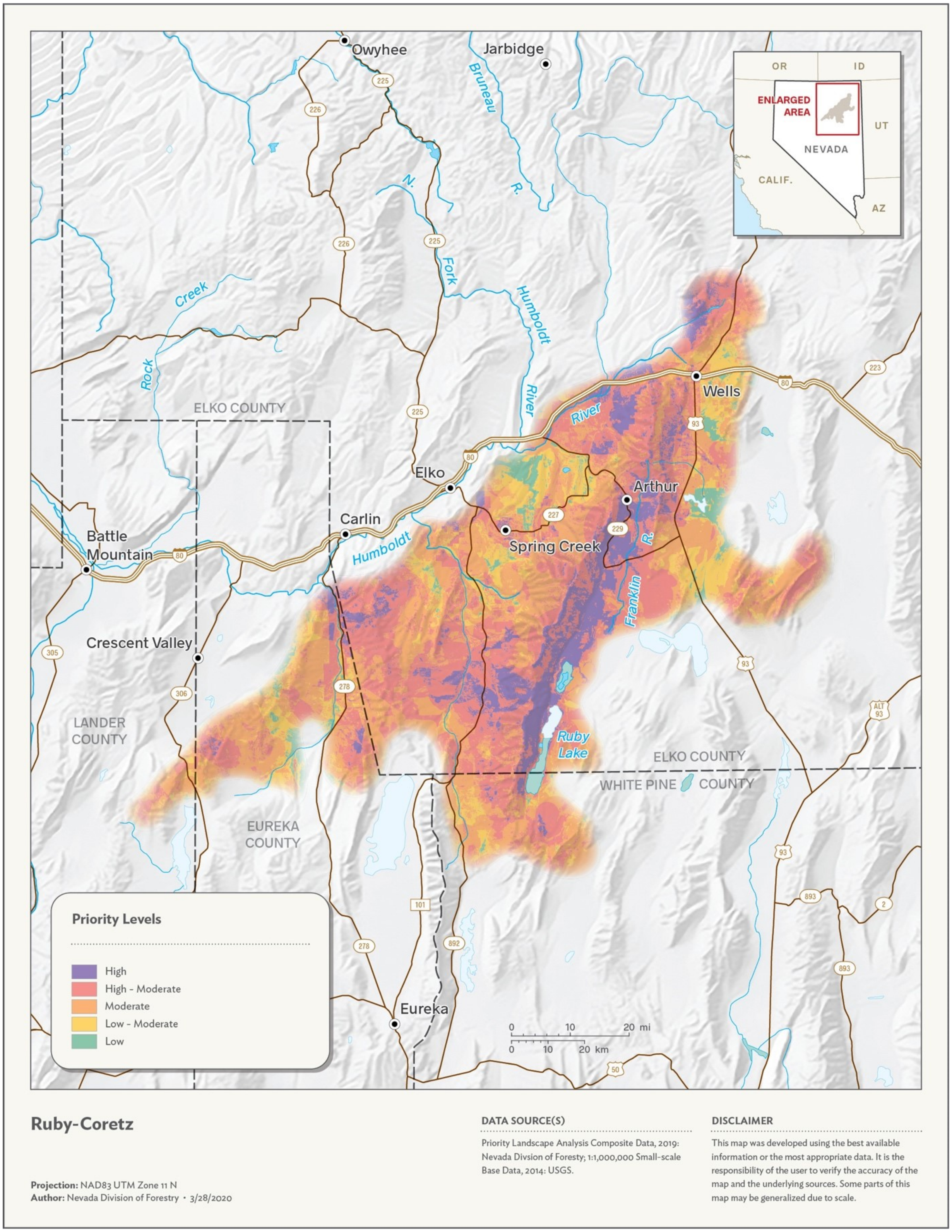

Figure 63. Map of the Ruby-Cortez priority area

Santa Rosa-Paradise

The Santa Rosa-Paradise area is in north central Nevada along the Oregon border. Populated areas include McDermitt on the Oregon border and Paradise Valley, a ranching community. The Santa Rosa Range is the largest range on the western side of this priority landscape area and includes the Santa Rosa Paradise Peak Wilderness. Smaller ranges include the Calico Mountains, the Hot Springs Range, and the Snowstorm Mountains on the eastern side. The Quinn River Valley is located in the northwest, while Paradise Valley and Eden Valley are located in the south. Rivers found within the area include the East Fork of the Quinn River, the North and South Forks of the Humboldt River, and the Little Owyhee River.

Stakeholders: Nevada Department of Wildlife, private landowners, US Forest Service

Existing Plans: Humboldt-Toiyabe National Forest Land and Resource Management Plan, Nevada Greater Sage Grouse Conservation Plan, Nevada Wildlife Action Plan

Resource Groups: Owyhee, Paradise/Sonoma, and Quinn River Conservation Districts

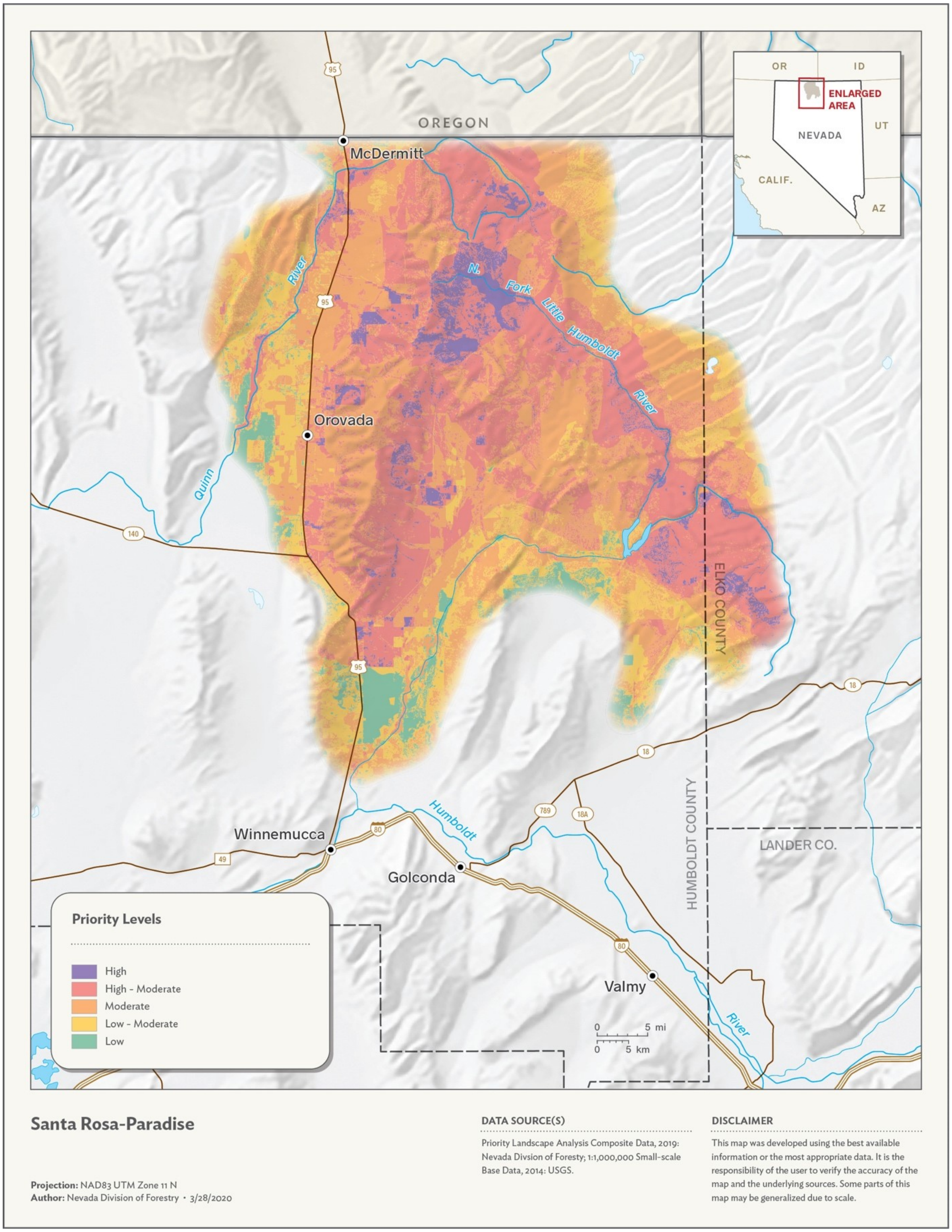

Figure 64. Map of the Santa Rosa priority area

Sierra Front-Pyramid-Pine Nuts

The Sierra Front – Pyramid – Pine Nuts area covers Washoe, Carson City, Douglas, and Lyon counties. It includes northern Nevada's largest population centers, the cities of Reno and Sparks. Fernley, Wadsworth, Patrick, Sun Valley, and Spanish Springs are also located in the northern part of this area. The state capital Carson City, and the smaller towns of Washoe City, Dayton, Stagecoach, and Silver Springs are in the center of the area, with Minden and Gardnerville located in the southern portion. This area includes many mountain ranges and valleys, with many valleys being either heavily populated or used for agriculture. Lakes found within this area include Pyramid Lake, a terminal lake that is fed by the Truckee River via Lake Tahoe, White Lake and Silver Lake north of Reno, and Washoe Lake located in Washoe Valley south of Reno. Mountain ranges include, from north to south, the Virginia Mountains, the Lake Range, the Fort Sage Mountains, the Pah Rah Range, the Carson Range, the Flowery Range, the Virginia Range, and the Pine Nut Mountains. Valleys include, from north to south, Warm Springs, Antelope, Hungry, Lemmon, Hidden, Pleasant, Washoe, Eagle, Carson, and Mineral.

Stakeholders: Bureau of Reclamation, Carson City County, City of Reno, City of Sparks, Douglas County, East Fork Fire, Nevada Department of Wildlife, Nevada State Lands, Nevada State Parks, Nevada State Public Works, private landowners, Pyramid-Paiute Tribe, Reno-Sparks Indian Colony, Tahoe Douglas Fire Protection District, the Nature Conservancy, US Forest Service, Washoe County, Washoe Tribe

Existing Plans: Carson City Community Wildfire Protection Plan (CWPP), Carson Range Multi-jurisdictional Fuels Reduction and Wildfire Prevention Plan, Douglas County CWPP, Land and Resource Management Plan Humboldt-Toiyabe National Forest for the Northern Sierra Area

Resource Groups: Carson Valley, Dayton Valley, Lahontan, Nevada Tahoe, Smith Valley, and Washoe/Storey Conservation Districts, Reno Urban Forestry Commission, Washoe / Storey County Weed Management Area

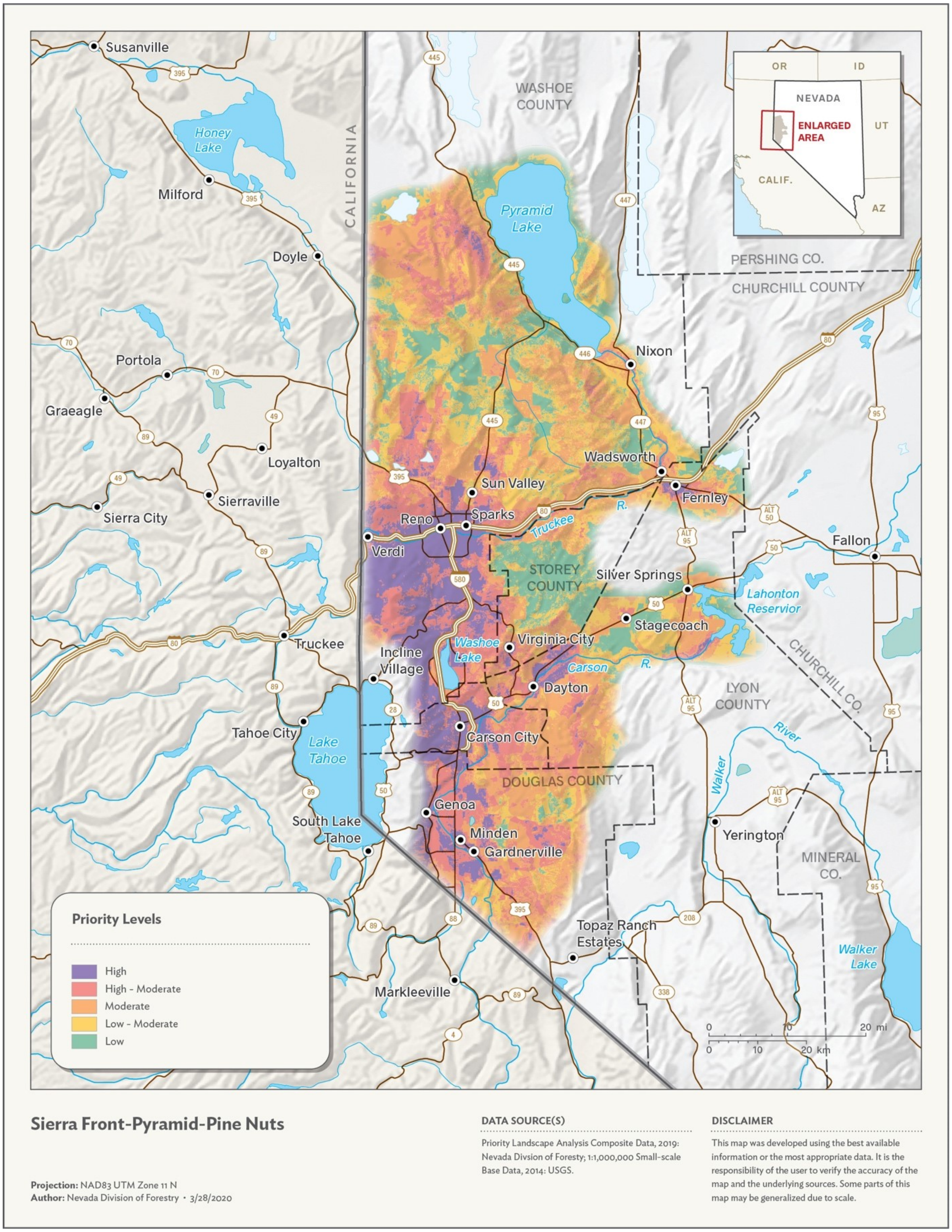

Figure 65. Map of the Sierra Front-Pyramid-Pine Nuts priority area

Steptoe-White River-Snake

The Steptoe-White-Snake priority landscape encompasses many north-south orientated mountain ranges and valleys in the classic basin and range topography of the Great Basin. From east to west they include the Snake Range, the Antelope Range, Schell Creek Mountains, Steptoe Valley, Cherry Creek Range, Egan Range, Butte Valley, the Medicine Range, White River Valley, northern Jakes Valley, Horse Range, Grant Range, White Pine Range, northern parts of Railroad Valley, southern Newark Valley, the northern extent of the Pancake Range and to the far southwest most of the Quinn Canyon Range. Common to all the valleys in this landscape is that their creeks, streams and rivers all drain into closed basins.

Ely is the only incorporated town in the priority landscape, with McGill, Baker and Lund being unincorporated with post offices and some services. Preston and Adaven are agricultural communities, while Cherry Creek and Locke are living ghost towns without services. Great Basin National Park highlights the list of nature preserves and wildlife areas in this priority landscape, which also includes Cave Lake State Recreation Area, the Humboldt-Toiyabe National Forest, Wayne Kirch and Steptoe Valley Wildlife Management Areas (state) and Railroad Valley Wildlife Management Area (BLM). A priority mule deer migration corridor runs along the White Pine Range, terminating in the south with winter range at "The Cove" (wet fertile meadows off US highway six). The landscape is rich in endemic flora and fauna, with many "island in the sky" and hot spring refugia. This area is historically noteworthy as the longest unpaved stretch of Pony Express trail in the United States—a testament to the remoteness of this landscape.

Stakeholders: Humboldt-Toiyabe National Forest, Bureau of Land Management, Great Basin National Park, Nevada Department of Wildlife (incl. Kirsch and Steptoe Valley Wildlife Management Areas), large ranches, mines, large-tract landowners on the wildland-urban interface.

Existing Plans: White Pine County Wildfire Protection Plan, Lincoln County Conservation District Resource Needs Assessment, White Pine County Conservation District Resource Needs Assessment, Ely District Resource Management Plan

Resource Groups: Eastern Nevada Landscape Coalition, Tri-County Weed Control, Nye-White Pine Resource Advisory Committee (including Humboldt-Toiyabe National Forest representatives, Lander and Eureka counties), White Pine Conservation District, Lincoln County Conservation District, Ruby Valley Conservation District, Tonopah Conservation District.

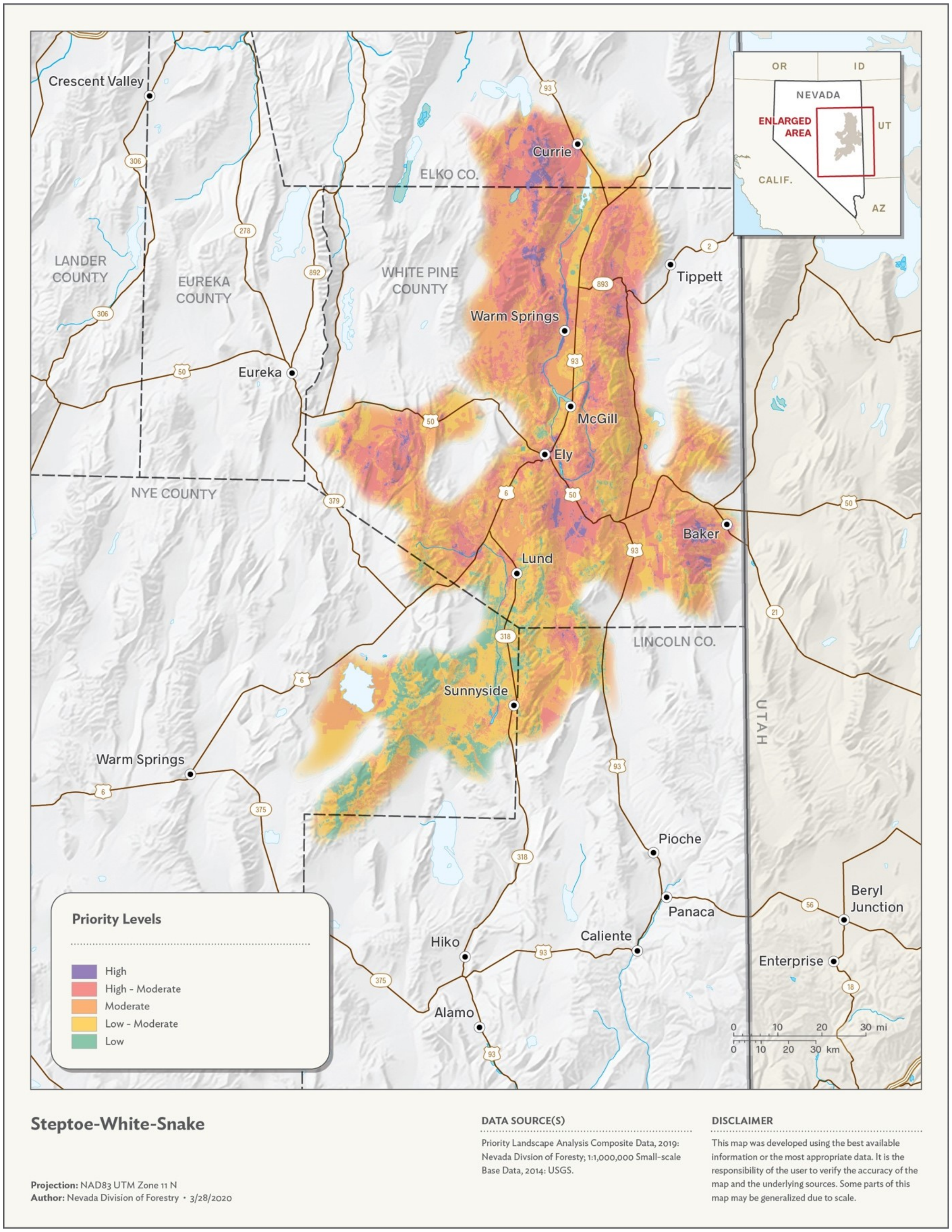

Figure 66. Map of the Steptoe-White-Snake priority area

Walker

The Walker area is in west-central Nevada in Churchill, Lyon, and Mineral counties. The largest population center is Yerington, and smaller towns include Wellington, Smith Valley, Topaz, and Hawthorne. Walker Lake, a terminal lake, is fed by the Walker River and is in the eastern-central part of the area, while Topaz Lake is in the western-central part of the area on the California-Nevada border. Mountain ranges from north to south include the Singatse Range, the Wassuk Range, the Pine Nut Mountains, and the Sweetwater Mountains. Valleys from north to south, include Campbell, Mason, Smith, Walker, and Antelope.

Stakeholders: Bureau of Land Management, Bureau of Reclamation, Department of Defense, private landowners, Nevada Department of Wildlife, Nevada State Parks, US Forest Service, Walker River Irrigation District, Walker River Paiute Tribe, Yerington Paiute Tribe

Existing Plans: Humboldt-Toiyabe National Forest Land and Resource Management Plan, Mason Valley Conservation District Resource Needs Assessment, Nevada Wildlife Action Plan, Nevada Greater Sage Grouse Conservation Plan, Smith Valley Conservation District Resource Needs Assessment

Resource Groups: Bi-State Sage-Grouse Local Area Working Group (LAWG), Mason Valley Conservation District, National Fish and Wildlife Foundation, Smith Valley Conservation District, Carson Valley Conservation District, Lahontan Conservation District, Trout Unlimited, the Nature Conservancy, Walker Basin Conservancy, Walker Lake Working Group

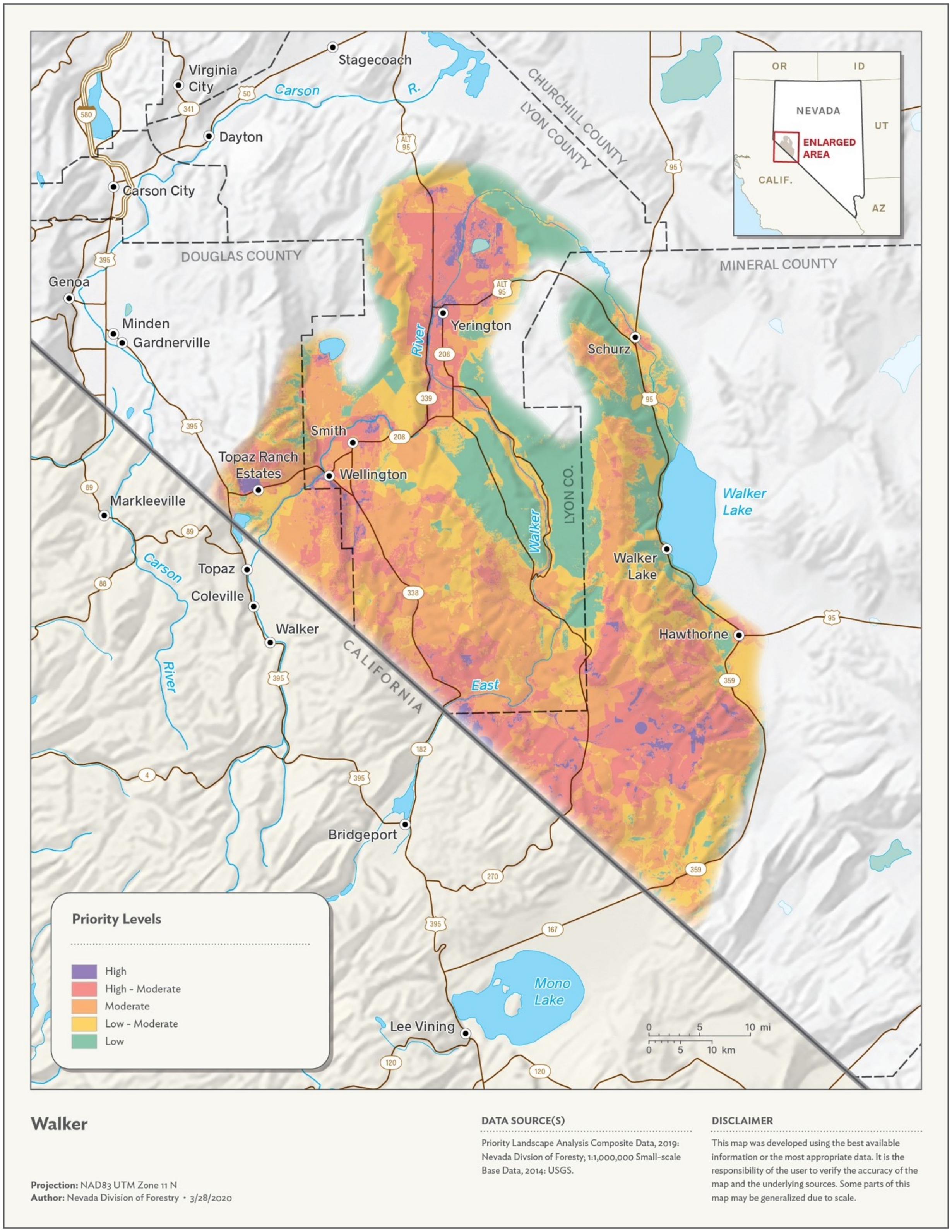

Figure 67. Map of the Walker priority area

White-Silver Peak

The White-Silver Peak priority landscape lies primarily within Esmeralda County and is relatively small among priority landscapes at only 960 sq. miles. The only town within the area is Dyer, with a 2018 population of only 290. The dominant land ownership is Bureau of Land Management and Inyo National Forest, with private ranching on fertile lands in the Fish Lake Valley. The White Mountains are at the western edge of the area, rising to 13,146 feet along the California state line at Boundary Peak. A series of peaks collectively called Silver Peak are on the east boundary, reaching 9,450 feet on the Piper Peak prominence. The north boundary is defined by Columbia Salt Marsh, and a central feature extending to the south boundary is Fish Lake Valley. Also, within the area are the Volcanic Hills, with multi-color volcanic ash and tuft deposits to near 7,400 feet elevation. Fertile areas in Fish Lake Valley are rich in agriculture, with alfalfa hay production and a diversity of specialty crops, such as lavender and grapes. Silver Peak has an abundance of historical and active mines including the only North American lithium mine. Hot springs are found in the northern end of the valley, which historically supported borax mining. Botanically, the area is rich in endemic species.

Stakeholders: Private and corporate landowners, agricultural producers, US Forest Service, Bureau of Land Management

Existing Plans: Nevada Wildlife Action Plan

Resource Groups: Esmeralda Conservation District, Mason Valley Conservation District

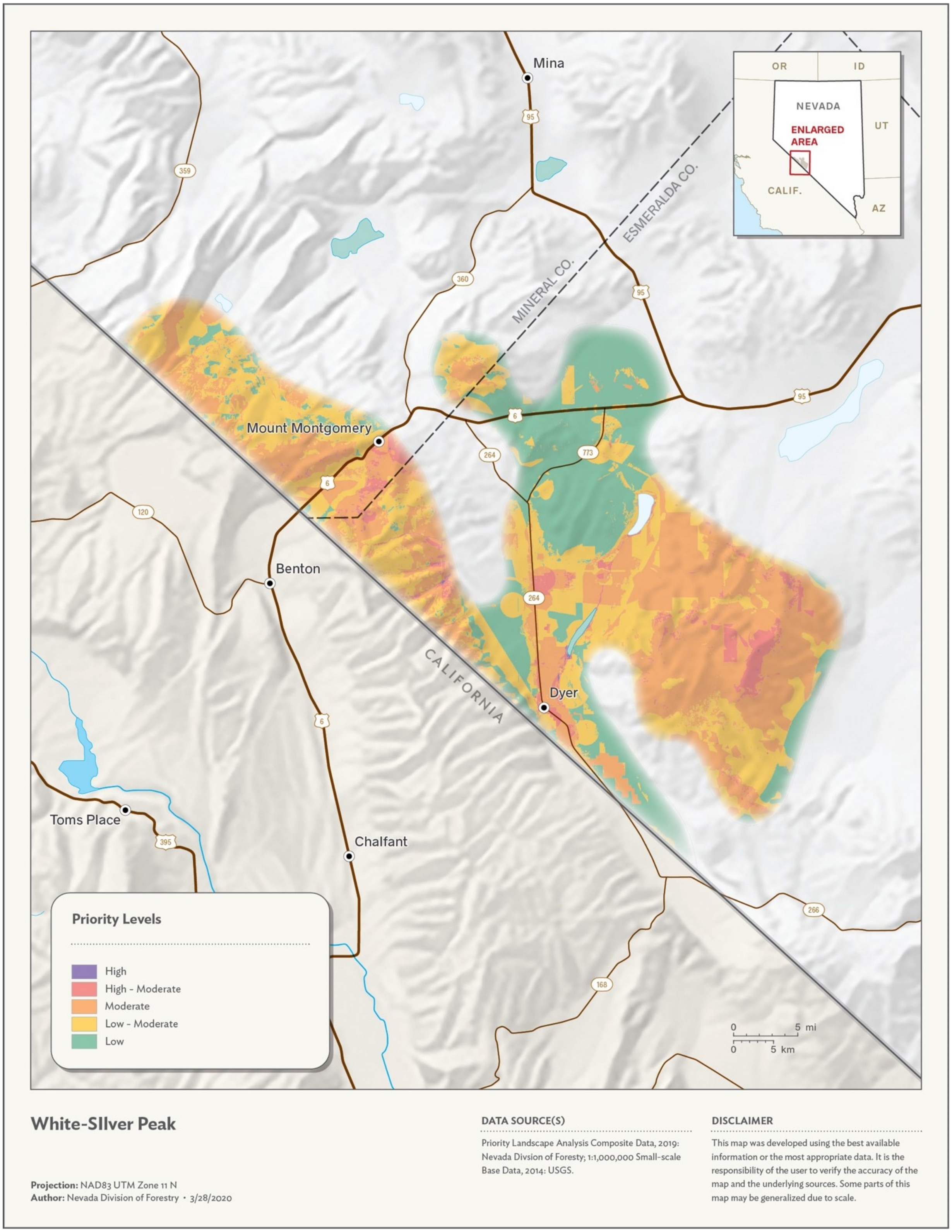

Figure 68. Map of the White-Silver Peak priority area

Wilson-Snake

The Wilson-Snake landscape incorporates classic basin and range expansive sagebrush dominated valleys and slopes interspersed with mountain ranges covered predominately with pinyon-juniper woodlands with pockets of mixed conifer and aspen forests. This region abutting the Utah border includes the northernmost extent of the Meadow Valley wash including the Wilson Creek mountains south to Panaca Summit, the White Rock mountains, and is bordered on the west by the eastern slopes of the Bristol and Fairview ranges. The broad Lake Valley separates the Wilson Range from the western ranges. Two wilderness areas are designated within this landscape, White Rock Range and Parsnip Peak, both rugged mountainous regions abundant with springs and wildlife. Echo Canyon and Spring Valley State Parks are located in this region, both centered around various forms of water resources (reservoirs, streams, and wetlands). The Wilson-Snake landscape supports some of the southernmost Greater Sage Grouse habitat in Nevada.

The town of Pioche is the largest populated area, with a population of 1,000. There are sparse full and part-time residences in the community of Mt. Wilson, Ursine, and throughout on scattered ranches. Between the presence of Meadow Valley Wash, Wilson Creek, Camp Valley Creek, abundant springs and ephemeral creeks, this region supports an abundance of large and small wildlife species, diverse vegetation, and has rich archaeological historic and pre-historic resources.

Stakeholders: Private ranches and landowners, agricultural producers, Bureau of Land Management, Nevada Department of Wildlife

Existing Plans: Lincoln County Resource Needs Assessment, Nevada Wildlife Action Plan, Ely District Resource Management Plan

Resource Groups: Meadow Valley Wildlife Unlimited, USFWS Partners in Conservation, Lincoln County Conservation District

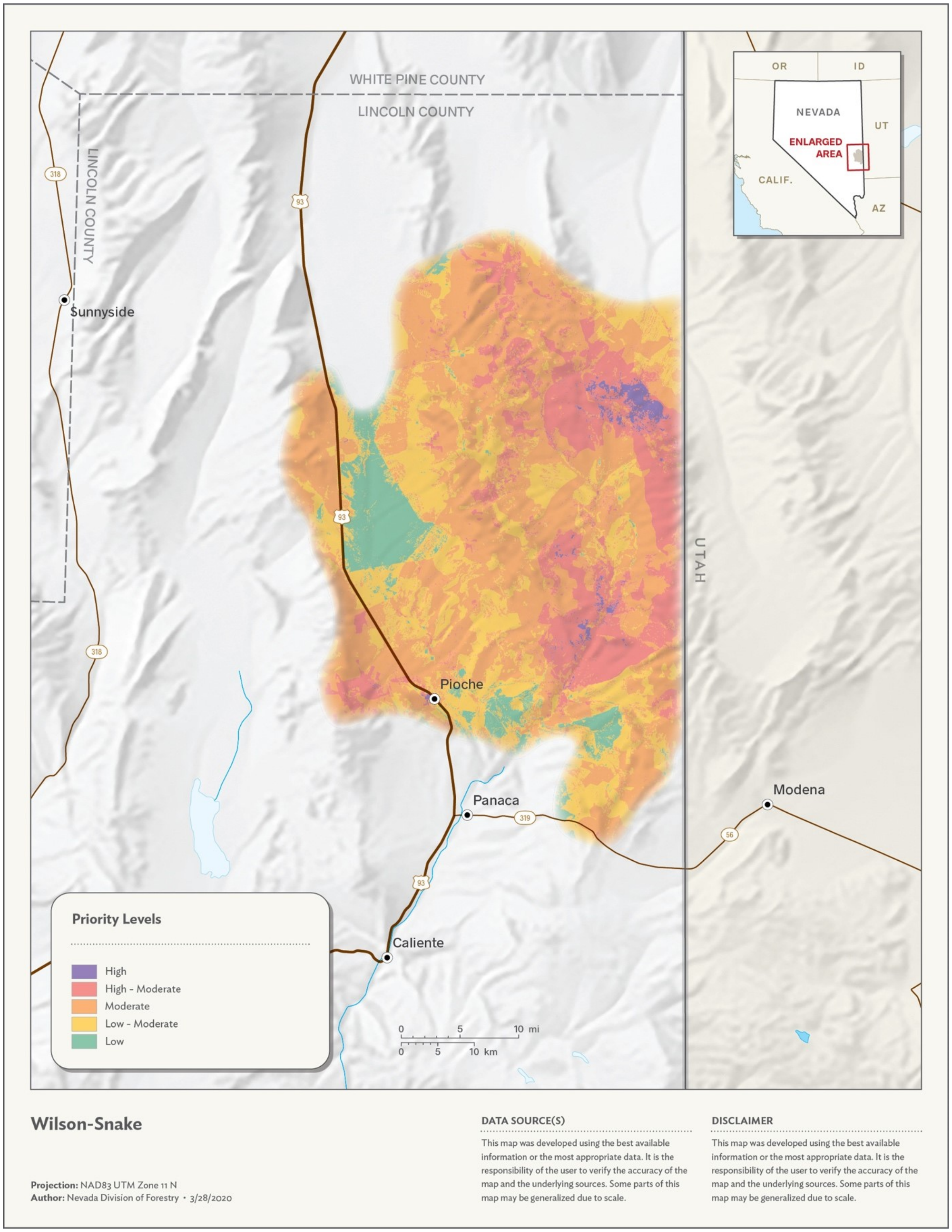

Figure 69. Map of the Wilson-Snake priority area

Winnemucca-Lower Humboldt

The Winnemucca-Lower Humboldt area encompasses the Lower Humboldt watershed and spans both sides of the I-80 corridor from the 40-mile desert to the west and Winnemucca to the east. Populated towns along I-80 include Lovelock, Rye Patch, Mill City, and Winnemucca. The smaller historic mining town of Unionville is located off of Interstate 80, south of Mill City. Mountain ranges include, from west to east: Trinity Range, West Humboldt Range, Majuba Mountains, Antelope Range, Eugene Range, East Range, and Sonoma Range. Valleys and flats include, from west to east: Lower Valley, which includes the Humboldt Wildlife Management Area located in the Humboldt Sink, Upper Valley, Packard Flat, Dun Glen Flat, and Grass Valley. Rye Patch Reservoir and Tuolon Lake are the largest bodies of water.

Stakeholders: Bureau of Land Management, Bureau of Reclamation, Division of Nevada State Parks, Nevada Department of Wildlife, private landowner, USFWS, US Forest Service

Existing Plans: Humboldt-Toiyabe National Forest Land and Resource Management Plan, Nevada Greater Sage Grouse Conservation Plan, Nevada Wildlife Action Plan

Resource Groups: Big Meadow, Lahontan, Paradise/Sonoma, Quinn River, and Stillwater Conservation Districts

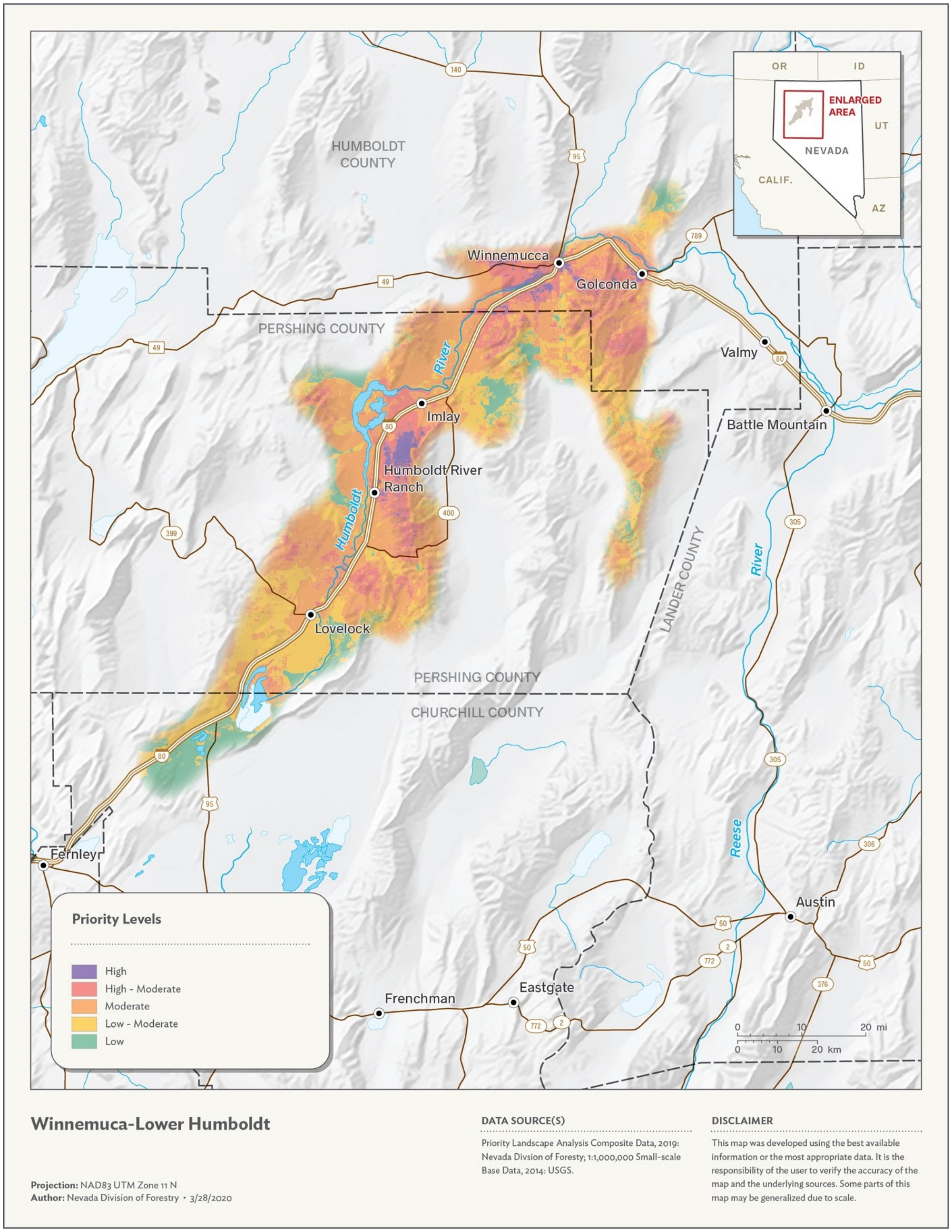

Figure 70. Map of the Winnemucca-Lower Humboldt priority area

Applicable Goals and Strategies for Priority Landscapes

Table 10. Nevada priority landscapes and their intersection with applicable key issues and threats to ecosystems

PRIORITY LANDSCAPES VS. KEY ISSUES AND THREATS - GOALS AND STRATEGIES	Amargosa-Lower Sand Springs-Pahrump	Central Basin and Range	Lahontan-Carson Sink	Lake Tahoe Basin	Las Vegas Valley-Islands in The Sky	Meadow Valley Wash	Moapa-Mead-Virgin Wash	Montana-Quinn-Kings	North Fork-Middle Humboldt	North Washoe-Sheldon	Northeast Elko	Owyhee-Bruneau-Jarbidge	Pahranagat Valley	Piute-Eldorado	Ruby-Cortez	Santa Rosa-Paradise	Sierra Front-Pyramid-Pine Nuts	Steptoe-White-Snake	Walker	White-Silver Peak	Wilson-Snake	Winnemucca-Lower Humboldt
#1 - Forest and Woodland Health																						
Goal 1-1: cooperative management and collaboration to maintain resilient forest in Nevada.																						
Strategy 1-1-1: engage the public through collaborative education and media events to increase awareness of linkages between forest health, sustainable community water supplies, and value of intact forest ecosystems to wildlife.	•		•	•	•		•	•	•		•	•	•	•	•	•	•	•	•		•	•
Strategy 1-1-2: provide more landowner outreach to generate interest and support from communities in watershed and forest health conservation programs, projects, and education programs.	•	•	•	•	•	•	•				•		•	•	•	•	•	•	•	•	•	•
Strategy 1-1-3: support and participate in the Nevada and National Cohesive Strategies, Shared Stewardship, Resource Needs Assessments and other Local Work Group efforts to protect forest ecosystems statewide from destructive wildfire and other threats to resilient landscapes	•	•	•	•	•	•	•		•		•		•		•	•	•	•	•		•	
Strategy 1-1-4: collaboratively create, find and utilize mutually supported forest and woodland conservation mechanisms that reduce fragmentation and increase landscape scale management.	•			•	•	•								•			•		•		•	
Goal 1-2: promote pro-active forest management for forest health statewide.																						
Strategy 1-2-1: provide public education and financial assistance to promote implementation of timber stand and woodland improvement projects for mixed conifer and aspen stand health.				•													•	•				

PRIORITY LANDSCAPES VS. KEY ISSUES AND THREATS - GOALS AND STRATEGIES	Amargosa-Lower Sand Springs-Pahrump	Central Basin and Range	Lahontan-Carson Sink	Lake Tahoe Basin	Las Vegas Valley-Islands in The Sky	Meadow Valley Wash	Moapa-Mead-Virgin Wash	Montana-Quinn-Kings	North Fork-Middle Humboldt	North Washoe-Sheldon	Northeast Elko	Owyhee-Bruneau-Jarbidge	Pahranagat Valley	Piute-Eldorado	Ruby-Cortez	Santa Rosa-Paradise	Sierra Front-Pyramid-Pine Nuts	Steptoe-White-Snake	Walker	White-Silver Peak	Wilson-Snake	Winnemucca-Lower Humboldt
Strategy 1-2-2: collaboratively seek and find realistic ways to manage pinyon-juniper for ecosystem health and sustainability.		•	•			•					•				•		•	•	•		•	
Strategy 1-2-3: further develop individual agency prescribed fire programs and encourage collaboration among all levels of government and NGO partners.					•												•	•			•	
Strategy 1-2-4: research and develop markets and products that create value for wood and carbon-based by-products of forest and woodland restoration and management treatments.		•															•	•			•	
Goal 1-3: maintain monitoring and management of invasive insects																						
Strategy 1-3-1: maintain monitoring for invasive insects and work with cooperating agencies to manage establishment threats in Nevada and apply management techniques at the landscape level.	•			•	•												•				•	
Strategy 1-3-2: adapt monitoring systems, communication protocols, and data management systems as necessary to more accurately inform state-wide forest health assessments and treatment priorities.	•			•	•												•					
Goal 1-4: reduce conversion of forests and woodlands to non-forest and woodland uses.																						
Strategy 1-4-1: identify the areas at greatest risk of conversion, perform public outreach and protect areas to preserve forest and woodland cover types.	•			•							•						•					
#2 - Wildfire Hazards																						
Goal 2-1: collaborate with other fire and natural resource management stakeholders to reduce the size, frequency, intensity, and costs of wildfire impacts in Nevada.																						
Strategy 2-1-1: protect existing assets and ecosystems from the destructive impacts of wildfire.	•		•	•	•		•	•	•	•	•	•		•	•	•	•		•		•	•

PRIORITY LANDSCAPES VS. KEY ISSUES AND THREATS - GOALS AND STRATEGIES	Amargosa-Lower Sand Springs-Pahrump	Central Basin and Range	Lahontan-Carson Sink	Lake Tahoe Basin	Las Vegas Valley-Islands in The Sky	Meadow Valley Wash	Moapa-Mead-Virgin Wash	Montana-Quinn-Kings	North Fork-Middle Humboldt	North Washoe-Sheldon	Northeast Elko	Owyhee-Bruneau-Jarbidge	Pahranagat Valley	Piute-Eldorado	Ruby-Cortez	Santa Rosa-Paradise	Sierra Front-Pyramid-Pine Nuts	Steptoe-White-Snake	Walker	White-Silver Peak	Wilson-Snake	Winnemucca-Lower Humboldt
Strategy 2-1-2: support, participate in, and implement the Nevada and national cohesive strategies.	•		•	•	•		•		•		•	•	•	•	•	•	•		•	•	•	•
Strategy 2-1-3: adopt and participate in the shared stewardship strategy for transboundary management of landscapes.	•		•	•	•	•	•		•		•	•			•	•	•		•		•	•
Strategy 2-1-4: implement interagency fire protection planning and cooperation for all phases of fire management.			•	•	•		•		•		•	•			•	•	•		•		•	•
Goal 2-2: increase public awareness and involvement in proactive wildfire prevention activities.																						
Strategy 2-2-1: provide public education and outreach to educate home and landowners in the wildland urban interface (WUI) focused on creating ignition resistant homes and communities.		•	•	•								•			•		•		•			•
Strategy 2-2-2: facilitate and support community ownership of wildfire threats and hazards, planning required and implementable mitigation.	•	•	•	•								•					•		•			•
Strategy 2-2-3: collaborate to provide and maintain a statewide coordination and tracking to facilitate fire-adapted communities' Community Wildfire Protection planning, implementation, and maintenance	•	•	•	•													•		•			•
Strategy 2-2-4: collaborate in the delivery of fire prevention activities and events.	•		•	•					•						•	•	•		•			•
Strategy 2-2-5: support the design, implementation, and enforcement of standards and codes for building construction and maintenance in the WUI. (IBC/IWUIC)		•		•	•											•	•		•			•
Strategy 2-2-6: collaboratively implement preparedness and pre-fire mitigation actions in WUI communities and wildlands that focus on creating fire adapted communities.		•		•	•				•			•			•	•	•		•		•	•

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Strategy 2-2-7: collaboratively implement pre-fire mitigation actions in wildlands that focus on creating fire resistant and resilient landscapes (e.g. Fuelbreaks, targeted, prescribed and outcome-based grazing, etc.).	●	●							●		●	●			●		●	●	●		●	●
Goal 2-3: maintain effective suppression capacity and response across all landscapes.																						
Strategy 2-3-1: ensure that agency and cooperator personnel are properly trained and qualified for wildland fire suppression and prescribed fire operations.				●	●		●		●					●	●						●	●
Strategy 2-3-2: ensure that agency and cooperator personnel are properly equipped for both wildfire suppression and prescribed fire operations.				●					●						●		●					●
Strategy 2-3-3: establish a fully integrated interagency wildland fire communications system.	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	
Strategy 2-3-4: create an efficient and effective network of protection resources, processes, and agreements enabling sharing of resources between cooperators.	●		●	●	●	●			●					●	●	●	●		●			●
Strategy 2-3-5: support volunteer fire departments and RFPAs capacity to assist with wildfire suppression and management activities state-wide.						●							●			●	●				●	●
Strategy 2-3-6: support Interagency Type I, II and III Incident Management Teams with staff, equipment and fiscal support to ensure adequate complex fire management capacity is maintained.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Goal 2-4: improve collection, reporting, storage and utilization of wildfire related data.																						
Strategy 2-4-1: track accomplishments, demonstrate successes and document failure to ensure decision makers can make informed decisions on adjusting strategy and implementing effective actions.				●	●		●										●					

PRIORITY LANDSCAPES VS. KEY ISSUES AND THREATS - GOALS AND STRATEGIES	Amargosa-Lower Sand Springs-Pahrump	Central Basin and Range	Lahontan-Carson Sink	Lake Tahoe Basin	Las Vegas Valley-Islands in The Sky	Meadow Valley Wash	Moapa-Mead-Virgin Wash	Montana-Quinn-Kings	North Fork-Middle Humboldt	North Washoe-Sheldon	Northeast Elko	Owyhee-Bruneau-Jarbidge	Pahranagat Valley	Piute-Eldorado	Ruby-Cortez	Santa Rosa-Paradise	Sierra Front-Pyramid-Pine Nuts	Steptoe-White-Snake	Walker	White-Silver Peak	Wilson-Snake	Winnemucca-Lower Humboldt
Strategy 2-4-2: utilize scientifically based risk assessments in prioritization and decision making.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Goal 2-5: prevent and manage exotic species invasions that respond to or drive wildfire risks and threats.																						
Strategy 2-5-1: ensure timely rehabilitation and restoration of fire disturbed landscapes, then monitor and report action successes and failures.	●				●	●	●		●		●	●		●	●						●	
Strategy 2-5-2: encourage, support and participate in pre-fire mitigation actions where conditions will result in exotic invasions.	●	●															●				●	
#3 - urban and community forests																						
Goal 3-1: Develop and maintain strong partnerships with key stakeholders that can contribute to urban and community forest design, establishment, and maintenance.																						
Strategy 3-1-1: increase connections and partnerships to collaborate on urban and community forestry program development and implementation.	●		●	●	●		●		●			●		●	●		●	●				●
Strategy 3-1-2: continue engagement with the western urban and community forestry network to stay current with emerging issues and maintain peer education opportunities.				●	●		●		●						●		●					●
Goal 3-2: promote the role of urban and community forestry in human health and wellness.																						
Strategy 3-2-1: expand opportunities and create connections for collaboration with the human health community.	●			●	●		●										●					●
Strategy 3-2-2: Develop and distribute education and outreach tools to improve and highlight the relationship between improved public health, wellness, and other values supported through urban and community forestry, and green infrastructure	●		●	●	●		●							●			●					●

PRIORITY LANDSCAPES VS. KEY ISSUES AND THREATS - GOALS AND STRATEGIES	Amargosa-Lower Sand Springs-Pahrump	Central Basin and Range	Lahontan-Carson Sink	Lake Tahoe Basin	Las Vegas Valley-Islands in The Sky	Meadow Valley Wash	Moapa-Mead-Virgin Wash	Montana-Quinn-Kings	North Fork-Middle Humboldt	North Washoe-Sheldon	Northeast Elko	Owyhee-Bruneau-Jarbidge	Pahranagat Valley	Piute-Eldorado	Ruby-Cortez	Santa Rosa-Paradise	Sierra Front-Pyramid-Pine Nuts	Steptoe-White-Snake	Walker	White-Silver Peak	Wilson-Snake	Winnemucca-Lower Humboldt
Goal 3-3: improve urban and community forest management, maintenance, and stewardship.																						
Strategy 3-3-1: support tree workers, arborists, and landscape industry workers through workshop sponsorships and technical instruction.	•			•	•		•							•			•					•
Strategy 3-3-2: work with partners in urban and community forestry to develop and encourage engagement with comprehensive programs, policies, and resources for enhancing urban forestry stewardship (e. G. Encourage tree city, campus, line, or campus health care USA recognition)	•			•	•		•		•					•			•	•				•
Strategy 3-3-3: increase the number of ISA certified arborists, ISA certified tree worker climber specialists and ISA certified tree worker aerial lift specialists.	•			•	•		•							•			•					•
Strategy 3-3-4: create and distribute tree selection, planting, and tree care resources.	•		•	•	•	•	•		•			•		•	•		•		•			•
Strategy 3-3-5: encourage and participate in local urban and community forestry assessment and management planning efforts.	•			•	•		•							•			•					•
Strategy 3-3-6: develop comprehensive, statewide data sets (lidar, multi-spectral imagery) for use by partners for canopy analysis and tree inventories.	•		•		•												•					•
Strategy 3-3-7: encourage and support urban and community inventories and I-Tree report production in all communities in Nevada.	•		•	•	•	•	•		•					•			•		•		•	•
Goal 3-4: diversify, leverage, and increase funding for urban and community forestry activities.																						
Strategy 3-4-1: provide annual briefings to partners and stakeholders on the progress and value of urban and community forestry and opportunities to invest with a purpose.	•			•	•												•					

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Strategy 3-4-2: determine and communicate the value of urban forest products and services to inform decisions and investments in urban and community forests (e.g. I-Tree reports).				•	•		•		•					•			•					
Strategy 3-4-3: develop and connect to urban wood utilization programs for timber products, chipping and biomass.				•	•												•					
Strategy 3-4-4: seek additional urban and community forestry program funding through public and private partnerships and connections with related departments or programs and the federal, state and local levels.	•			•	•				•								•					
Goal 3-5: increase public awareness and environmental education to promote urban and community forest stewardship.																						
Strategy 3-5-1: strengthen environmental education programs that focus on urban and community forestry through outreach materials highlighting the benefits of trees.	•			•	•	•	•							•			•					•
Strategy 3-5-2: create and distribute tree selection, planting, and tree care resources.	•		•	•	•	•	•		•			•		•	•		•				•	•
Strategy 3-5-3: increase outreach and educational opportunities for underserved communities to increase urban forestry stewardship.	•		•		•	•	•		•			•	•	•	•		•	•	•		•	•
#4 Riparian-Wetland Systems																						
Goal 4-1: improve the health of wetland plant communities through outreach and education.																						
Strategy 4-1-1: educate landowners about techniques to maintain healthy and functioning watersheds and waterways through the development and dissemination of best management practices for Nevada.	•		•		•	•	•	•			•			•	•	•	•		•	•	•	•
Goal 4-2: implement conservation and preservation practices through partnerships to improve riparian function.																						

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Strategy 4-2-1: protect and enhance water quality, protect fish and wildlife habitat, maintain habitat connectivity by implementing management and restoration practices.	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•		•	•
Strategy 4-2-2: partner with and provide outreach to landowners and land users to promote sustainable land management practices that sustain healthy vegetation communities which are more resilient to problematic erosion and gullying.	•	•	•	•		•	•	•	•	•	•	•			•	•	•	•	•		•	•
Strategy 4-2-3: facilitate public-private partnerships to prioritize and implement management strategies along riparian corridors that cross multiple landownership categories.	•	•	•	•	•	•		•	•	•	•	•	•		•	•	•	•	•		•	•
Goal 4-3: use science-based strategies to improve riparian ecosystem function and expand riparian habitat through active project implementation.																						
Strategy 4-3-1: implement strategies to reduce invasive species establishment in riparian corridors and remove existing populations.	•		•	•	•	•	•	•	•		•	•	•	•	•	•		•	•		•	•
Strategy 4-3-2: implement "early detection rapid response" (EDRR) actions, monitoring, and active EDRR education for landowners and communities.	•		•	•	•		•	•	•	•			•		•	•	•		•			•
Strategy 4-3-3: reconnect waterbodies with floodplains and implement practices to raise water tables where decreases result from land management practices or environmental degradation.	•		•	•		•	•		•			•		•	•		•		•		•	•
Strategy 4-3-4: re-establish native tree and other vegetation canopies along riparian corridors to restore effective riparian ecosystem functions.	•		•	•		•	•	•		•			•	•	•	•	•		•			•
Strategy 4-3-5: support improvement of riparian health in urban and community settings.	•		•	•	•		•	•						•		•	•		•			•

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Strategy 4-3-6: reduce abundance of encroaching conifers in riparian areas to increase groundwater availability along riparian zones and reduce loss of deciduous riparian species.		•		•											•		•		•		•	
Goal 4-4: improve the resiliency of riparian systems to wildfires and climate change.																						
Strategy 4-4-1: implement wildfire prevention activities in watersheds to sustain watershed functions and avoidance of catastrophic wildfire and post-fire erosion events.				•	•											•	•		•		•	•
Strategy 4-4-2: implement post-wildfire soil-stabilization and habitat restoration activities to improve vegetation recovery rates and reduce detrimental impacts to riparian systems.				•	•							•		•	•	•	•		•		•	•
Strategy 4-4-3: implement riparian health projects utilizing plant materials and techniques relevant for future climate projections.	•		•	•		•	•						•	•		•	•		•		•	•
Strategy 4-4-4: when possible, continue monitoring and reporting on riparian improvement efforts following established protocols and collaborate with partners to allow further evaluation of changes in vegetation communities resulting from a changing climate.	•		•	•		•	•						•			•	•		•		•	•
#5 - Sagebrush Ecosystems																						
Goal 5-1: improve wildfire suppression response and effectiveness within sagebrush ecosystems.																						
Strategy 5-1-1: continue and enhance efforts to suppress wildfire (e. G. Collectively identify and fill geographic gaps in suppression capacity).	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Strategy 5-1-2: implement wildfire prevention and fuel reduction techniques in key locations to protect intact sagebrush ecosystems and areas with restoration treatment investments		•	•					•	•	•	•	•		•	•	•	•	•	•	•	•	•

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Goal 5-2: improve sagebrush ecosystems by increasing site resistance and resilience.																						
Strategy 5-2-1: maximize the implementation of restoration, rehabilitation and management projects that preserve and improve the resistance and resilience of sagebrush ecosystem lands.		•								•						•	•		•		•	•
Strategy 5-2-2: educate landowners and land managers on the availability of opportunities for assistance through federal, state and NGO supported programs.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Goal 5-3: educate the public as well as decision and policy makers on the importance and value of sagebrush ecosystems, the importance of successful pre-suppression and restoration actions, the wildfire-cheatgrass cycle, wildfire prevention, wildfire in general, and the need to find a reasonable pathway for wild horse populations to be reduced and maintained and Appropriate Management Levels (AML)																						
Strategy 5-3-1: create unified messages and educational materials about these subjects in various distributable, consumable and understandable formats.										•		•	•		•				•			•
Strategy 5-3-2: distribute, inform and educate the public and public officials using unified educational materials and messages produced.	•			•	•		•							•			•					
#6 - Species Requiring Specialized Conservation																						
Goal 6-1: preserve Nevada's native plant and wildlife biodiversity and preclude legal protective species listings through effective stewardship of rare and unique populations and habitats.																						
Strategy 6-1-1: ensure land management and project implementation plans consider and mitigate impacts to rare and listed species.	•			•	•	•	•							•			•					
Strategy 6-1-2: seek to conserve lands with important habitats through promoting conservation easements and other natural resource protection measures.	•			•	•	•	•							•			•					

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Strategy 6-1-3: support the Nevada conservation credit system that facilitates the exchange of debits and credits between entities that impact sagebrush ecosystems and entities that manage and conserve those habitats.		●								●	●				●	●		●			●	●
Strategy 6-1-4: produce and distribute plant materials for critical habitat restoration projects.	●			●	●	●	●						●	●		●	●		●			●
Strategy 6-1-5: develop and update species status reports and use them to educate the public and public officials about species at risk.	●			●	●		●							●			●					
Strategy 6-1-6: conduct adequate amounts of surveys, studies and research focused on increasing knowledge of the natural history, distribution and habitat requirements of species at-risk.	●			●	●	●	●							●			●				●	
Strategy 6-1-7: provide environmental review of proposed development projects within critical habitats and provide technical review of research proposals to further knowledge of at-risk species.	●			●			●										●	●		●	●	
Strategy 6-1-8: proactively review necessity of adding at risk species to the state list of fully protected species.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
#7 - Water Quality and Quantity																						
Goal 7-1: protect water quality and quantity in urban and community environments.																						
Strategy 7-1-1: Ensure urban and community environments have adequate green infrastructure water quality and quantity conservation practices implemented	●			●	●		●										●					
Strategy 7-1-2: use of water efficient landscapes occupied by low water use vegetation.	●			●	●		●										●					
Goal 7-2: maintain Nevada's watersheds by performing necessary management that builds ecosystem community resistance and resilience and soil stability in the inevitable occurrence of disturbances (e. G. Wildfire, drought, insects and diseases, etc.).																						

PRIORITY LANDSCAPES VS. KEY ISSUES AND THREATS - GOALS AND STRATEGIES	Amargosa-Lower Sand Springs-Pahrump	Central Basin and Range	Lahontan-Carson Sink	Lake Tahoe Basin	Las Vegas Valley-Islands in The Sky	Meadow Valley Wash	Moapa-Mead-Virgin Wash	Montana-Quinn-Kings	North Fork-Middle Humboldt	North Washoe-Sheldon	Northeast Elko	Owyhee-Bruneau-Jarbidge	Pahranagat Valley	Piute-Eldorado	Ruby-Cortez	Santa Rosa-Paradise	Sierra Front-Pyramid-Pine Nuts	Steptoe-White-Snake	Walker	White-Silver Peak	Wilson-Snake	Winnemucca-Lower Humboldt
Strategy 7-2-1: collaborate with the nonpoint source water pollution management program, source water protection program, and local source water protection teams to identify priority areas, create plans, and implement protection strategies.	•			•	•	•	•						•				•		•			
Strategy 7-2-2: implement proactive watershed management practices that maintain adequate vegetative cover, reduce soil erosion, and fuel loading conducive to reducing non-point source pollutants.				•	•	•	•						•	•	•		•		•			•
Strategy 7-2-3: restore rivers, streams and other riparian area, flood plains and wetlands to proper functioning condition to increase groundwater recharge, reduce sedimentation of water supplies, and increase seasonal water flows.	•		•	•	•	•	•						•		•		•				•	•
Strategy 7-2-4: rehabilitation of wildland fire-impacted and abandoned agricultural lands to stabilize soils that will decrease erosion and sedimentation in riparian and wetlands areas.						•							•		•	•		•	•	•		•
Goal 7-3: Increase agricultural water use efficiency and runoff or tail water quality.																						
Strategy 7-3-1: create riparian buffers along agricultural fields and other working lands to trap sediments and filter pollutants.						•	•						•				•		•			
Strategy 7-3-2: increase irrigation efficiency to conserve water supplies and reduce agricultural return flows that decrease water pollution.			•				•				•		•			•	•		•			•
Goal 7-4: create and distribute a unified message and education to the public and public officials about the importance of watershed protection and water resource conservation.																						
Strategy 7-4-1: increase wildland fire prevention education and messaging to reduce the number of human-caused wildland fires.			•	•	•		•		•		•	•		•	•	•	•		•			•

PRIORITY LANDSCAPES VS. KEY ISSUES AND THREATS - GOALS AND STRATEGIES	Amargosa-Lower Sand Springs-Pahrump	Central Basin and Range	Lahontan-Carson Sink	Lake Tahoe Basin	Las Vegas Valley-Islands in The Sky	Meadow Valley Wash	Moapa-Mead-Virgin Wash	Montana-Quinn-Kings	North Fork-Middle Humboldt	North Washoe-Sheldon	Northeast Elko	Owyhee-Bruneau-Jarbidge	Pahranagat Valley	Piute-Eldorado	Ruby-Cortez	Santa Rosa-Paradise	Sierra Front-Pyramid-Pine Nuts	Steptoe-White-Snake	Walker	White-Silver Peak	Wilson-Snake	Winnemucca-Lower Humboldt
Strategy 7-4-2: increase water resource conservation education and messaging to increase water use efficiency and decrease impacts to water quality.				•			•						•				•		•			
#8 - Climate Change Mitigation																						
Goal 8-1: increase carbon sink and sequestration activities associated with wildland fire and natural resource management practices (e. G. Rehabilitation, restoration etc.).																						
Strategy 8-1-1: use appropriate plant species for restoration and rehabilitation projects and scale up markets, businesses and facilities that produce the required plant materials.	•			•	•		•		•			•			•		•		•			•
Strategy 8-1-2: enhancing water use efficiency of plants growing through appropriate land management practices.	•			•			•						•				•					
Strategy 8-1-3: restore, rehabilitate and manage soils to control erosion and increase soil quality.				•			•				•		•		•		•		•			
Strategy 8-1-4: harvest and utilize forest and rangeland biomass products (including urban and community forests, for producing items or supporting practices that store carbon (e. G. Construction materials, biochar, etc.).		•		•	•												•	•				
Strategy 8-1-5: maintain or increase the extent of forest and/or woodland ecosystems, including urban and community forests, to protect existing carbon stocks.			•	•	•		•										•					
Strategy 8-1-6: promote, support, and increase urban reforestation and management.	•	•	•	•	•				•			•			•		•					•
Goal 8-2: reduce greenhouse gas emission from land use and management activities while preserving ecological processes.																						
Strategy 8-2-1: prevent wildfires from occurring more frequently and severely than ecosystem norms				•	•		•										•					•

PRIORITY LANDSCAPES VS. KEY ISSUES AND THREATS - GOALS AND STRATEGIES	Amargosa-Lower Sand Springs-Pahrump	Central Basin and Range	Lahontan-Carson Sink	Lake Tahoe Basin	Las Vegas Valley-Islands in The Sky	Meadow Valley Wash	Moapa-Mead-Virgin Wash	Montana-Quinn-Kings	North Fork-Middle Humboldt	North Washoe-Sheldon	Northeast Elko	Owyhee-Bruneau-Jarbidge	Pahranagat Valley	Piute-Eldorado	Ruby-Cortez	Santa Rosa-Paradise	Sierra Front-Pyramid-Pine Nuts	Steptoe-White-Snake	Walker	White-Silver Peak	Wilson-Snake	Winnemucca-Lower Humboldt
Strategy 8-2-2: increase the use of fire surrogates for land management.				●	●	●										●	●				●	
Goal 8-3: facilitate the creation and participate in a carbon market and incentivize participation in existing programs that support carbon management as part of their objectives and outcomes.																						
Strategy 8-3-1: provide an inventory of the emissions from ecological processes under various land management scenarios.		●		●								●			●		●	●			●	
Strategy 8-3-2: provide an inventory of carbon sinks.		●		●								●			●		●	●			●	
Strategy 8-3-3: provide incentives for partners and cooperators engaging in programs that result in marketable carbon, carbon sequestration or less carbon emissions.		●		●								●			●		●	●			●	
Goal 8-4: create and distribute technical and educational materials to inform policy development, management decisions, and the public.																						
Strategy 8-4-1: scale down climate change predictive models to determine regional trends and impacts in the state.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Strategy 8-4-2: create climate change susceptibility models to inform land user and manager decisions and actions.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Strategy 8-4-3: create and make a comprehensive menu of climate change mitigation tools and techniques available for natural resource, land, and fire managers.	●			●	●	●	●						●				●				●	

Other Priority Areas

There are several programs that are supported by the USFS State and Private Forestry – Cooperative Forestry Assistance programming and administered by NDF in Nevada. These include:

- Forest Legacy
- Forest Stewardship
- Community Forest and Open Space Conservation
- Urban and Community Forestry
- Ecosystem Service and Markets
- Wood Innovations
- State Fire Assistance
- Volunteer Fire Assistance
- Hazardous Fuels – Community Protection
- Forest Taxation and Estate Planning

Each of these programs has eligibility criteria, which often relate to conditions of the property, natural resources, and landowners. Eligibility criteria dictate which lands qualify for support from these programs. In addition, stakeholders and cooperators have assisted in selecting priority areas within eligible locations where these programs are focused by state agencies and other cooperators. This section addresses four priority areas:

- Forest Legacy Areas
- Forest Stewardship Areas
- Multi-State Priority Areas
- Shared Stewardship Priority Areas

One of the site-specific site characteristics to become eligible for program support is forest cover. To quantify and identify the amount of forest cover on a property, the state is required to define what species are eligible forest species. Table 11 is a list of species in Nevada that are designated by this plan and recognized by USFS and NDF as part of the qualifying criteria for USFS Cooperative Forestry Assistance. These species were selected because they provide critical watershed functions, critical wildlife habitats and can restore site potential on degraded landscapes. There are invasive species included in this table that occupy large amounts of native and urban landscapes. Where they do exist in native landscapes, they are managed by agencies for their reduction and enhancement of native or desirable rehabilitation species.

Table 11. Species that are designated by this plan as a forest species in Nevada to qualify for Cooperative Forestry Funding from the US Forest Service. To view urban and community forest species, please see Appendix K.*

USDA Scientific Name	USDA Common Name	High Elevation Forests	Pinyon-juniper Woodlands	Mixed Conifer Forests	Quaking Aspen	Riparian-Wetlands	Hot/Warm Deserts	Urban & Community Forests*
Abies concolor	white fir			•	•			
Abies lasiocarpa var. *lasiocarpa*	subalpine fir	•		•	•			
Abies lowiana	Sierra white fir			•				
Abies magnifica	California red fir			•				
Acer glabrum var. *diffusum*	Rocky Mountain maple			•	•			
Acer glabrum var. *glabrum*	Rocky Mountain maple		•	•		•		
Acer grandidentatum var. *grandidentatum*	bigtooth maple			•	•	•		
Acer negundo var. *interius*	boxelder			•	•			•
Alnus incana ssp. *tenuifolia*	thinleaf alder					•		
Alnus rhombifolia	white alder					•		
Amelanchier alnifolia var. *alnifolia*	Saskatoon serviceberry	•	•	•		•		
Amelanchier alnifolia var. *cusickii*	Cusick's serviceberry			•	•	•		
Betula occidentalis	water birch					•		
Celtis laevigata var. *reticulata*	netleaf hackberry					•		
Cercis orbiculata	California redbud					•	•	
Cercocarpus ledifolius var. *intercedens*	curl-leaf mountain mahogany		•					
Cercocarpus montanus var. *montanus*	alderleaf mountain mahogany		•					
Chilopsis linearis ssp. *arcuata*	desert willow						•	
Crataegus douglasii	black hawthorn					•		
Crataegus rivularis	river hawthorn					•		

USDA Scientific Name	USDA Common Name	High Elevation Forests	Pinyon-juniper Woodlands	Mixed Conifer Forests	Quaking Aspen	Riparian-Wetlands	Hot/Warm Deserts	Urban & Community Forests*
Frangula betulifolia ssp. *obovata*	obovate buckthorn					•		
Frangula californica ssp. *ursina*	California buckthorn					•		
Fraxinus anomala var. *anomala*	singleleaf ash		•			•	•	
Fraxinus cuspidata	fragrant ash		•			•		
Fraxinus dipetala	California ash						•	
Fraxinus velutina	velvet ash					•		
Gleditsia triacanthos	honeylocust					•		
Hesperocyparis arizonica	Arizona cypress						•	•
Juniperus californica	California juniper		•				•	
Juniperus grandis	western juniper		•	•				
Juniperus occidentalis	western juniper		•					
Juniperus osteosperma	Utah juniper		•				•	
Juniperus scopulorum	Rocky Mountain juniper		•			•		
Parkinsonia aculeata	Jerusalem thorn						•	
Parkinsonia florida	blue paloverde						•	•
Picea engelmannii var. *engelmannii*	Engelmann spruce	•		•	•			
Pinus albicaulis	whitebark pine	•						
Pinus contorta var. *murrayana*	Sierra lodgepole pine	•						
Pinus edulis	Two needle pinyon		•					
Pinus flexilis	limber pine	•		•	•	•		
Pinus jeffreyi	Jeffrey pine			•				
Pinus lambertiana	sugar pine			•				

USDA Scientific Name	USDA Common Name	High Elevation Forests	Pinyon-juniper Woodlands	Mixed Conifer Forests	Quaking Aspen	Riparian-Wetlands	Hot/Warm Deserts	Urban & Community Forests*
Pinus longaeva	Great Basin bristlecone pine	•		•				
Pinus monophylla	singleleaf pinyon		•	•				
Pinus monticola	western white pine			•				
Pinus ponderosa var. *ponderosa*	ponderosa pine		•	•		•		
Pinus ponderosa var. *scopulorum*	ponderosa pine		•	•	•	•		
Pinus ponderosa var. *washoensis*	Washoe pine		•	•	•			
Populus alba	white poplar					•		•
Populus angustifolia	narrowleaf cottonwood					•		
Populus balsamifera ssp. *trichocarpa*	black cottonwood					•		
Populus fremontii ssp. *fremontii*	Fremont cottonwood					•		•
Populus tremuloides	quaking aspen					•		•
Prosopis glandulosa var. *torreyana*	western honey mesquite						•	
Prosopis pubescens	screwbean mesquite						•	
Prunus virginiana var. *melanocarpa*	black chokecherry				•	•		
Pseudotsuga menziesii var. *glauca*	Rocky Mountain Douglas-fir			•		•		
Pseudotsuga menziesii var. *menziesii*	Douglas-fir			•				
Psorothamnus spinosus	smoketree						•	
Purshia stansburiana	Stansbury cliffrose						•	
Quercus chrysolepis var. *chrysolepis*	canyon live oak							
Quercus gambelii var. *gambelii*	Gambel oak						•	
Quercus turbinella	Sonoran scrub oak						•	
Robinia pseudoacacia	black locust					•		

USDA Scientific Name	USDA Common Name	High Elevation Forests	Pinyon-juniper Woodlands	Mixed Conifer Forests	Quaking Aspen	Riparian-Wetlands	Hot/Warm Deserts	Urban & Community Forests*
Salix alba	white willow					•		•
Salix amygdaloides	peachleaf willow					•		
Salix bebbiana	Bebb willow					•		
Salix geyeriana	Geyer willow					•		
Salix gooddingii	Goodding's willow					•		
Salix lasiolepis var. *lasiolepis*	arroyo willow					•		
Salix ligulifolia	strapleaf willow					•		
Salix lucida ssp. *caudata*	greenleaf willow					•		
Salix lucida ssp. *lasiandra*	Pacific willow					•		
Salix lutea	yellow willow					•		
Salix planifolia ssp. *planifolia*	diamondleaf willow					•		
Salix prolixa	MacKenzie's willow					•		
Salix scouleriana	Scouler's willow	•	•	•	•	•		
Sambucus nigra ssp. *cerulea*	blue elderberry					•		
Sambucus racemosa var. *melanocarpa*	Rocky Mountain elder					•		
Sambucus racemosa var. *racemosa*	red elderberry					•		
Senegalia greggii	catclaw acacia						•	
Shepherdia argentea	silver buffaloberry		•			•		
Sorbus scopulina var. *scopulina*	Greene's mountain ash			•	•	•		
Taxus brevifolia	Pacific yew	•						
Tsuga mertensiana	mountain hemlock	•						
Washingtonia filifera	California fan palm					•	•	

USDA Scientific Name	USDA Common Name	High Elevation Forests	Pinyon-juniper Woodlands	Mixed Conifer Forests	Quaking Aspen	Riparian-Wetlands	Hot/Warm Deserts	Urban & Community Forests*
Yucca brevifolia var. *brevifolia*	Joshua tree						•	•
Yucca brevifolia var. jaegeriana	Jaeger's Joshua tree						•	
Yucca elata	soaptree yucca						•	•
Invasive Species								
Elaeagnus angustifolia	Russian olive					•		•
Tamarix spp.	saltcedar					•		

Forest Legacy Areas and Assessment of Need

Working forests are valuable because of their ability to provide sustainable timber products, high quality wildlife habitat, watershed and natural resource protection, carbon sequestering, oxygen production, and multiple recreational opportunities. Development and fragmentation of these forested areas threatens forest-related benefits they provide to current and future generations. Forest Legacy funding protects and conserves private forest lands that maximize public conservation values. NDF administers the federally funded Forest Legacy Program (FLP) with oversight from the USFS. The program intent is identification of environmentally important forest areas that are threatened by conversion to non-forest uses, to protect forest lands via conservation easements and other mechanisms, and to recognize other conservation opportunities.

The Assessment of Need (AON), a requirement for states participating in the Forest Legacy Program, is a detailed analysis of the issues pertinent to the program and helps prioritize locations in the state for FLP proposals. It includes input from many organizations, agencies, and individuals as well as public comment. This FRWAP identifies high priority areas where the procurement of conservation easements and fee simple title is a key strategy. Agencies, land trusts, or other organizations may have an interest in protecting these areas for a variety of purposes. The strategies identified within this plan are intended to guide and support these efforts in addition to those in which the FLP participates. NDF completed the Forest Legacy Program AON as part of this plan. All the required components developed in conjunction with the NDF Advisory Committee (functioning in-part as the State Forest Stewardship

Coordinating Committee) were integrated into this plan. Through this process, these areas were expanded based on development threats, scarcity of forestlands, and values of riparian areas for ecosystem health and function. Appendix D contains the required elements of the AON, including the applicable eligibility criteria, specific Forest Legacy Areas for designation, and the process used by NDF to evaluate and prioritize projects to be considered for inclusion in the Forest Legacy Program. The Strategy section of this plan contains the specific goals and strategies to be accomplished by the FLP.

Forest Legacy Areas provide the priority areas for the Forest Legacy Program to help private landowners and counties preserve Nevada's working forest lands. This assessment considers the newest available data to support the analysis and make necessary changes in Forest Legacy Areas as identified below. The priority landscapes analysis as well as research and descriptions of pertinent eligibility criteria required by the National Forest Legacy Guidelines were used to determine if the Forest Legacy Areas were still valid and reflective of the need for working forest protection. Based on this evaluation, there was not high correlation between the existing Forest Legacy Areas and the required criteria for consideration. Therefore, these areas were expanded to reflect the analysis results (Figure 71 and Table 12). As a result, there were six geographically discrete Forest Legacy Areas identified and one conditional Forest Legacy Area. This conditional area consists of the Riparian-Wetland areas across the state, which are defined by species designated in Table 11, as well as soils and hydrological conditions supportive of riparian-wetland species.

Table 12. Forest Legacy Areas, the approximate number of potentially qualifying acres for Forest Legacy Program Support, and the applicable eligibility criteria for each area.

Forest Legacy Areas	Potentially Qualifying Acres*	Timber and other forest commodities	Scenic resources	Public recreation opportunities	Riparian areas	Fish and wildlife habitat	Known threatened and endangered species	Known cultural resources	Other ecological values
Jarbidge River	306,613	●	●	●	●	●	●	●	
Mt. Charleston	3,173	●	●	●	●	●	●	●	
Muddy River	1,394		●	●	●	●	●	●	
Santa Rosa Range	2,026		●	●	●	●		●	
Schell Creek	1,2461	●	●	●	●	●		●	
Tahoe-Sierra Front	331,346	●	●	●	●	●		●	
Riparian Areas**	305,976		●	●	●	●	●	●	

**Potentially qualifying acres are non-federal lands, less than 40% slope on average, and greater than 10-acre parcels that have the necessary forest species cover (Table 11) of 75% or greater or can be restored to that level.*
***Eligible Riparian-Wetland acreages have been omitted since "Riparian-Wetland Areas" is listed as a separate category.*

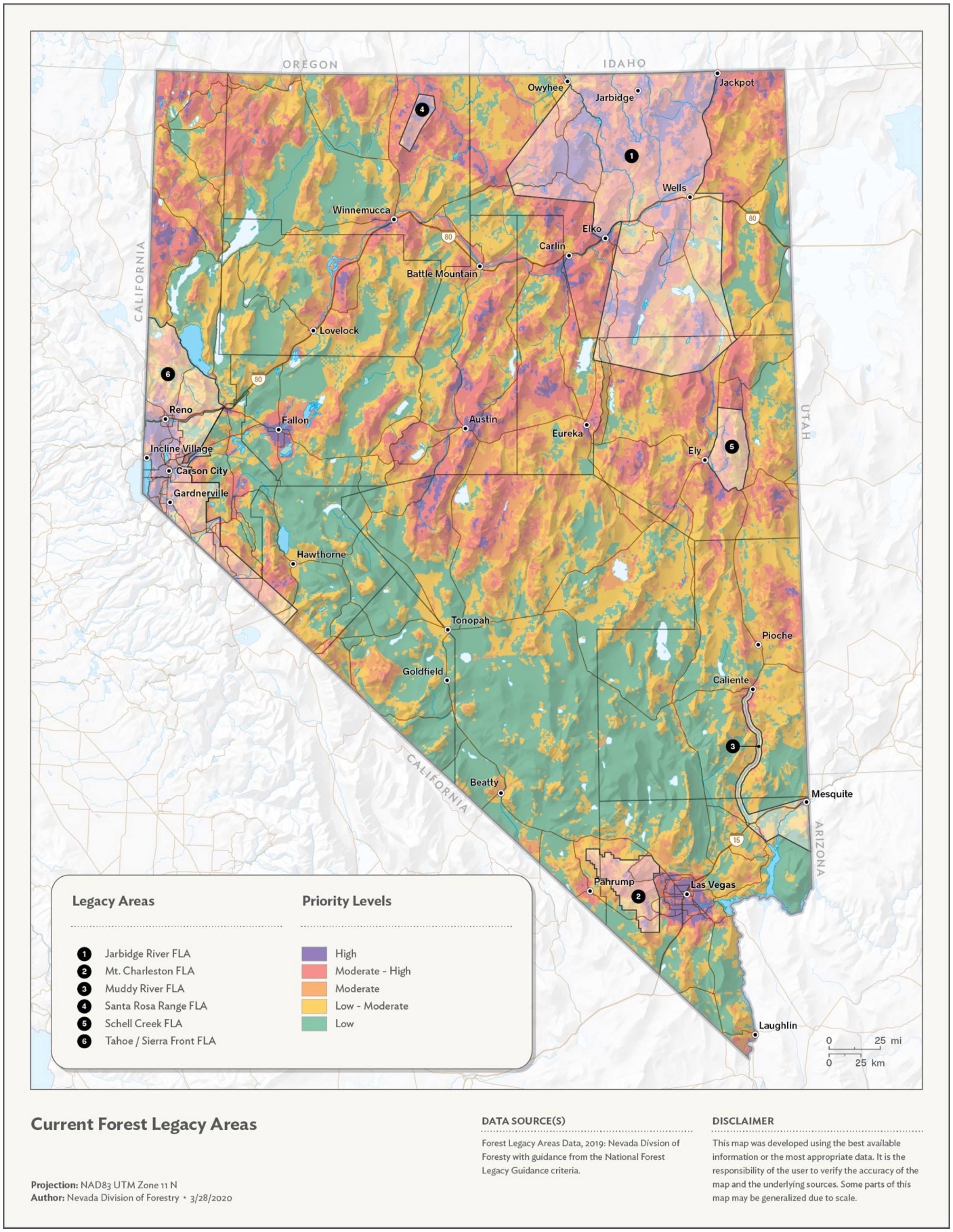

Figure 71. Forest Legacy Areas overlaid on priority landscapes analysis results.

Forest Stewardship - Important Forest Resource Areas

Forest Stewardship is a nationally supported Cooperative Forestry Assistance program that connects private landowners with the information and tools they need to manage their forests and woodlands. Important Forest Resource Areas are those landscapes considered to have high program potential for forest or woodland cover defined by National Forest Stewardship Program Standards and Guidelines. These areas are required to be designated as a part of this plan per USFS-SPF guidance.

A spatial analysis was performed to further prioritize lands into a smaller and more focused subset of parcels that qualify for Forest Stewardship program support. Appendix A describes the methods and layers used to complete the Forest Stewardship Program lands analysis, which designated lands that have stewardship potential, high stewardship potential (Forest Resource Areas), and no stewardship potential (Figure 72). The results of the analysis showed that there are approximately 2,120,150 acres of Forest Stewardship Program eligible acres, of which 1,007,526 acres are considered to have high stewardship potential, and about 1,940,381 acres or 92 percent of these exist within the priority landscapes. Most states are restricted to 50 percent or less of eligible acres being considered important forest resource areas. However, Nevada was provided an exemption from this rule because the state of Nevada does not invest in the Forest Stewardship Program.

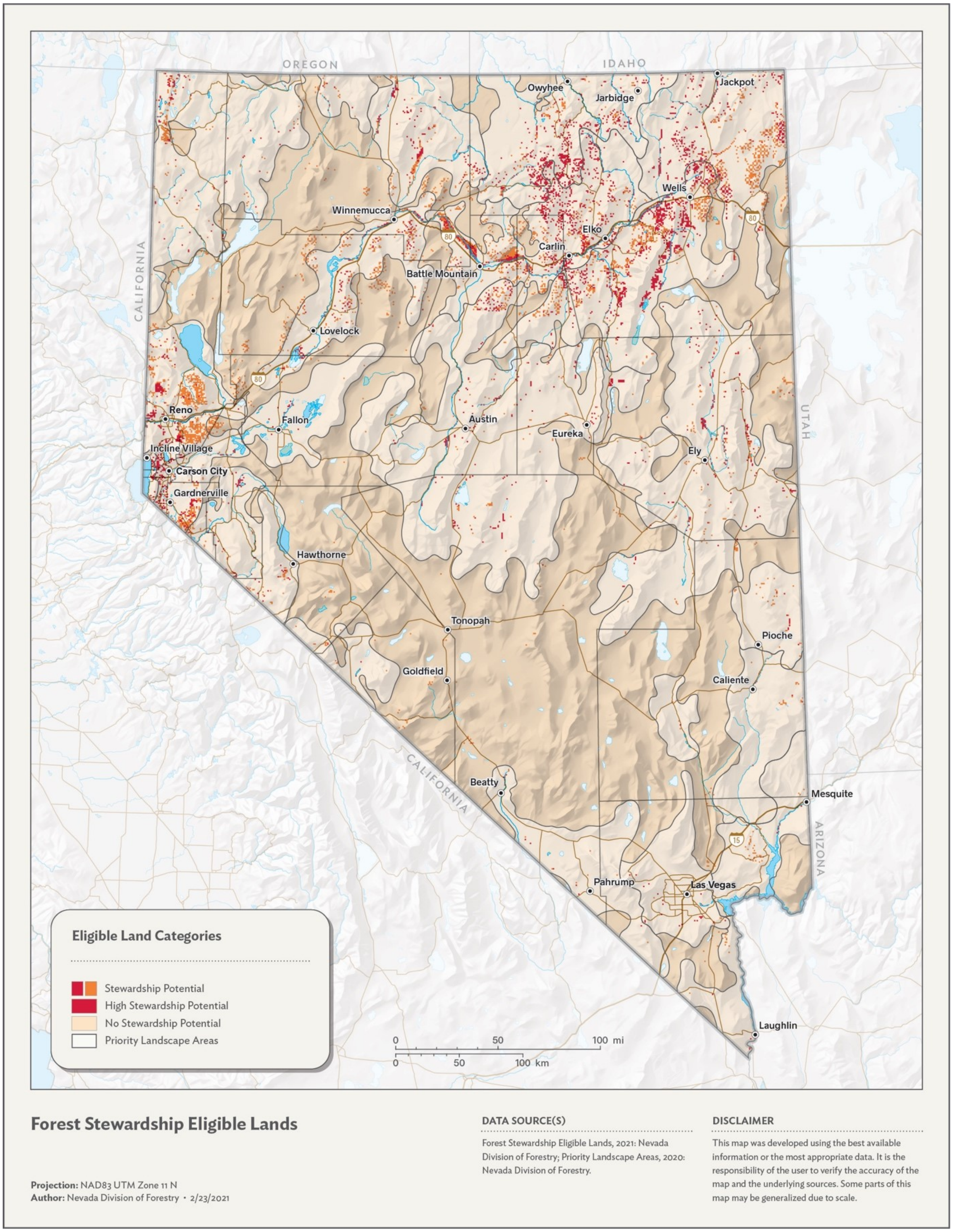

Figure 72. Forest Stewardship Program Important Forest Resource Areas in Nevada.

Multi-State Priority Landscapes

USFS-SPF direction requires regional and multi-state analyses to delineate multi-state priority landscape areas. In the West, states are independently developing action plans that are appropriate for their unique circumstances. A regional assessment of the West does not exist; therefore, states work together to identify priority landscapes across state boundaries after individual state plans are completed. Appendix I contains the current information on multi-state priority landscapes.

Shared Stewardship Priority Areas

In 2018, the USFS announced its national pursuit of the Shared Stewardship concept and released the Toward Shared Stewardship Across Landscapes: An Outcome-Based Investment Strategy (USFS 2018). In 2019, the National Association of State Foresters released the supportive report A Century of Shared Stewardship: State Foresters and the Forest Service (NASF 2019), which supported the premise and practice of shared stewardship. It highlighted all the successes that had been achieved by sharing decision making and priority setting. The Shared Stewardship initiative has led to new partnerships and commitments among those partners to work together in the right place, at the right time, with the right approach and tools. In 2019, Nevada land management partners held coordinating meetings that created discussion and consensus rich environments that allowed the partners to start forming an idea of how and where land management agencies could best implement this new strategy. Following the meeting, the Agreement for Shared Stewardship was executed by the Governor, USFS, Nevada Indian Commission, USFWS, and BLM. Appendix C describes the process by which Shared Stewardship in Nevada was officially adopted and the status of developments of the initiative, including a map of the Shared Stewardship Priority Areas in Nevada.

Implementation of the Forest, Range, and Watershed Action Plan

Implementation of this Forest, Range, and Watershed Action Plan

The implementation of this plan requires a significant analysis of conditions within each priority landscape to determine the actual need for management actions. The analysis provided through the preceding sections illuminate the scale and scope of priority issues and general locations of need. The level of data collection and analysis required to calculate actual needs has not occurred. Considering this, available records were consulted to approximate the capability of land management and conservation partners in Nevada, and to the natural resource management needs required for implementing this plan.

Approach

The goals and strategies set forth in this plan can only be accomplished through a combination of re-focusing existing resources and increasing capability and capacity where needed. Unifying these concepts, under direction from a cohesive set of leaders across stakeholder organizations, in a collaborative decision-making setting will allow all partners to align their capabilities to maximize their impact on natural resource management and conservation.

Capability and Capacity Assessment and Development

Organizational capabilities in Nevada are based on the cumulative independent efforts of natural resource and fire management agencies being independently led, strategized, planned, and equipped to implement overlapping missions and priorities on specific jurisdictional or topical areas. There have been significant areas of partnering to achieve broader landscape scale success, though it is not universal across agencies or landscapes in the state.

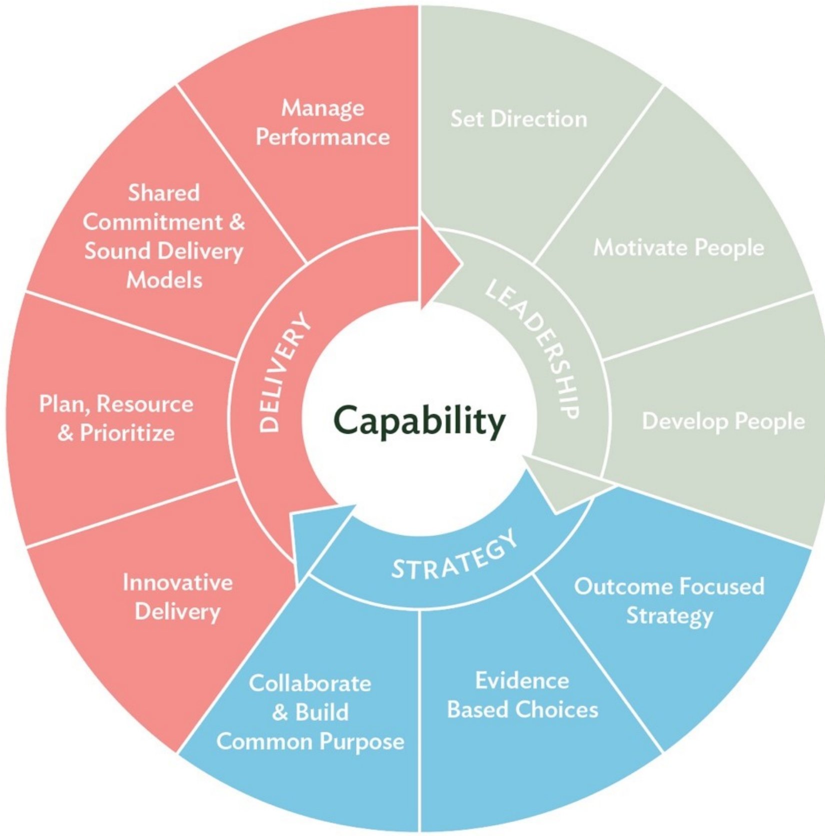

Figure 73. Capability leading, strategizing, and implementation process and elements.

Leadership and Strategy

With the current leadership emphasizing stakeholder participation in Nevada's Shared Stewardship and Cohesive Strategy efforts, most of the stakeholders are starting to build strategies that will result in enhancing and building overall capability sets that match the outcomes sought by the broader set of statewide natural resource and fire management stakeholders. Once the strategy has been developed, stakeholders need to target localized levels and design detailed plans that demarcate resources required to meet performance expectations. Key elements of Nevada's capability assessment and development includes process design, delivery systems, technological support, equipment inventories, skillset, and work force capacity.

Service Delivery

The current capability and capacity of all partners for strategy implementation across Nevada was estimated from the self-reported statistics of average annual accomplishments by major land management partners in Nevada. The information is presented in Table 13. While this table does not reflect every accomplishment from every potential source, it accounts for most of the accomplishments of primary land management agencies including USFS, BLM, NDOW, NDF, and NRCS. Natural resource and wildland fire management services delivered are the cumulative result of all partners operating at a specific capability and capacity under existing budgets, work forces, structures, equipment, technology, and expertise. Fluctuation in any of these areas will cause a shift in these accomplishments and the associated outcomes. These activities are funded and implemented by all levels of government agencies and NGO partners active in Nevada. Most of the efforts are funded through federal agency budgets and pass-through federal grants to state and local agencies. This situation is in relative alignment with land ownership acreage within the state and is proportional to the amount of risks, threats, and key issues found on those lands.

Table 13. Comparison of the current and required average annual statewide accomplishment of forest, range, and watershed management activities in Nevada.

Performance Areas	Current Accomplishment Capability	Targeted Accomplishment Capability	Difference
Land Treatment			
Acres treated or restored (seeding, planting, prescribed fire, fuel reduction, weed treatments)	585,887	878,831	+292,944
Planning/permitting			
New acres under treatment, stewardship or other plans (NEPA or otherwise approved)	105,000	315,000	+210,000
Community wildfire protection plans updated	5	60	+55
Public and stakeholder education/training			
Individuals educated in fire prevention or conservation education events	26,000	39,000	+13,000
Safe and Effective Fire Response			
Early detection cameras/lookouts	41	65	+24
Early detection post-lightning aerial/remote sensing reconnaissance	15%	75%	+60%
Average wildland fire initial attack success	90-98%	94-98%	+4%
Initial attack fire response quantity	500-700	500-700	No change
Urban Environments			
Communities assisted with urban forestry	40	100	+60
Urban forest management plan updates	3	10	+7
Natural resource related industry and economic health			
Agricultural production acres improved (NRCS 2012)	208,834	208,834	No change
Mines in production (BLM 2020)	165	198	+33
Renewable energy developments in production (PUC 2018, PUC 2020)	66	87	+21
Outdoor recreation jobs supported (NOBC 2020)	87,000	96,000	+9,000
Livestock/Wildlife water source maintenance and/or construction	502	1994	+1492
Recreational opportunities afforded			
Developed and maintained recreation sites	286	286	No change
Developed trails (motorized and non-motorized)	5,794	5,794	No change
Hunting and fishing licenses sold	243,394	243,394	No change
Fish and wildlife protection and conservation			
Special status species listed	59	59	No change
Special status species managed/assessed	37	59	+22
Collaborative planning and management			
Local area or issue working groups assembled, facilitated, and functional	6	26	+20

Collaboration Resource Management

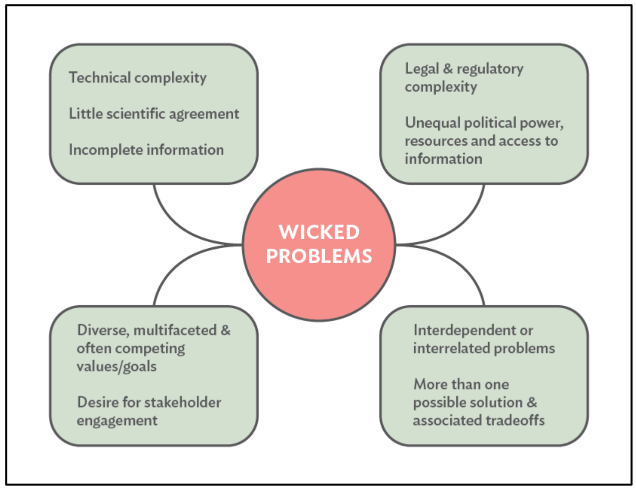

Figure 74. Factors associated with controversial or highly politicized (wicked) problems are extremely difficult or impossible to solve with a collaborative approach (Van Riper 2020).

The juxtaposition and diversity of natural resource values, competing interests, threats, cultures, experiences, knowledge, and jurisdictional responsibilities in Nevada requires that natural resource users, managers, and regulators combine their efforts to address issues collectively to be effective in achieving their goals and solving problems. Collaborative problem solving is effective when the right people are brought together to be constructive in the presence of good information. While science has helped inform these decisions by speaking to the level of uncertainty, tradeoffs, benefits, risks, and costs associated with different options, science alone cannot determine what is socially, politically, or economically feasible or valued. With these values, groups pursuing collaborative natural resource management have developed a reciprocal understanding, shared knowledge, and mutual trust to collectively produce better outcomes. Ultimately, human capital (skills, knowledge, and experiences), social capital (relationships) and mobilization of resources (labor, funding, materials, skills, and knowledge) has resulted in collective actions that have created significant natural resource management advancements at large scales. To create impactful actions, collaborators must pay close attention to the scale and nature of the challenges to match group capabilities and resources to the subject matter of the challenges. Where collaborative efforts were tried and didn't have the appropriate participation, processes, and facilitation in place, impactful successes like increases in capacity, synergistic solutions, common visions, collective action, and sustainable solutions were not always found (Van Riper 2020).

Recent investments in Nevada drive collaborative activities, but there is a need for more structural organization across the state for collaborative efforts to meet desired expectations. Independent and unrelated efforts are needed in some cases, yet similar needs across many geographically defined areas lend the situation to a design where a statewide hierarchical system could pave the way for collaborative leadership groups providing strategic direction to many local working groups that collaborate on the delivery of the strategy. Appendix J offers additional information to help guide participants and coordinators of collaborative natural resource management efforts.

Interstate Collaboration

Nevada's neighboring states are faced with the same or similar issues identified in this plan. Where the same issues or priority landscapes designated by each state abut at state lines, states will work collaboratively to address issues across a broader landscape. Inter-state collaboration on addressing natural resource issues will continue to occur between Nevada and the five neighboring states of Arizona, Oregon, Idaho, California, and Utah.

Monitoring

Ongoing monitoring by NDF and partners will provide data for determining whether changes are needed in our approach to addressing identified threats/issues. Strategies that prove effective through forest health monitoring, pre- and post-project and periodic follow-up photo-monitoring, and other efforts will continue. Less effective monitoring strategies will be evaluated for needed change. The strategies identified are part of a long-term program which shall be updated and adapted as a result of effectiveness monitoring and changing natural resource conditions.

In addition to pre- and post-project photo-monitoring that occurs with NDF projects, longer term monitoring is achieved through periodic inspections of a sample of NDF projects to ensure that conditions are maintained, or intended trajectories are occurring. Due to advances in technology, the locations of all NDF actions on the landscape can be readily tracked and mapped to determine the amount of focus and investment occurring within each of the priority landscapes. This data along with monitoring data compiled by other agencies may be shared with the hope that collaboration and complementary actions by partners to focus on appropriate landscapes will be taken. Recent technological and database advancements, data sharing opportunities, shared priorities, and collaborative projects across various agencies and groups are more commonplace, but involve considerable communication, time, and effort.

Nevada is also the beneficiary of several significant, large-scale, and often long-running ecosystem monitoring efforts including BLM's Assessment, Inventory, and Monitoring (AIM) program, the Habitat Assessment Framework (HAF) program on BLM and USFS lands, NDOW's Project Effectiveness/Vegetation Monitoring, UNR's Stringham Lab, and the Sagebrush Steppe Treatment Evaluation Project (SageSTEP), among others. These programs collect the baseline data that often inform landscape priorities and actions.

Resources Necessary and Limitations

Nevada's resource and fire management partners generally do not have the capacity to accomplish all identified strategies within each of the identified priority landscapes in this plan. Table 13 identifies the additional accomplishments necessary to reach goals outlined in the strategy section of this plan. Accomplishments in excess of identified needs must be scrutinized to determine where additional capacity building will be the most effective. When scrutinizing these needs, it is important for partners to consider support for legal, financial, planning, collaborative facilitation, implementation, monitoring, coordination, and collaboration to ensure that investments result in the desired increase in accomplishments. It is important to note that although the intent of this document is to be comprehensive, there will undoubtedly be unforeseen needs outside those identified that will require additional expenditure of resources.

Collaborative Processes

The lack of well-organized and supported collaborative processes in Nevada is currently holding the stakeholders back from realizing sustainable and mutually supported strategic directions and accomplishments of natural resource and wildfire management goals. Specialized assistance and training are needed to create and sustain a collaborative culture into the future. Some structure will be required to orient multiple groups, initiatives, and stakeholders toward commonly established goals, measures of success, and adaptation processes. The Conservation District Local Work Group function under NRCS Manual Title 440 Part 501 could provide the leadership for this collaborative structure and culture at the local level with engagement of all stakeholders within each Conservation District. Likewise, the Shared Stewardship and Cohesive Strategy structures have been combined into a single process where the Shared Steward Agreement establishes a statewide Executive Committee to help support locally led collaborative efforts. There are several other statewide efforts, like the Nevada Collaborative Conservation Network, Nevada Sagebrush Ecosystem Council, that are pursuing this approach.

Delivery Systems

As new strategies are developed and local stakeholders define objectives for their respective landscapes, assessments of current systems used to plan and deliver services must be designed to allow multiple stakeholders to provide their services on the same landscape in concert, and within specified timelines.

Technological Support

In an age where stakeholders rely on each other for capability and capacity to reach objectives, technology is often the bridge that creates opportunities for common platforms for assessment, planning, tracking, and reporting. Field operated units with GIS and GPS capabilities are required in most cases to support the synergistic approach required at the field level. In addition to these devices, bandwidth servicing field stations, servers, software, and personnel with expertise to design, assemble, manage, deploy, and train the workforce on these systems and devices is required.

Equipment Inventories

Most natural resource and wildfire management tasks are highly reliant upon equipment inventories held by agencies because the equipment is specialized. In most cases, the agency's inventory matches their current staffing to operate and the expectations for production within the agency. As local level working groups define landscape management objectives, these groups will also need to facilitate the allocation of resources, including equipment to ensure that projects are accomplished in a reasonable timeframe. There may be a need to expand current equipment fleets or contracting pools to expand the capacity to achieve project objectives.

Monitoring

With monitoring conducted by several agencies and aforementioned groups related to the effectiveness of projects and site and landscape trends, recognition of the importance of expending the time and effort required to appropriately train staff to follow appropriate protocols, successfully document treatment areas, actions, and results must be maintained. Many of these aspects related to project monitoring have the potential to be squeezed due to various workload constraints and capacity issues, moving targets, turnover, etc. Moreover, projects have the tendency to receive only brief follow-up monitoring and then largely be forgotten after projects are closed out due to the move to new agency directives, and new projects and funding sources. Including longer term monitoring in project budgets when possible can be a tool to better ensure the fate of the project as well as ensure durability of the investments that have been made.

In addition, monitoring efforts, data-basing, and uses of data across agencies can be quite different. Various databases accumulate data, some of which is more accessible, user friendly, and of higher quality than others. Considerable efforts in recent years are being made by the BLM to update some of their databases, by the USFS to provide their spatial project data online, by NDF to include its treatment areas and project details online, and NDOW to compile both its own projects and allow private lands projects to be entered and mapped as well. In addition, the Land Treatments Database is still compiling data on relevant land treatments, and the Conservation Efforts Database has recently been updated by FWS and USGS to allow all Greater Sage-grouse conservation efforts to be entered by all agencies and mapped in one place. The Sagebrush Ecosystem Program also provides details and a map of the locations of various Conservation Credit System credit projects. A few agencies must protect the information of private landowners. Several of these databases will soon allow a user to import and export shapefiles, which is a real advancement from products of the past. Despite these advances, navigating the various data sharing tools can require some skill and take time to become technically savvy on what are often proprietary geospatial platforms. Assessing all this information before implementing a small scale or opportunistic project is still not possible given time constraints. On the other hand, the workload associated with the stewardship of various data and data sharing applications, can be considerably labor- intensive. Furthermore, there is the last step of putting data in the hands of researchers when appropriate to advance scientific understanding, which could be made easier through more consistent protocols, reporting, data schemes, etc. Despite having come a long way, further integration is likely necessary to allow the workload necessary for considerable collaboration to be streamlined.

Skillsets and Work Force Capacity

As collaboration becomes more common, supportive technology gets integrated, and landscape achievements become the expectation, new and greater amounts of skills and labor pools will need to be developed among the stakeholders.

Training individuals and expanding the collaborative facilitation pool in Nevada will be required if these processes are expected to succeed and produce beneficial outcome.

The constant evolution of scientific developments and technological advancements requires that professionals be provided continuing education throughout their careers. In some cases, new technology will require that more labor be provided to administer systems, processes, hardware, or software that never existed in the past.

As Nevada grows toward more collaborative and landscape scale approaches, there will be a need to expand the fleet of equipment or hire contractors that have the capabilities needed. Contractor pools have been shallow for some time regarding areas of performance typically administered by the agencies. If contractors were to become a significant resource, there would have to be steps taken to communicate projected needs and workshops undertaken to educate and train potential contractors on how to qualify and be hired to perform tasks on projects.

Accomplishment Tracking and Reporting

Natural resource and fire management agencies currently monitor the impact of their programs through tracking accomplishment metrics associated with each program area. Through the Shared Stewardship initiative and other partnerships, partners will refine and continue to track and report common accomplishment metrics annually to evaluate their progress toward goals and strategies in this and other plans. It will be necessary to design a system that can aggregate these accomplishment statistics to know if land management agencies are making progress toward their goals together.

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Appendix A – Priority Landscapes Assessment & Forest Stewardship Lands Analysis Methodologies and Layer Descriptions

Priority Landscapes Assessment

A comprehensive geospatial analysis was conducted using 29 data sets selected for their themes, attributes, efficacy, and completeness. Some data sets were recommended by the direction of the USFS and other state and federal agencies for use in a standard statewide assessment. Additional data sets were included when determined as necessary, and each data set was initially processed to be used in a raster-based analysis. The geospatial methodologies used to analyze the data required that each data set be placed into one of three categories, including 1) threats, 2) values, and 3) collaborative opportunities, which helped in understanding the purpose and role of each data set. A per-cell statistical (sum) analysis was used to composite the data sets in all three categories. Then the results of the analysis were classified, denoting the priority values in five nominal classes, including 1) low, 2) low-moderate, 3) moderate, 4) high-moderate, and 5) high, which represent a relative ranking to help describe landscape prioritization.

Beginnings of Forest Resource Assessment Project

The Forest, Range and Watershed Resource Assessment Project (FRWAP) initially identified over 60 different geospatial data sets that could be important in assessing Nevada's forest, rangeland, and watershed resources. To effectively assess landscape resources and determine priority landscapes, it was critical to obtain the most relevant, current, and accurate data possible. This prompted the FRWAP working committee to identify and acquire data sets specific to the key issues and threats described in the FRWAP, including forest and woodland health, wildfire hazards, urban and community forests, riparian wetland systems, species requiring special conservation, water quality and quantity, and climate change mitigation. Some pre-existing data sets used in the 2007 Spatial Analysis Plan (SAP), which was originally created for the Forest Stewardship Program, were also considered for use in the FRWAP. However, since 2007 many of the SAP data sets were updated, or entirely new data sets were made available from other sources. Ultimately, NDF staff identified 29 data sets with accompanying methodological documentation that would be effective in describing the nature of the identified key issues and threats. These 29 data sets were used in the first version of the Forest, Range and Watershed Resource Analysis (FRWRA) and are listed in table 2. For more detailed descriptions of each data set and the values used to determine assigned weights, please see the "Analysis Layer Descriptions" section.

Data Layer Acquisition and Compilation

The 29 data sets used in the first version of the geospatial analysis were primarily acquired from public sources, including, but not limited to, NDF, BLM, USGS, USFS, NRCS, U. S. Census

Bureau, Nevada Division of Natural Heritage (NNHP), Desert Research Institute (DRI), Multi-Resolution Land Characteristics Consortium (MRLC), and Landfire. Additional guidelines on which data sets to include were provided by the USFS, such as the use of the *Forests to faucets* and the *Forest and the woodland insects and disease* data sets.

The geospatial analysis consists of three data set categories:

1. **Base Data:** Data consisting of hill-shading, major roads, major lakes and streams, and county boundaries, which were acquired from the USGS National Map data platform. These base data sets were then compiled, processed, generalized, and symbolized for use in the FRWRA maps that were designed at an approximate scale of 1:3,700,000. Other accompanying data sets used throughout the FRWAP included Nevada land ownership acquired from the BLM, which included ownership boundaries for federal, state, tribal, municipal, and private lands.

2. **Input Data:** Data consisting of the compiled and geo-processed data sets developed as inputs for the analyses, including the 29 data sets related to the key issues and threats identified in the FRWAP

3. **Output Data:** Data consisting of the analytical output from the threats, values, and collaborative opportunities analysis, as well as the final composite priority landscape map and associated products

Data Manipulation

The 29 data sets used in the first version of the geospatial analysis were originally a combination of raster and vector (i.e. points, lines, or polygons) data types, with some data sets containing different extents at a variety of scales. Most of the data sets required geoprocessing, allowing them to be effectively analyzed using raster-based methods. There were three main components in processing each data set, including 1) transformation, 2) sub-setting, and 3) conversion. Any data sets not using a modified (Central meridian set to ~116° west) Lambert Azimuthal Equal Area (NAD 83 datum) map projection were transformed (i.e. re-projected). A 3-mile buffer around the Nevada state boundary was used as a mask to clip each data set that extended beyond state bounds to reduce the processing time during the analysis. Lastly, each vector data set was converted to a raster using nearest neighbor resampling and a spatial resolution of 30 meters to retain categorical distinctions and spatial consistency, as most of the raster data sets used in the analysis were discrete and natively 30 meters in resolution. During the conversion process, converted data sets containing attributes critical to the analysis were maintained in related tables, or a single value field was used for those data sets that did not have multiple retained fields.

Once all the data sets were processed, each raster was reclassified based on a weighted criterion consisting of ranked and standardized values. The first step in this process involved classifying the cells in each data set respective of their theme and value range using the natural breaks (Jenks) classification method, or the data set's inherent classification scheme was evaluated and used for data containing an existing classed field. The classification scheme developed for the analyses consisted of 3 nominal ranges described as low (1), moderate (2), and high (3). Then, the classed data sets were reclassified to contain class values between 1 and 3, representing the nominal low-to-high scheme. Some data sets could not be classified because they did not contain a range of descriptive values, requiring that each cell be reclassified to contain a value of 3, representing a standardized value. This normalized the importance of the data set in relation to others containing classes. Certain data sets were determined to have the greatest importance were assigned a value of 6, which was considered a prioritized value. Lastly, data sets containing areas without data or where cells had a value of 0, were reclassified and assigned as "No Data," omitting these cells from being considered during the initial three analyses that determined priority areas for the values, collaborative opportunities, and threats categories.

GIS Analysis and Discussion

To determine priority landscapes, the data sets in the *threats, values,* and *collaborative opportunities* categories were summed on a per-cell basis using the cell statistics tool in ArcGIS. The results of the analysis produced cell values between 1 and 52, describing areas with no coincident cells and other areas showing significant overlap. The composited priority landscapes raster also contained a small number of null values denoting areas without any information, which were re-classified and assigned a value of 0. The cells containing values of 1 or greater were re-classified into five nominal classes, ranging from low to high (see table 1 below). As the values increase from 1 to 52, the intensity of the layer composition increases, highlighting areas where there are greater instances of *threats*, *values,* and/or *collaborative opportunities*. The visual results of the analysis indicated that the data sets that were prioritized, which included CWPP communities (NDF 2005, 2020), the wetland map of Nevada (DRI 2018), and urban areas (NLCD 2016), had the largest impact, as they were the most prominent. It is also important to note that, unlike many similar analyses that use a weighted sum overlay methodology, the data sets were classified and weighted prior to running the analyses to remove any differences in numeric formatting. For example, percentage values that were in a double-precision format were re-classified as integers, which was the data type used throughout the analysis. The purpose of using the same numeric data type was to make the results of the analyses more comprehensible when data sets were summed, avoiding data obfuscation. Lastly, the low-to-high class scheme used in this analysis (see Table 1 below) represents a relative ranking of prioritized landscapes, where the low category describes areas with the least composition of input data and the high category describes areas with the greatest composition. In other words, each category has no other inherent meaning beyond its relationship to the other categories in the ranking, strictly describing levels of input data composition as a measure of relative landscape prioritization.

To view the priority landscape analysis layers in greater depth, please visit the following web address: NDF FRWAP Data Portal.

Table 1. Priority landscape analysis map class values.

Composite Layer Values	Classes
1 – 11	Low
11 – 15	Low - Moderate
15 – 20	Moderate
20 – 26	High - Moderate
26 – 52	High

Layers Used and Assigned Weights

Table 2. Landscape threats and values, and collaborative opportunity layers.

#	Layers	Classes	Weights
LANDSCAPE THREATS			
1	Annual Grasses (NLCD 2016)	High, Moderate, Low	3,2,1
2	Forest and Woodland Insects & Disease (USFS 2010-2019)	High, Moderate, Low	3,2,1
3	Geothermal Potential (NBMG 2009)	High, Moderate, Low	3,2,1
4	Mineral Development Potential (NDM 2020)	High, Moderate, Low	3,2,1
5	Noxious Weeds (EDDMaps 2019)	High, Moderate, Low	3,2,1
6	Pinyon-juniper Priority Treatment Areas (NDF 2020)	Standardized Value	3
7	Section 303d - Impaired Waters (EPA 2015)	Standardized Value	3
8	Solar Potential (NREL 2019)	High, Moderate, Low	3,2,1
9	West Wide Wildfire Risk Assessment (Sanborn 2013)	High, Moderate, Low	3,2,1
10	Wild Horse Appropriate Management Level (Henning 2017)	High, Moderate, Low	3,2,1
LANDSCAPE VALUES			
1	Biomass Potential (NBMG 2020)	Standardized Value	3
2	BLM & USFS Grazing Allotments with AUMs (BLM 2019, USFS 2019)	High, Moderate, Low	3,2,1
3	CWPP Communities (NDF 2005, updated in 2020)	Prioritized Value	6
4	Developed Recreation (USFS 2019, BLM 2019, NPS 2019, State Parks 2004)	High, Moderate, Low	3,2,1
5	Forests to Faucets (NASF 2011)	High, Moderate, Low	3,2,1
6	Mule Deer Migration Corridors (NFWF 2019-2020)	Standardized Value	3
7A	Nevada Active Mines and Energy Producers (NBMG 2019)	High, Moderate, Low	3,2,1
7b	Solar Power Producers (DOE 2019) – *Joined with the Nevada Active Mines & Energy Producers data set listed above.*	--	--
8	Threated & Endangered Species (NNHP 2017)	Standardized Value	3
9	Wetland Map of Nevada (DRI 2018)	Prioritized Value	6
10	Wildland Urban Interface Areas (USFS 2017)	High, Moderate, Low	3,2,1
11	Urban Areas (NLCD 2016)	Prioritized Value	6
COLLABORATIVE OPPORTUNITIES			
1	BLM Sagebrush Project Planning Areas (BLM 2015)	Standardized Value	3
2	Ecosystem Resistance & Resilience (USFS 2014)	High, Moderate, Low	3,2,1
3	Nevada Crucial Habitat Assessment (NDOW 2013)	High, Moderate, Low	3,2,1
4	Sage-Grouse Priority Habitat Management Areas (SETT 2019)	Standardized Value	3
5	Section 602 - Forest Insect and Disease Areas (USFS 2014)	Standardized Value	3
6	USFS Fuels Projects (USFS)	Standardized Value	3
7	Wildlife Action Plan Focal Areas (NDOW 2017b)	Standardized Value	3

Analysis Layer Descriptions

Landscape Threat Layers

1 - Annual Grasses (NLCD 2016)

The 2016 NLCD (National Land Cover Dataset) *Annual herbaceous shrubland fractional component* data set was developed by the USGS in conjunction with other federal partners for the Multi-Resolution Land Characteristics Consortium (MRLC) project. The data set provides annual herbaceous percent vegetation cover estimates in raster format at a native spatial resolution of 30 meters, which was produced using ground measurements, imagery from high-resolution commercial satellites and Landsat 8, as well as regression tree modeling. The final product predominantly shows cheatgrass and other annual grasses found within the western U.S. It is important to note that native annual grasses may be shown in the data in areas of high elevation. All cells containing five percent annual grass coverage or greater were extracted from the original dataset and classified into three nominal ranges using a custom classification scheme. Areas containing between five and twenty percent annual grass cover were ranked the highest given their ability to be effectively treated. The table below shows the class ranges, the associated weights, and final classes.

% of Annual Grass Coverage per 30m Pixel	Weights	Classes
5 – 20%	3	High
21– 50%	2	Moderate
51 – 75%	1	Low

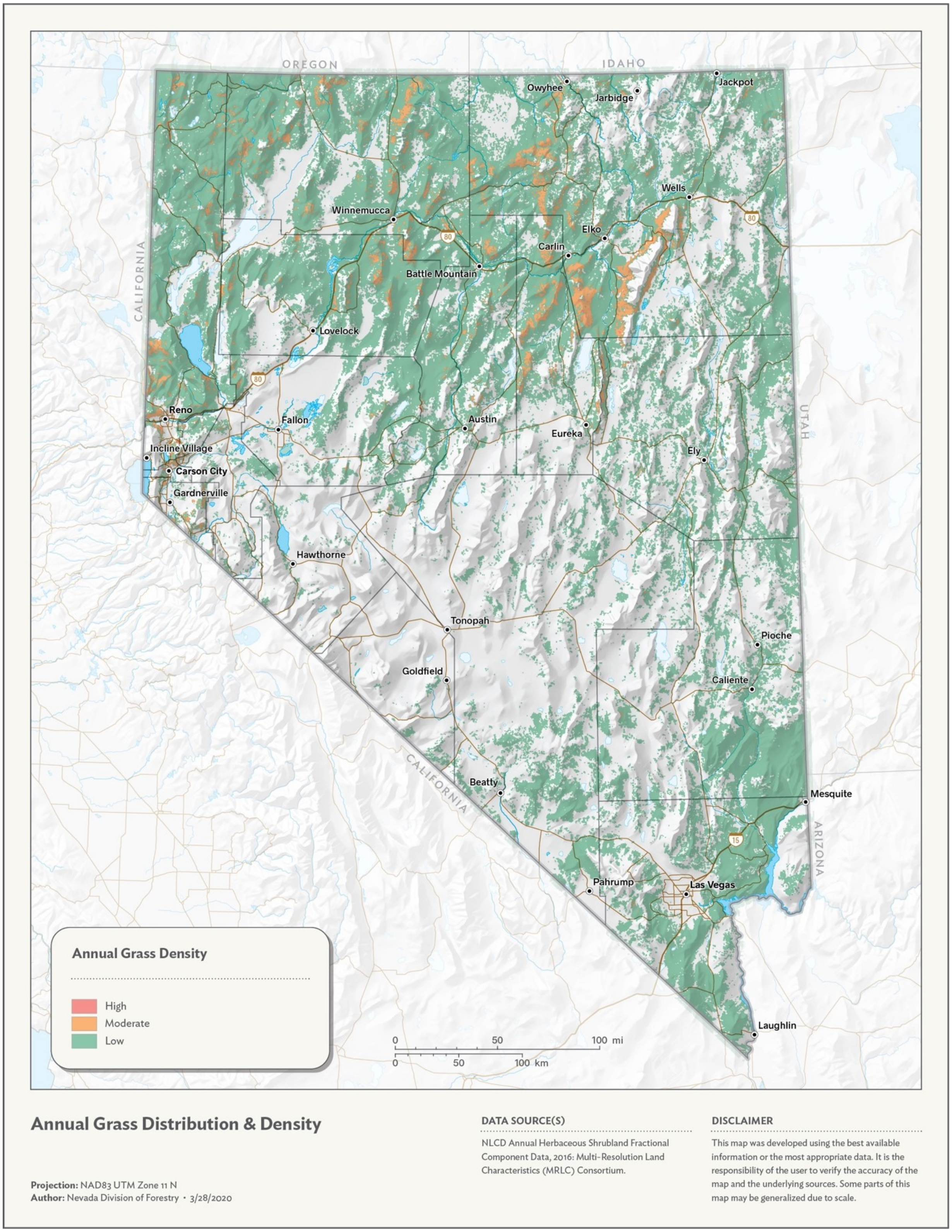


Figure 1. Map of annual grass density

2 - Forest and Woodland Insects & Disease (USFS & NDF 2010-2019)

The *Forest and woodland insect and disease* data set was developed by Justin Williams at the USFS Forest Health Protection office. The data set was created by identifying five common threats to forests in Nevada, including mountain pine beetle, white pine rust, pinyon needle scale, other defoliators, and noxious weeds. These threats were represented as a 30-meter resolution raster data sets and used in a weighted sum analysis that produced a new raster containing a 1 to 15 value range describing the amount of overlap between the five threat input data sets. The resulting cell values were placed into five nominal classes (i.e. low, low-moderate, moderate, moderate-high, and high) using the natural breaks (Jenks) classification method. The five classes used in results of the landscape threats analysis were further reclassified into three nominal ranges using the same classification method. The table below shows the class ranges, the associated weights, and final classes.

Threat Level Values	Weights	Classes
1 – 3. 96	1	Low
3. 97 – 9. 01	2	Moderate
9. 02 – 15	3	High

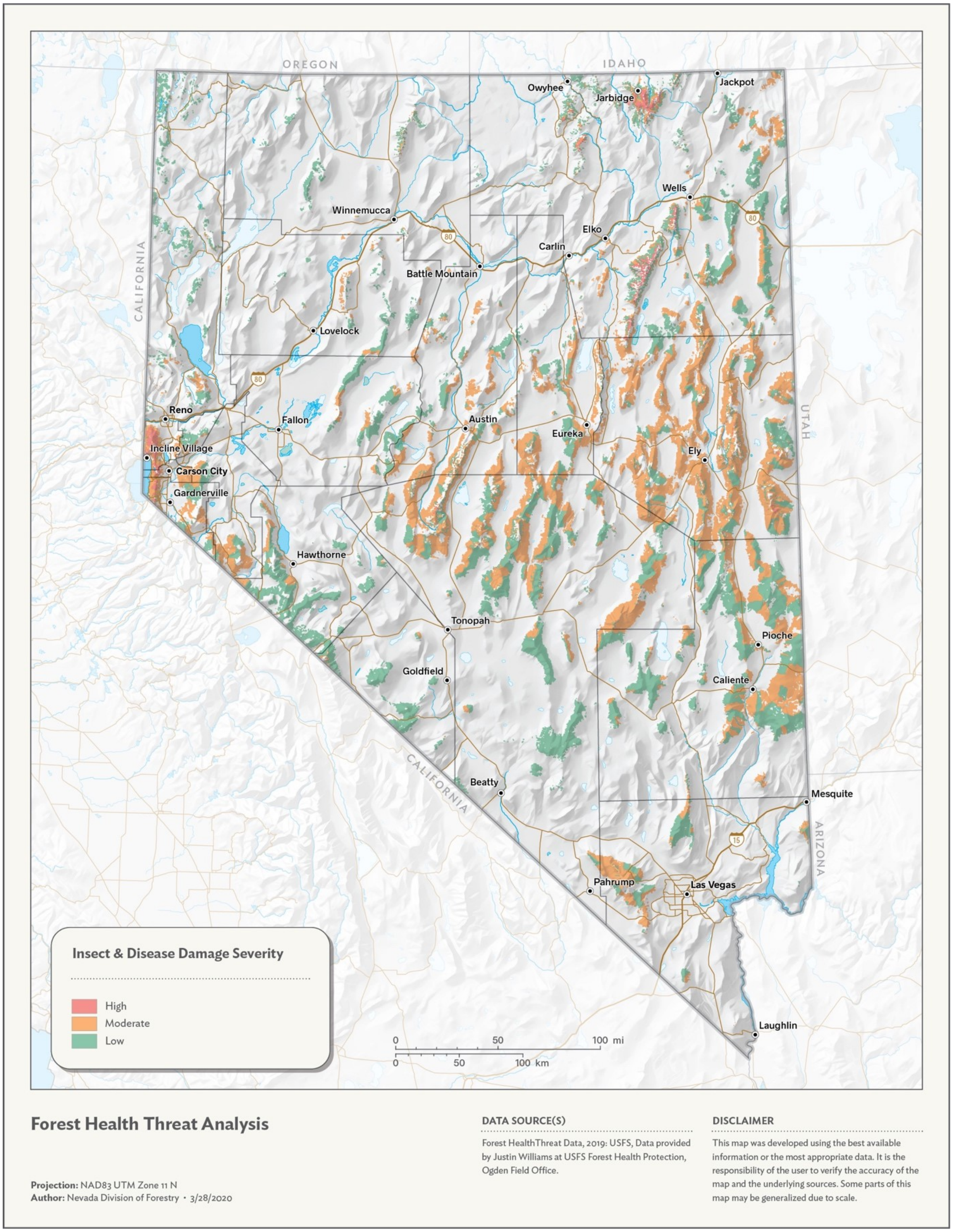


Figure 2. Map of forest health threats

3 - Geothermal Potential (NBMG 2019)

The 2019 geothermal potential data set was developed by the Nevada Bureau of Mines and Geology and describes areas with direct and indirect evidence of geothermal activity. Areas showing high geothermal potential are defined by direct evidence of near-boiling temperatures in springs and wells, or high local potential with temperatures greater than or equal to 150 degrees Celsius. Areas showing indirect potential, or a moderate ranking comprise the second class, which is defined by quaternary felsic volcanic rocks occurring within a five km distance of a known geothermal source, springs or wells with temperatures greater than or equal to 100 degrees Celsius, springs or wells with temperatures between 50 and 92 degrees Celsius, or where there are "very favorable" conditions according to selected geologic and geophysical criteria. Lastly, the third class includes areas showing indirect evidence of groundwater temperatures greater than or equal to 100 degrees Celsius and are considered "favorable." The geothermal areas that were placed into the three classes described above were then converted to a 30-meter spatial resolution raster. The table below shows the class ranges, the associated weights, and final classes.

Local & Regional Groundwater Temp.	Weights	Classes
> 100 Degrees < 150 Degrees (Regional)	1	Low
> 150 Degrees (Regional)	2	Moderate
> 150 Degrees (Local)	3	High

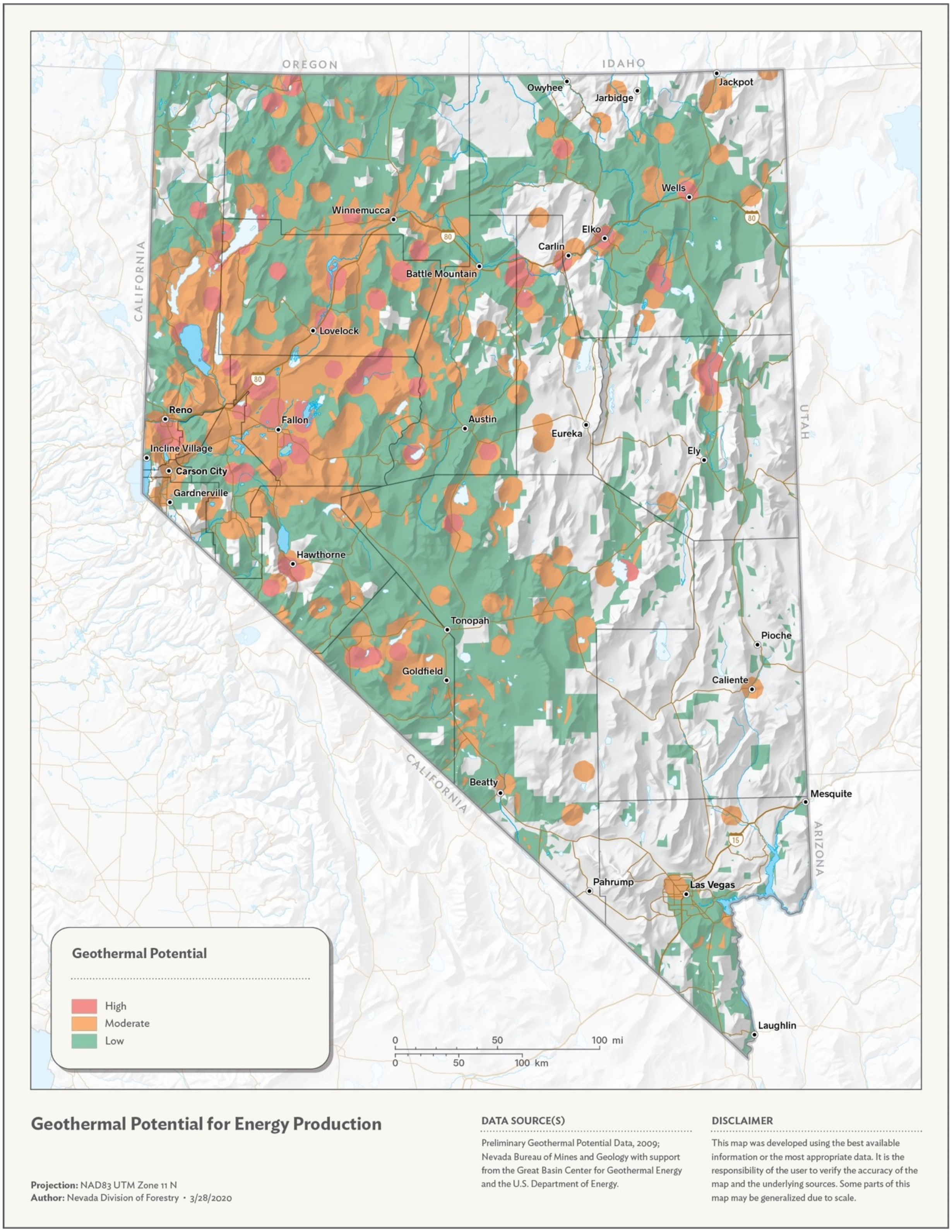


Figure 3. Map of geothermal potential

4 - Mineral Development Potential (NDM 2019)

The *2019 Mineral development potential* data set was developed by the Nevada Division of Minerals and describes PLSS sections containing active mining claims with the total number of claims associated with each section. It is important to note that section acreages do not represent the actual acreages claimed but are used as enumeration units for understanding mining claim density. Also, small claims may not be shown between October and February due to assessment dates and report filings. All active mining claims were converted to a 30-meter spatial resolution raster and classified into three nominal ranges based on the total number of claims per section using the natural breaks (Jenks) classification method. The table below shows the class ranges, the associated weights, and final classes.

Claims per PLSS Section	Weights	Classes
1 - 24	1	Low
25 - 70	2	Moderate
71 - 367	3	High

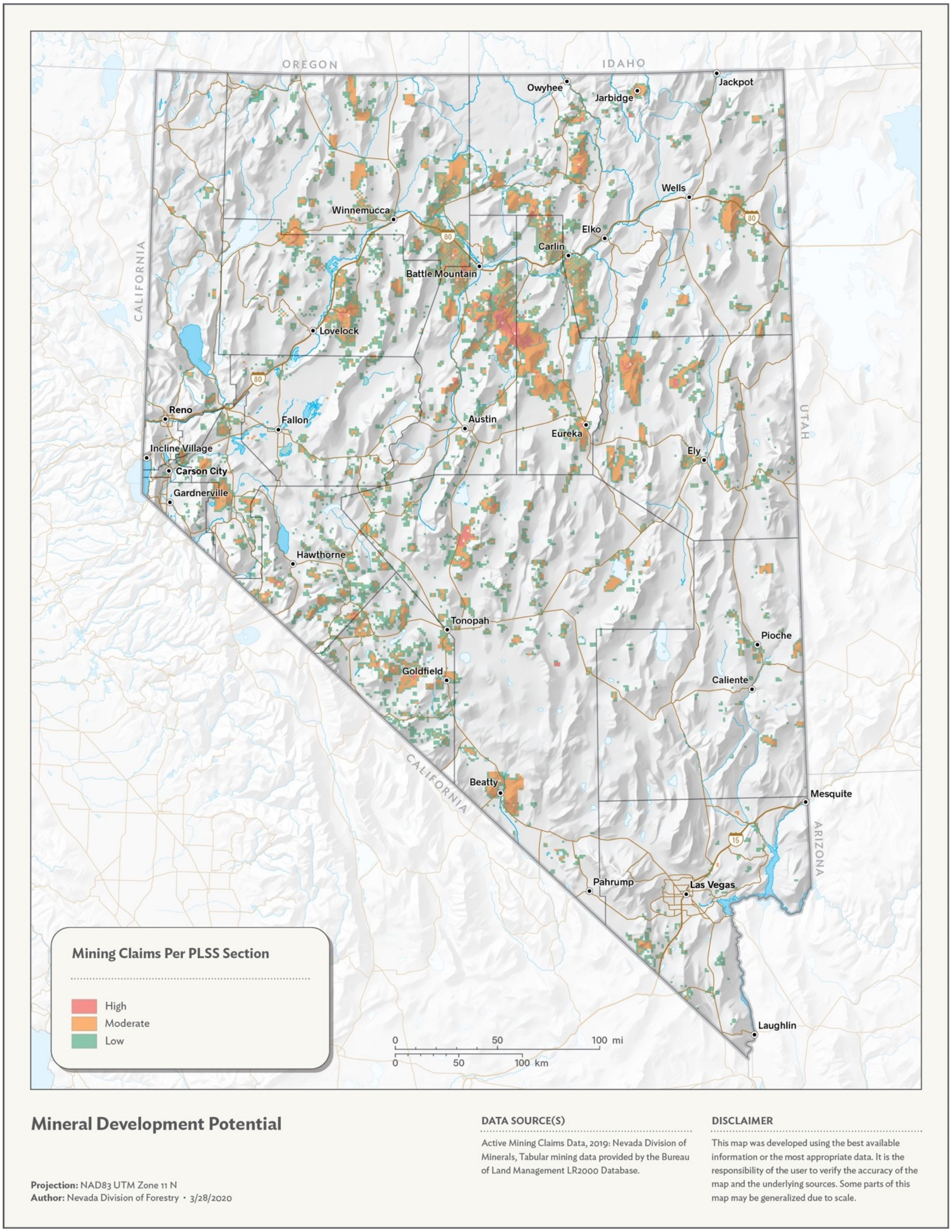


Figure 4. Map of mineral development potential

5 - Noxious Weeds (EDD Maps 2019)

The *2019 Noxious weeds* data set was developed by EDD Map and consisted of point features representing noxious weed occurrences throughout Nevada. Point features could not be effectively evaluated in a raster-based analysis. Therefore, the noxious weed points were converted to a 30-meter raster and joined to level 6 hydrologic units (i.e. watershed boundaries) using zonal statistics. The resulting zonal statistics field was divided by the total area (square miles) of each watershed boundary to produce the percent coverage of noxious weeds per watershed. The watershed boundary data set was then converted to a raster at a spatial resolution of 30 meters, and only included those watersheds containing instances of noxious weeds. The watersheds describing percent coverage for noxious weeds were classified into three nominal ranges using the natural breaks (Jenks) classification method. The table below shows the class ranges, the associated weights, and final classes.

% of Noxious Weed Instances per Sq. Mile	Weights	Classes
1 – 4 %	1	Low
5 – 23%	2	Moderate
24 – 55%	3	High

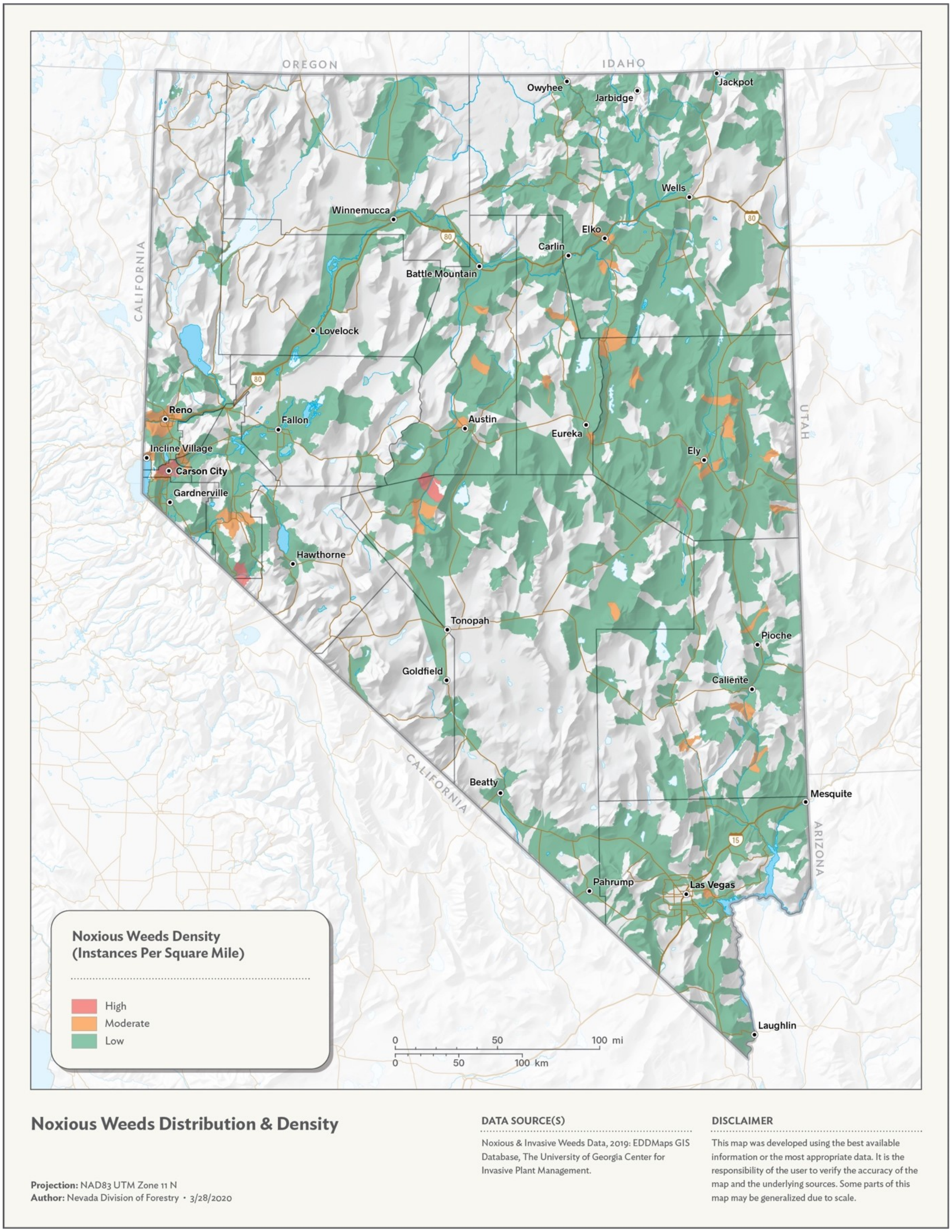


Figure 5. Map of noxious weeds distribution and density

6 - Pinyon-juniper Priority Treatment Areas (NDF 2020)

With pinyon-juniper expanding within Nevada, the *Pinyon-juniper (PJ) Treatment Priorities* data set was developed to key in on where treatments of encroaching PJ would best benefit greater and bi-state sage-grouse populations. Within the Greater Sage-grouse (GRSG) habitat management areas, the Sagebrush Ecosystem Technical Team (SETT) mapped seasonal GRSG Habitat Suitability Index (HSI) values of 70 percent within PJ Phase I and II areas to represent their best areas to initially target treatments for the most impactful and immediate benefit to GRSG. Also, in the analysis are habitat areas where strategic treatments of Phase I and II PJ would likely benefit the bi-state population. The USGS Coates Lab developed the bi-state products as well as the GRSG habitat management areas and the GRSG HSI that were foundational in the *Pinyon-juniper Priority Areas* layer (Coates et al. 2016). In addition, the Conservation Planning Tool from USGS has been developed to assess potential projects at smaller scales and evaluate the likely costs and benefits to bi-state sage-grouse populations from various treatments that can be implemented with a similar planning tool soon to be available for the GRSG (Ricca et al. 2018). For the current Pinyon-juniper Treatment Priorities map, these layers for the GRSG and bi-state population were combined and then converted to a raster at a spatial resolution of 30 meters. The data were then converted from vector to raster and assigned a standardized value of 3. The table below shows the associated weight and final class.

Categories	Weights	Classes
Pinyon-juniper Priority Treatment Areas	3	Standardized

Figure 6. Map of pinyon-juniper priority treatment areas

7 - Impaired Waters; 303d (EPA 2014)

The *2014 Impaired waters* data set was developed by the EPA under the Clean Water Act section 303d. The purpose of the data set is to geographically describe “waters that are too polluted or degraded to meet the state water quality standards” (EPA 2010). States are required to submit impaired waters to be listed by the EPA, which are then associated with the *Medium resolution national hydrography* dataset at a scale of 1:100,000. The *Impaired waters* data set for Nevada consisted of streams and waterbody features, which were associated with level 6 hydrologic units (i.e. watershed boundaries) to produce areas containing impaired waters. The resulting hydrologic unit boundaries were then converted from vector to raster at a spatial resolution of 30 meters and were then assigned a standardized value of 3. The table below shows the associated weight and final class.

Categories	Weights	Classes
Impaired Watersheds	3	Standardized

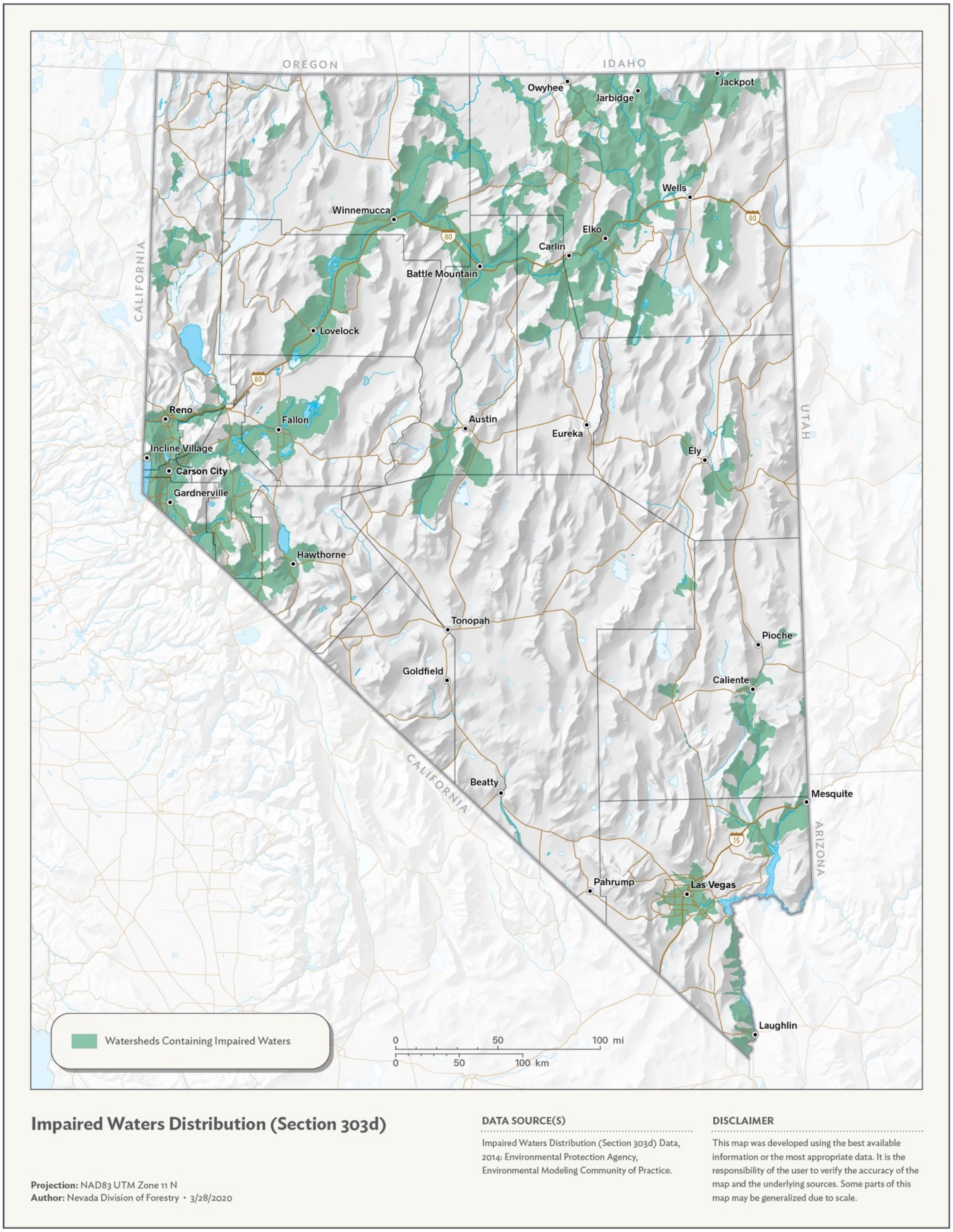


Figure 7. Map of listed impaired waters by watershed

8 - Solar Potential (NREL 2019)

The *2019 Solar potential* data set was derived from Direct Normal Irradiance (DNI) data that was produced using a 4 km x 4 km grid by the National Renewable Energy Laboratory (NREL). The *DNI* data set was subset by isolating locations that could potentially contain solar energy production facilities by removing areas greater than 3 percent slope, open water features, protected lands, and BLM solar exclusion zones. This produced a final data set showing actual locations available for a solar energy facility with a suitable DNI value. The resulting areas were then converted from vector to raster at a spatial resolution of 30 meters. The final *DNI* raster data set was classified into three nominal ranges using the natural breaks (Jenks) classification method by the amount of solar energy that reaches the Earth's surface in kilowatt hours/per square meter/per day. The table below shows the class ranges, the associated weights, and final classes.

KWH / M^2 / Day	Weights	Classes
5. 4 – 6. 5	1	Low
6. 5 – 7. 14	2	Moderate
7. 14 – 7. 96	3	High

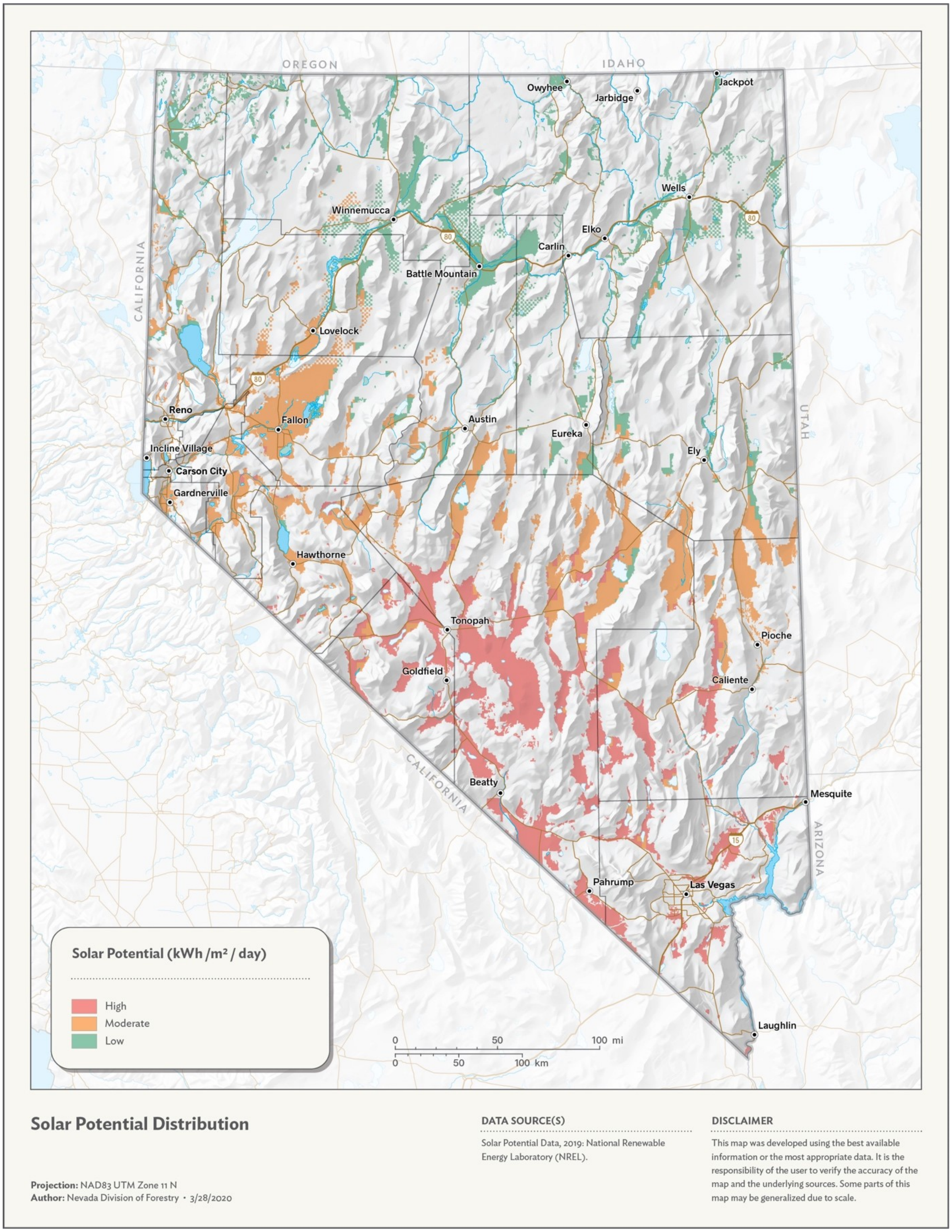


Figure 8. Map of solar potential

9 - West Wide Wildfire Risk Assessment (Sanborn 2013)

The 2013 West Wide Risk Assessment was developed by The Sanborn Map Company and supported by the Oregon Department of Forestry, Western Forestry Leadership Coalition, Council of Western State Foresters, and the USFS. This 30-meter spatial resolution raster data set denotes wildland fire risk using a developed index (fire risk index or the FRI) from two derived products, including the fire threat index (FTI) and the fire effects index (FEI). The FRI contained nine classes ranging from extremely low risk to extremely high risk. NDF staff decided that only risk classes showing moderate values or greater should be considered, which included classes five through nine. All cells describing fire risk within category five or greater were extracted from the original dataset and grouped into two nominal ranges, including fire risk from either moderate-to-high or from high-to-extreme. The table below shows the class ranges, the associated weights, and final classes.

Fire Risk Index	Weights	Classes
Moderate, Moderate-High (5 – 6)	2	Moderate
High, Very High, Extreme (7 – 9)	3	High

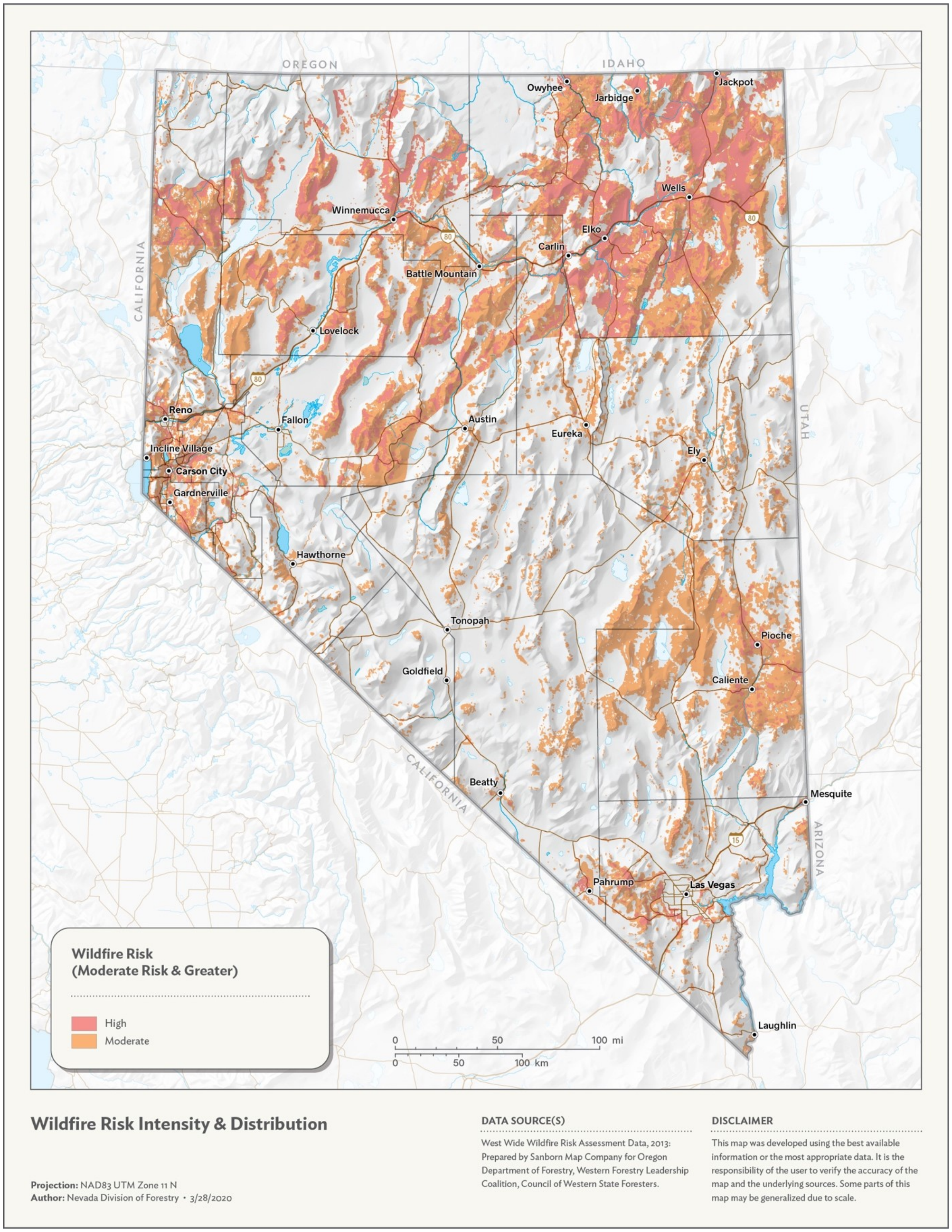
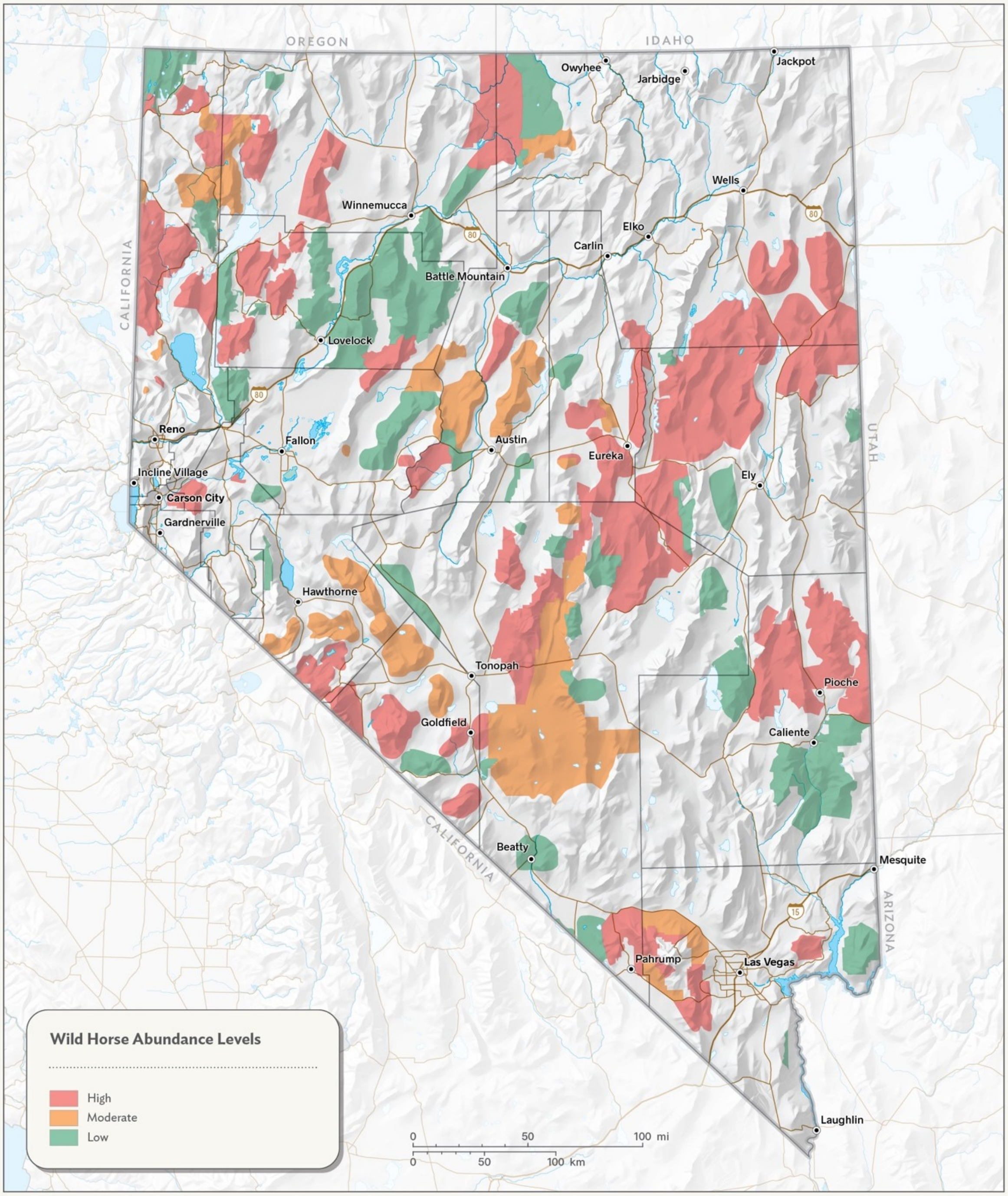


Figure 9. Map of wildfire risk

10 - Wild Horse Appropriate Management Level (Henning 2017)

The 2017 *Wild horse appropriate management level* data was developed by Jacob Henning at the University of Wyoming. This data set denotes the estimated number of wild horses in relation to Appropriate Management Level (AML) numbers within BLM wild horse and burro management areas and herd areas, and USFS wild horse and burro territories. The data sets original classification scheme was used to rank each management area, which is defined by those areas within the ascribed AML or contain wild horses but do not have AML values (i.e. herd areas do not contain AML values), areas with numbers greater than 100% or less than 200% of AML, and areas with numbers greater than 200% of AML. The AML areas were then converted from vector to raster at a spatial resolution of 30 meters. The final raster data set was classified into three nominal ranges using the previously mentioned classification scheme. The table below shows the class ranges, the associated weights, and final classes.

Estimated Wild Horse Abundance Relative to AML	Weights	Classes
Within AML or Presence of Wild Horses	1	Low
Greater than 100% to Less than 200%	2	Moderate
Greater than 200%	3	High



Estimated Wild Horse Abundance Relative to Appropriate Management Levels (AML)

Projection: NAD83 UTM Zone 11 N
Author: Nevada Division of Forestry • 3/28/2020

DATA SOURCE(S)

Wild Horse Abundance Levels Data, 2017: Jacob Hennig, University of Wyoming.

DISCLAIMER

This map was developed using the best available information or the most appropriate data. It is the responsibility of the user to verify the accuracy of the map and the underlying sources. Some parts of this map may be generalized due to scale.

Figure 10. Map of wild horse abundance relative to AML

Landscape Values Layers

1 - Biomass Potential (NBMG 2020)

The *2020 Biomass potentia*l data set is distributed by the Nevada Bureau of Mines and Geology and describes tree-dominated areas on less than 40 percent slopes. The *Biomass potential* data set for Nevada consisted of polygon features, which were converted from vector to raster at a spatial resolution of 30 meters and were then assigned a prioritized value of 3. The table below shows the associated weight and final class.

Categories	Weights	Classes
Biomass Potential Areas	3	Standardized

Figure 11. Map of biomass potential.

2 - BLM & USFS Grazing Allotments with AUMs (BLM 2019, USFS 2019)

The *BLM & USFS grazing allotment* data set was developed using allotment boundary data from the BLM and the USFS, which were joined with Animal Unit Month (AUM) data. The AUM data used for the USFS grazing allotments was provided by Rixey Jenkins (Range & WHB Program Manager at the Humboldt-Toiyabe National Forest), which included USFS permitted AUM values for each allotment. Likewise, permitted AUM values for BLM grazing allotments were gathered from the BLM Rangeland Administration System Reports database. The AUM values were joined to their respective grazing allotment boundaries using allotment IDs. The resulting allotment data were then divided by total acres per allotment, creating an AUMs per acre value for each allotment. Allotments that had 0 permitted AUMs were omitted from the calculation, and the remaining allotments containing values were converted to a raster at a spatial resolution of 30 meters. The allotments were then classified into three nominal ranges using the natural breaks (Jenks) classification method. The table below shows the class ranges, the associated weights, and final classes.

AUMs per Acre	Weights	Classes
. 02 –. 0 5	1	Low
. 06 – .08	2	Moderate
. 09 – 7	3	High

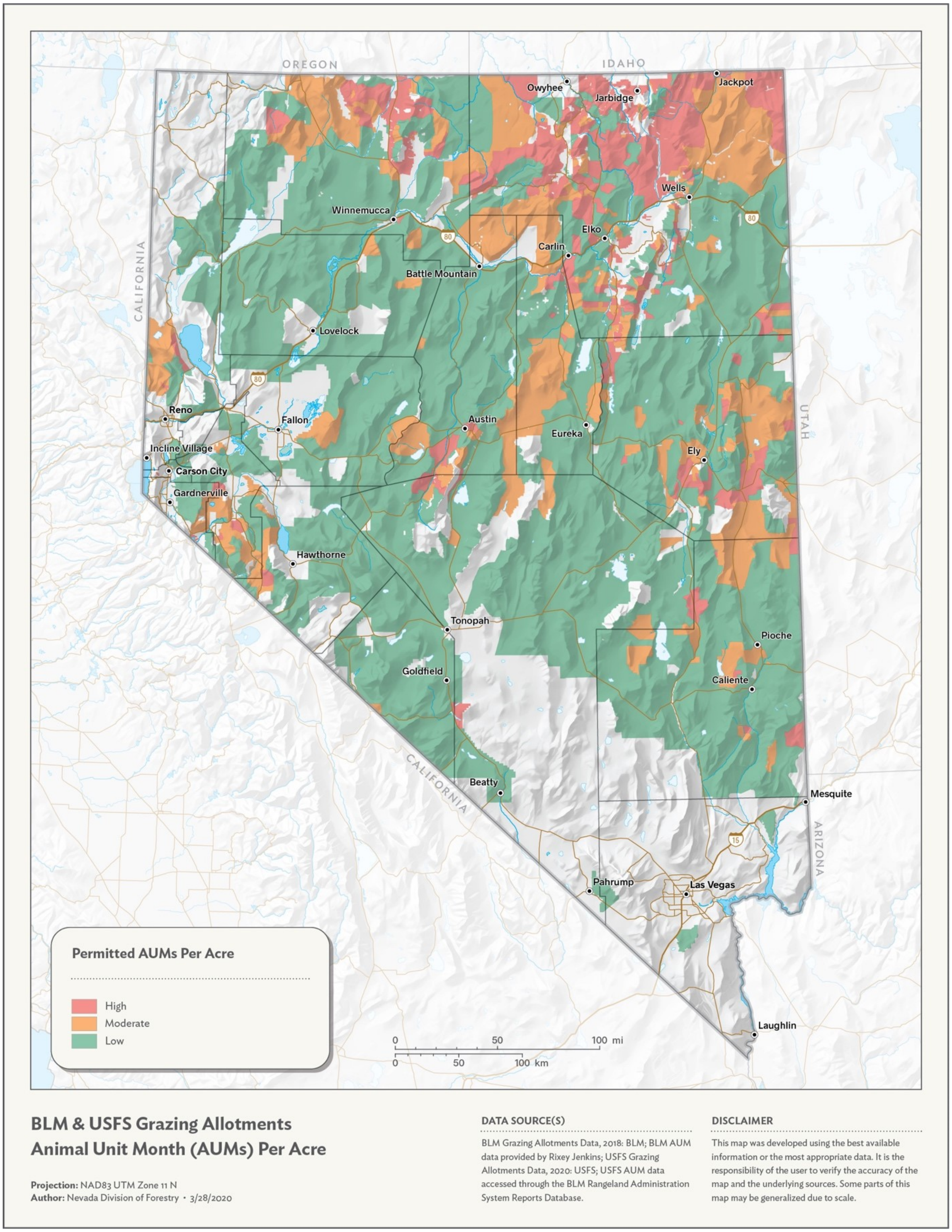


Figure 12. BLM and USFS grazing allotments with AUMs per acre

3 - CWPP Communities (NDF 2020)

The *2020 CWPP communities* data set was originally developed in 2005 by the Nevada Division of Forestry and the Nevada Fire Safe Council. The goal was to delineate community areas to assist them in protecting life, property, and shared assets from wildfires, further helping state agencies and communities meet the requirements of the Healthy Forests Initiative. The *CWPP communities* data set for Nevada consisted of community polygon features that were updated to better correlate with changes in urban development using high-resolution satellite imagery, which were converted from vector to raster at a spatial resolution of 30 meters and were then assigned a prioritized value of 6. The table below shows the associated weight and final class.

Categories	Weights	Classes
CWPP Communities	6	Prioritized

Figure 13. Map of CWPP community boundaries

4 - Developed Recreation (USFS 2019, BLM 2019, NPS 2019, State Parks 2004)

The *Developed recreation* data set was created by compiling hiking, motorized, and multi-use trail data, as well as recreation facility (e. g. campgrounds, campsites, and points of interest) data from the USFS, BLM, NPS, and Nevada State Parks. Point and line features representing recreational facilities and trails could not be effectively evaluated in a raster-based analysis. Therefore, all points and lines were converted to a 30-meter raster and joined to level 6 hydrologic units (i.e. watershed boundaries) using zonal statistics. The resulting zonal statistics field was divided by the total area (square miles) of each watershed boundary to produce the percent coverage of developed recreation features per watershed. The watershed boundary data set was then converted to a raster at a spatial resolution of 30 meters, and only included those watersheds containing recreation information. The watersheds describing percent coverage for developed recreation were classified into three nominal ranges using the natural breaks (Jenks) classification method. The table below shows the class ranges, the associated weights, and final classes.

% of Developed Recreation per Sq. Mile	Weights	Classes
< 1%	1	Low
1 – 2%	2	Moderate
> 2%	3	High

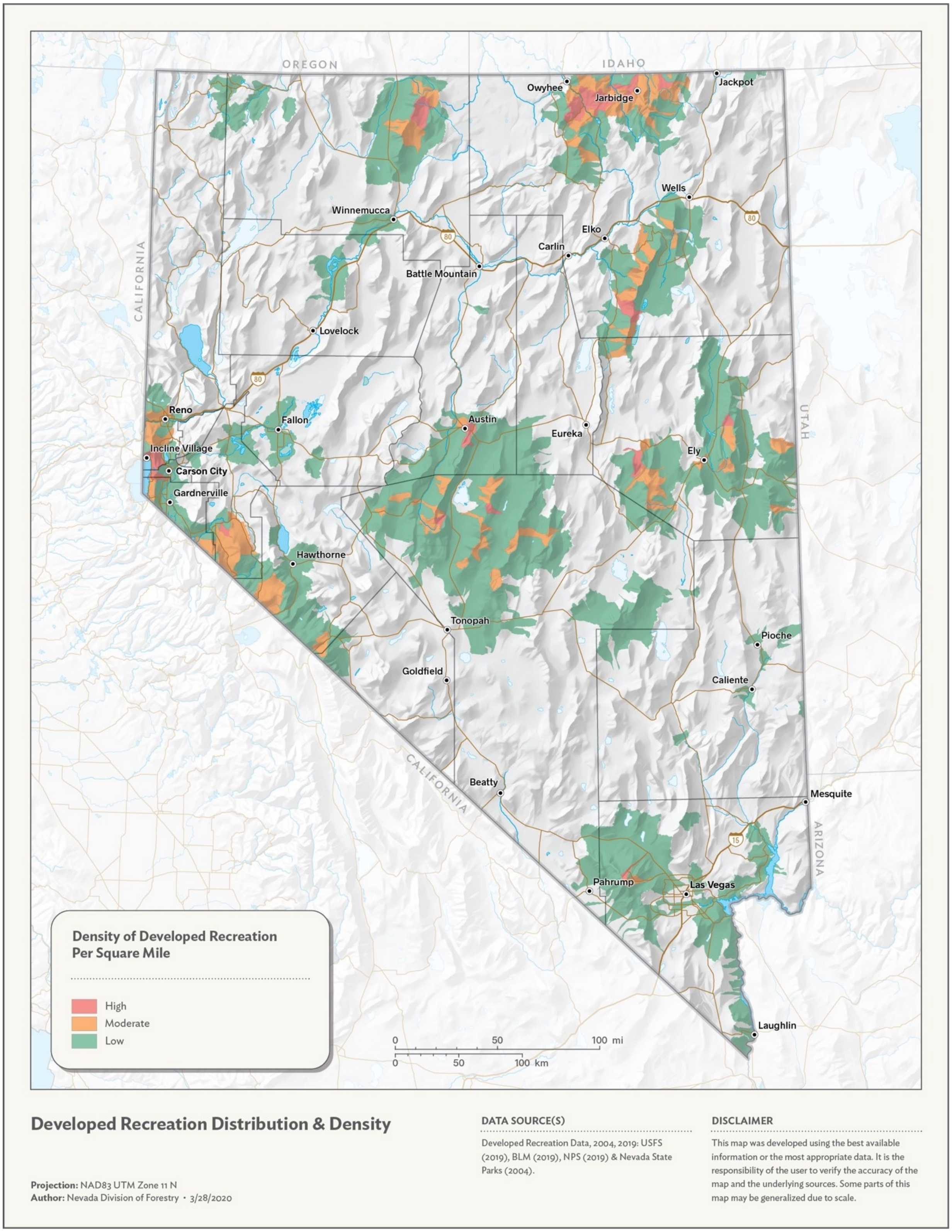


Figure 14. Map of developed recreation

5 - Forests to Faucets (NASF 2011)

The *2011 Forests to faucets* data set was developed by USFS to model areas critical to surface drinking water, describing watersheds that serve population centers and may be impacted by development and threats to forests. The final product shows level 6 Hydrologic Units (i.e. watershed boundaries) designated as sources of drinking water in relation to the total population that utilizes the watersheds, as well as the change in the associated populations based on decennial U. S. Census data. Watersheds designated as drinking water sources were originally classified into nine classes based on the total associated population by the USFS. The nine classes were converted from vector to a raster at a spatial resolution of 30 meters and were then broken into three classes using the natural breaks (Jenks) classification method to develop a nominal ranking from low-to-high. The table below shows the class ranges, the associated weights, and final classes.

Total Population in Target Watersheds	Weights	Classes
25 – 5,000	1	Low
5,001 – 250,000	2	Moderate
> 250,000	3	High

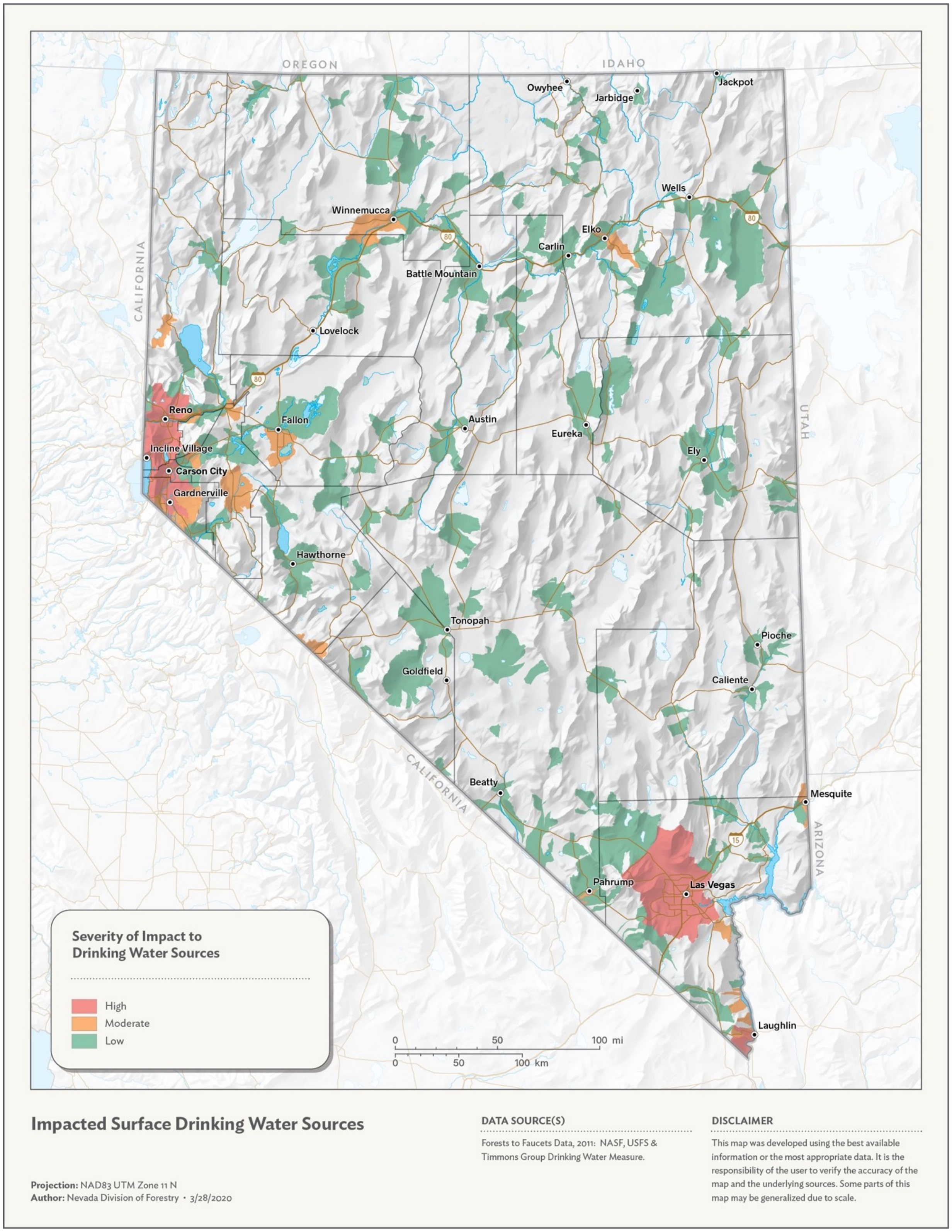


Figure 15. Map of impacted surface drinking water

6 – Mule Deer Migration Corridors (NFWF 2020)

The 2020 *Mule Deer migration corridor* data set was produced by WEST Inc. in conjunction with the USGS cooperative at the University of Wyoming. Secretarial Order 3362 directed federal agencies to work in cooperation with the State of Nevada to find and improve the quality of big game habitats and movement corridors, including mule deer and other large migratory species. The State of Nevada worked with the USGS to analyze GPS collar data for three priority mule deer migration corridors, developing geospatial data depicting priority migration corridors, winter ranges, and stopovers using the Brownian Bridge Movement Model (BBMM). The three priority mule deer migration corridors were converted from vector to a raster at a spatial resolution of 30 meters and were then assigned a standardized value of 3. The table below shows the associated weight and final class.

Categories	Weights	Classes
Mule Deer Migration Corridors	3	Standardized

Figure 16. Map of Mule Deer migration corridors

7A - Nevada Active Mines and Energy Producers (NBMG 2019)

The *2019 Nevada active mines and energy producers'* data set was developed by the Nevada Bureau of Mines and Geology and shows all active mines and energy producing facilities, including solar energy producers. The data was represented as point features, which could not be effectively evaluated in a raster-based analysis. Therefore, the points were converted to a 30-meter raster and joined to level 6 hydrologic units (i.e. watershed boundaries) using zonal statistics. The resulting zonal statistics field was divided by the total area (square miles) of each watershed boundary to produce the percent coverage of active mines and energy producers per watershed. The watershed boundary data set was then converted to a raster at a spatial resolution of 30 meters, and only included those watersheds containing source data. The watersheds describing percent coverage for active mines and energy producers were classified into three nominal ranges using the natural breaks (Jenks) classification method. The table below shows the class ranges, the associated weights, and final classes.

% of Mines & Energy Producers per Sq. Mile	Weights	Classes
< 1%	1	Low
1 – 4. 5%	2	Moderate
> 4. 5%	3	High

7B - Solar Power Producers (DOE 2019)

The *2019 Solar power producers* data set was developed by the Department of Energy, describing the locations of active and in-development solar power facilities. Facility locations were joined with the Nevada Active Mines and Energy Producers data set.

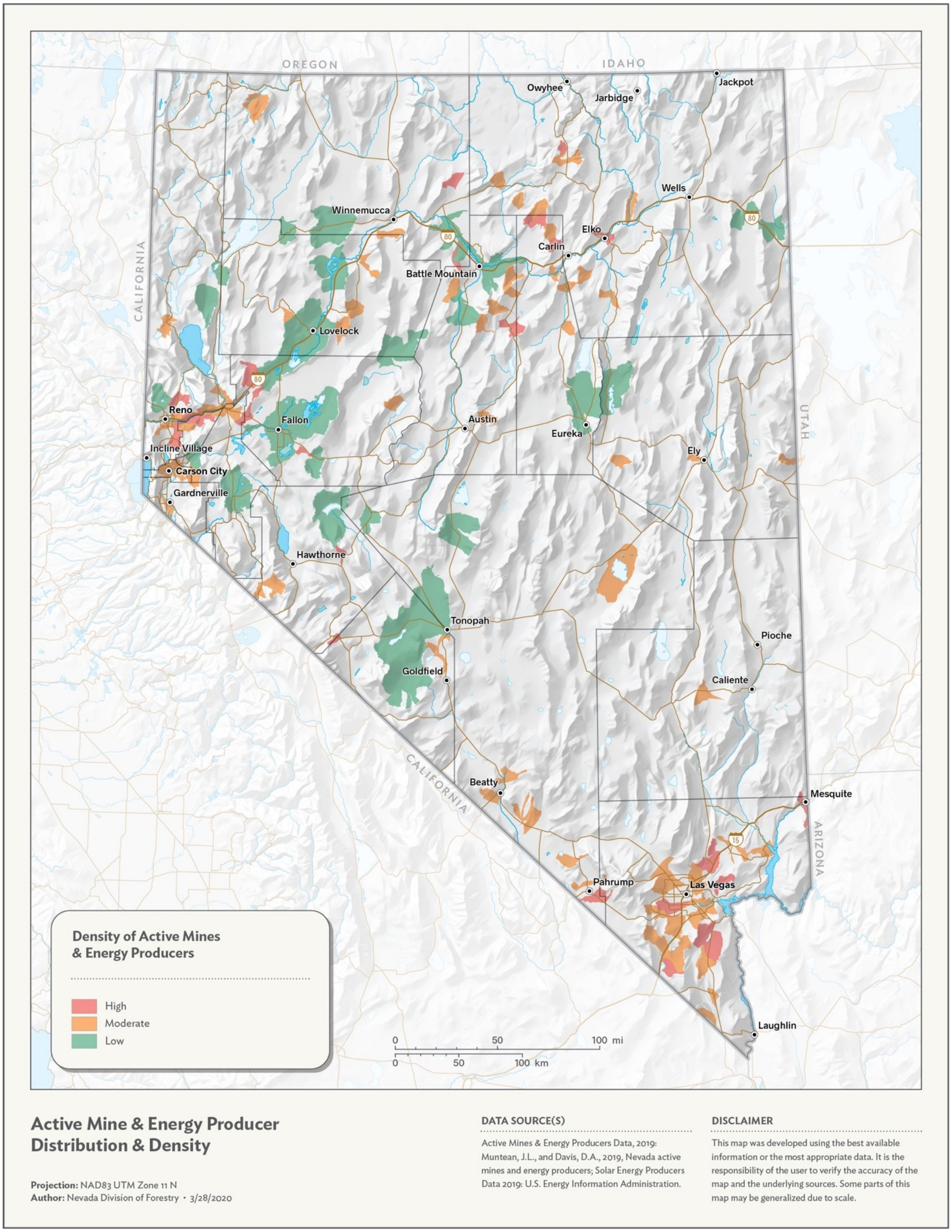


Figure 17. Map of active mines and energy producers

8 - Threatened & Endangered Species (NNHP 2017)

The *2017 Threatened and endangered species* data set was developed by the Nevada Natural Heritage Program (NNHP) and denotes point locations and areas where threatened and endangered plants and animals are known to exist, including those listed in the Endangered Species Act database. NNHP collects and tracks species that meet certain biological standards, mapping their locations using GPS techniques and locational descriptors. The *Threatened and endangered species* data set was converted from vector to raster at a spatial resolution of 30 meters and were then assigned a standardized value of 3. The table below shows the associated weight and final class.

Categories	Weights	Classes
Plant & Animal Species	3	Standardized

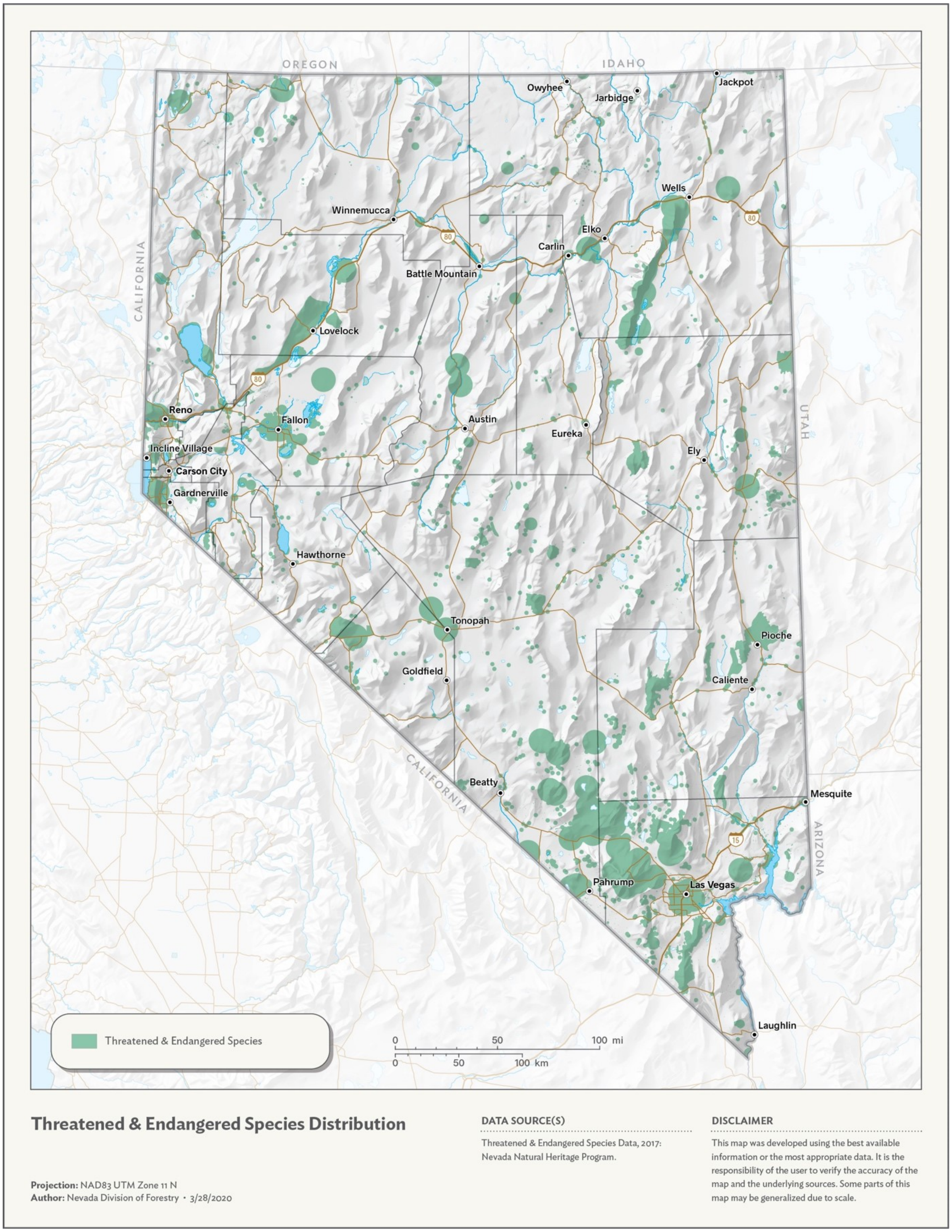


Figure 18. Map of threatened and endangered species

9 - Wetland Map of Nevada (DRI 2018)

The 2018 *Wetland map of Nevada* was developed by the Desert Research Institute (DRI) with support from the Environmental Protection Agency (EPA). This vector data set describes riparian and wetland areas throughout Nevada and was derived from a compilation of vetted geospatial data sources, including the National Wetlands Inventory, the *National hydrography* dataset, GSSURGO soils data, spring locations from the Springs Stewardship Institute, the DRI Map of Riparian Vegetation, wet meadows maps from USFS and the University of Nevada, and Normalized Difference Vegetation Index (NDVI) data derived from Landsat imagery. Areas described in the data set as riparian or wetlands were converted from vector to raster at a spatial resolution of 30 meters and were then assigned a prioritized value of 6. The table below shows the associated weight and final class.

Categories	Weights	Classes
Riparian & Wetland Areas	6	Prioritized

Figure 19. Map of riparian and wetland areas

10 - Wildland Urban Interface Areas (USFS 2017)

The 2017 *Wildland-urban interface* data set was developed by the USFS. This vector data set denotes where populated areas interface with wildland vegetation and was constructed by compiling 1990-2010 U. S. Census data with USGS National Land Cover data. The data set was classified by the proximity of urban development to vegetation, and the density of both vegetation and urban development. Six categories were extracted from the data set to represent three nominal classes, ranging from low-to-high, which were converted from vector to raster at a spatial resolution 30 meters. The table below shows the class categories, the associated weights, and final classes.

Vegetation-Urban Density Categories	Weights	Classes
Low & Very Low-Density Interface/Intermix	1	Low
Medium Density Interface/Intermix	2	Moderate
High Density Interface/Intermix	3	High

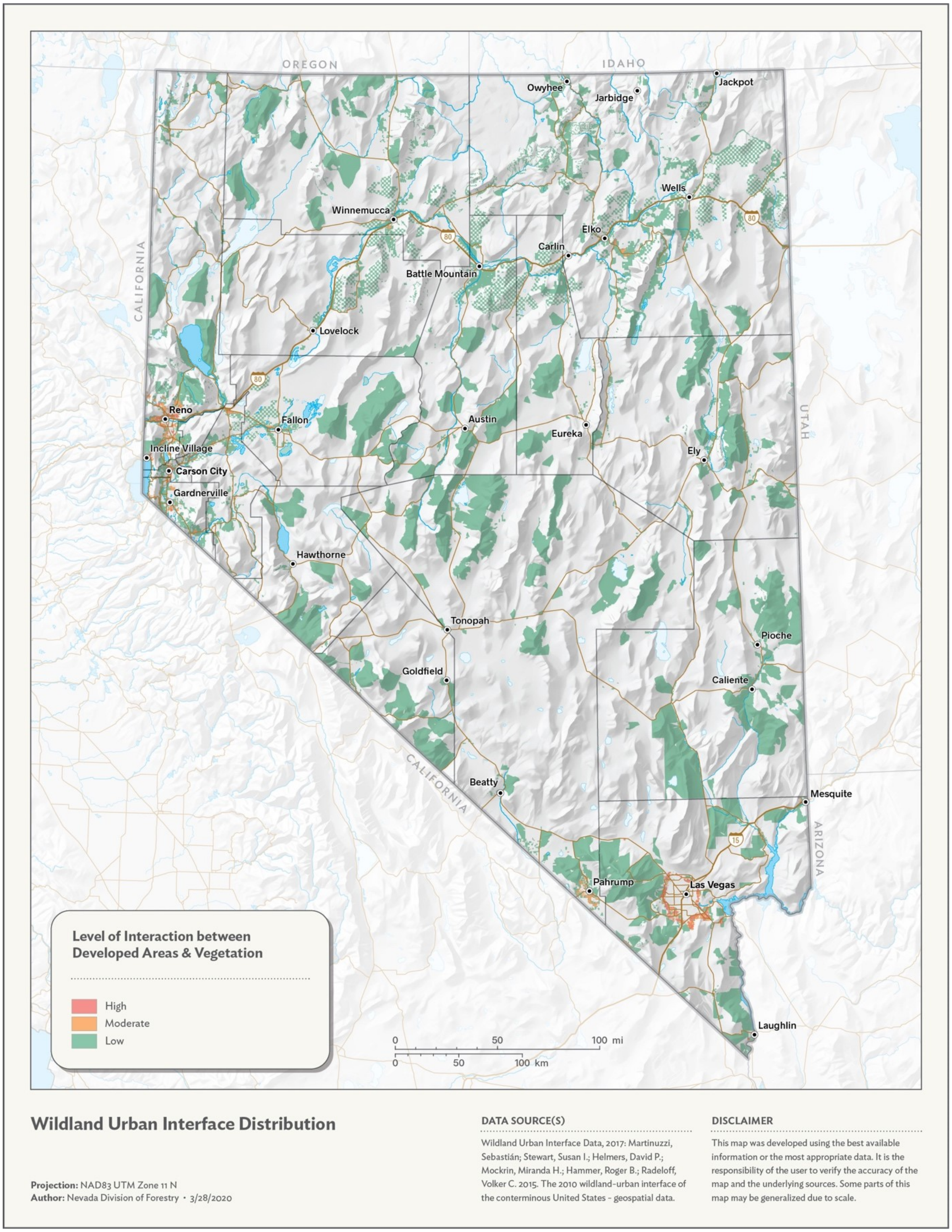


Figure 20. Map of wildland urban interface areas

11 – Urban Areas (NLCD 2016)

The 2016 *NLCD (National Land Cover Dataset) Developed impervious descripto*r data set was developed by the USGS in conjunction with other federal partners for the Multi-Resolution Land Characteristics Consortium (MRLC) project. This raster data set denotes the percent impervious surface per pixel area (30-meter spatial resolution) for the entire United States, and separately characterizes roads and percent vegetation within developed areas. All cells that were classified as being low, medium, and high in terms of development intensity (i.e. percent coverage per pixel of imperious surface), excluding roads, were extracted and generalized to remove gaps representing the excluded roads within developed area boundaries. All generalized developed areas were assigned a prioritized value of 6. The table below shows the associated weight and final class.

Categories	Weights	Classes
High, Medium, & Low Intensity Developed	6	Prioritized

Figure 21. Map of urban and developed areas

Landscape Collaborative Opportunities

1 – BLM Project Areas (BLM 2015)

The *2015 BLM priority project planning area* data set was developed by the BLM to denote potential landscape and habitat restoration project areas within the Western Association of Fish and Wildlife Management Agencies Management Zones (WAFWA) in Nevada. Projects could include threat reduction to habitat from annual grasses, pinyon-juniper expansion, and wildfire rehabilitation. The BLM project areas data set was converted from vector to raster at a spatial resolution of 30 meters and were then assigned a standardized value of 3. The table below shows the associated weight and final class.

Categories	Weights	Classes
BLM Project Areas	3	Standardized

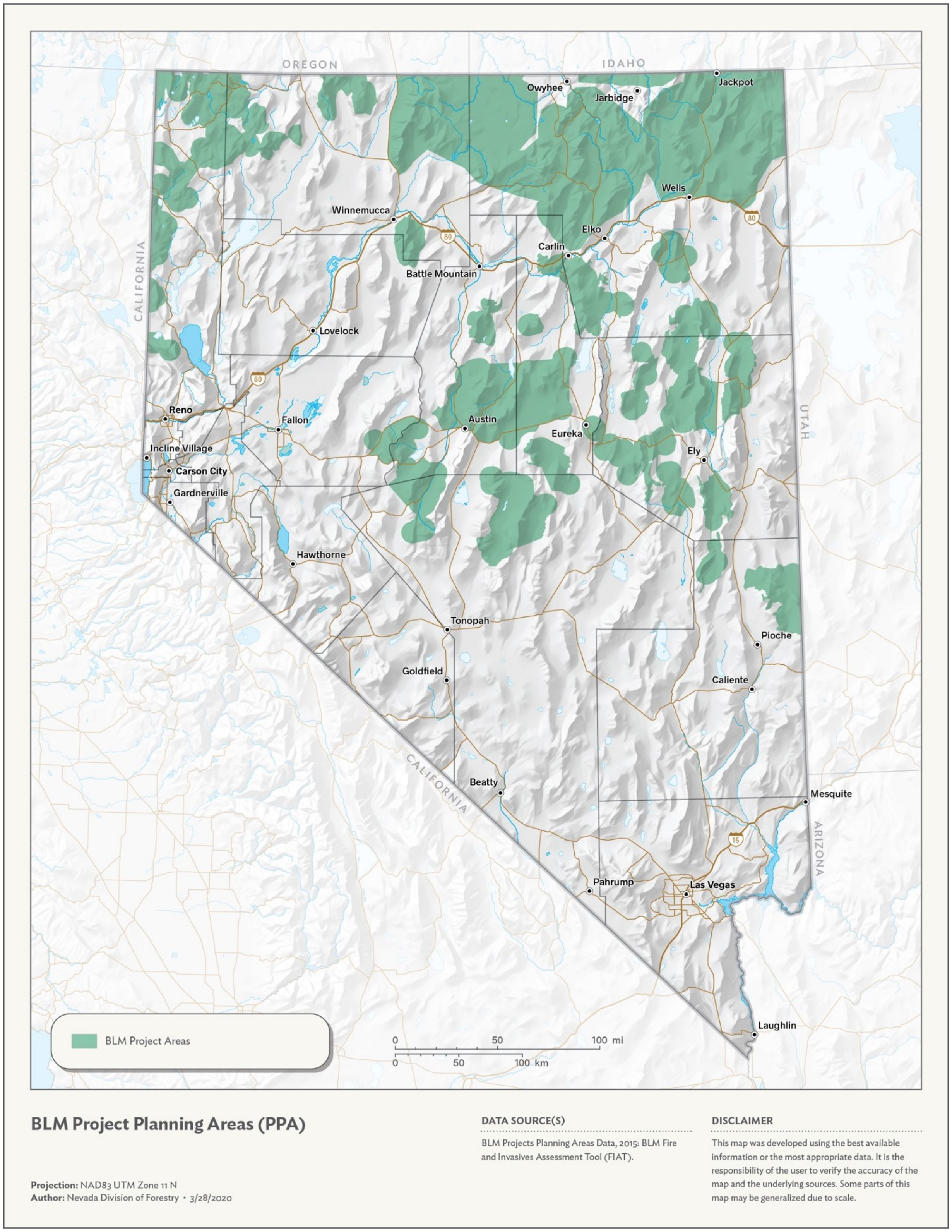


Figure 22. Map of BLM project planning areas.

2 – Ecosystem Resistance & Resilience (USFS 2014)

The *2014 Ecosystem resistance and resilience 30-meter raster* data set was developed by the USFS for use in evaluating the ability of landscapes to resist the growth of cheatgrass and recover after a disturbance. The data set is based on bio-physical conditions, including soil temperature and moisture and shrub type. These conditions were categorized into three classes, including low, moderate, and high, which were adapted for use in the analysis. The table below shows the class categories, the associated weights, and final classes.

Common Characteristics	Weights	Classes
Warm-moist, Warm-dry / Wyoming Big Sagebrush	1	Low
Cold-dry, Cool-dry / Low Sagebrush	2	Moderate
Cold-moist, Cool-moist / Mountain Big Sagebrush	3	High

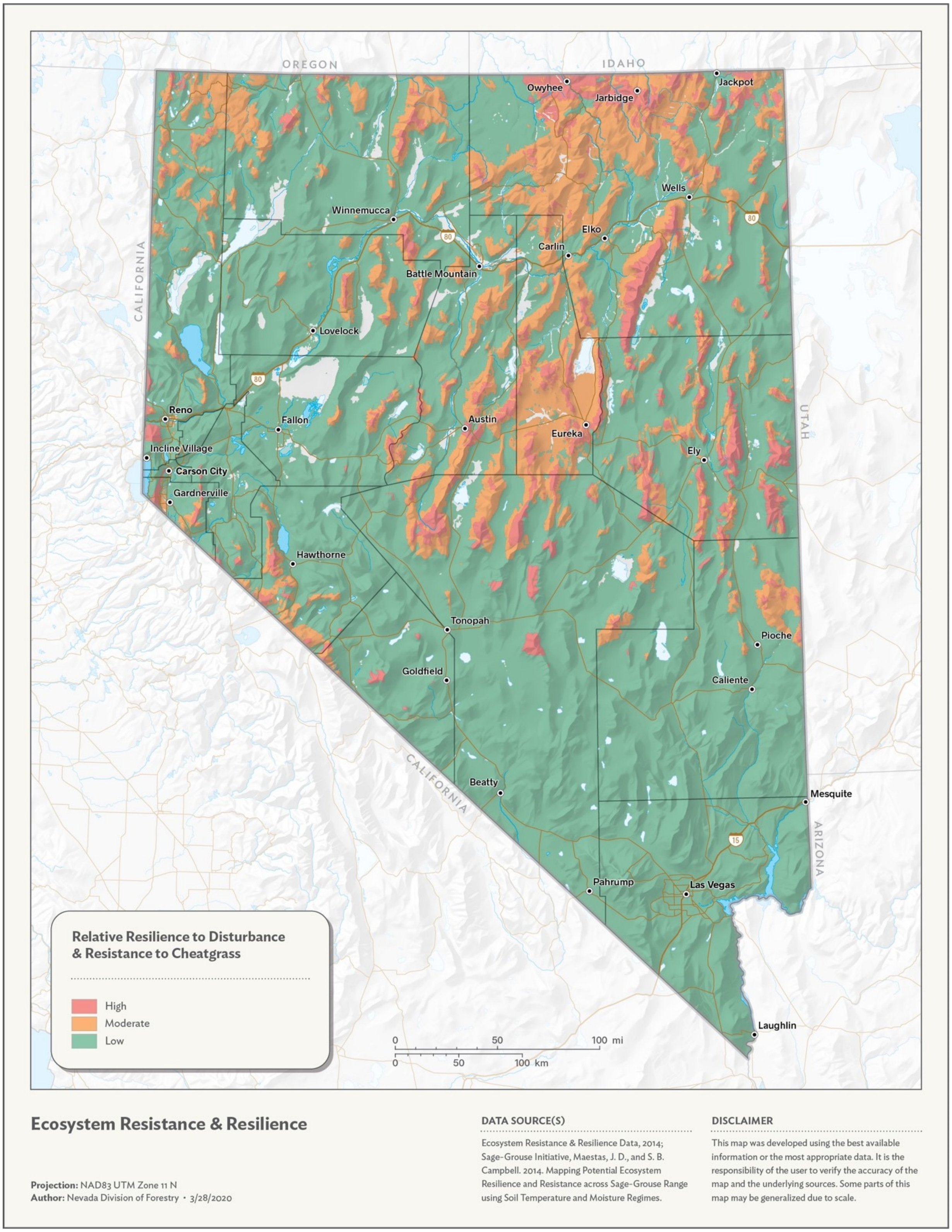


Figure 23. Map of ecosystem resistance and resilience

3 - Nevada Crucial Habitat Assessment (NDOW 2013)

The *2013 Nevada Crucial Habitat Assessment Tool (CHAT)* data set was developed by the Nevada Department of Wildlife with guidance from the Western Governors' Wildlife Council White Paper to create a more contiguous cross-state habitat assessment. Ultimately, this assessment data was intended to assist in identifying and prioritizing crucial habitats to meet conservation objectives. The CHAT analysis used a set of input data to describe crucial habitat areas, including habitats for species of concern, native and unfragmented habitat, wetland and riparian habitat, and habitat for species of economic and recreational importance. The resulting values were displayed using a relative scale within 640-acre hex-bin units for the entire state of Nevada. The hex-bin values spanned from one to six, where one describes the most crucial habitat and six represents the least crucial habitat. The scale does not represent values intrinsically tied to a specific phenomenon, but the relative probability that a crucial habitat would be found in an area. The data set was converted from vector to raster at a spatial resolution of 30 meters and the value range spanning from one to six were categorized into three classes, including low, moderate, and high, which were adapted for use in the analysis. The table below shows the class categories, the associated weights, and final classes.

Crucial Habitat Values (CH Rank)	Weights	Classes
1 - 2	3	High
3 - 4	2	Moderate
5 - 6	1	Low

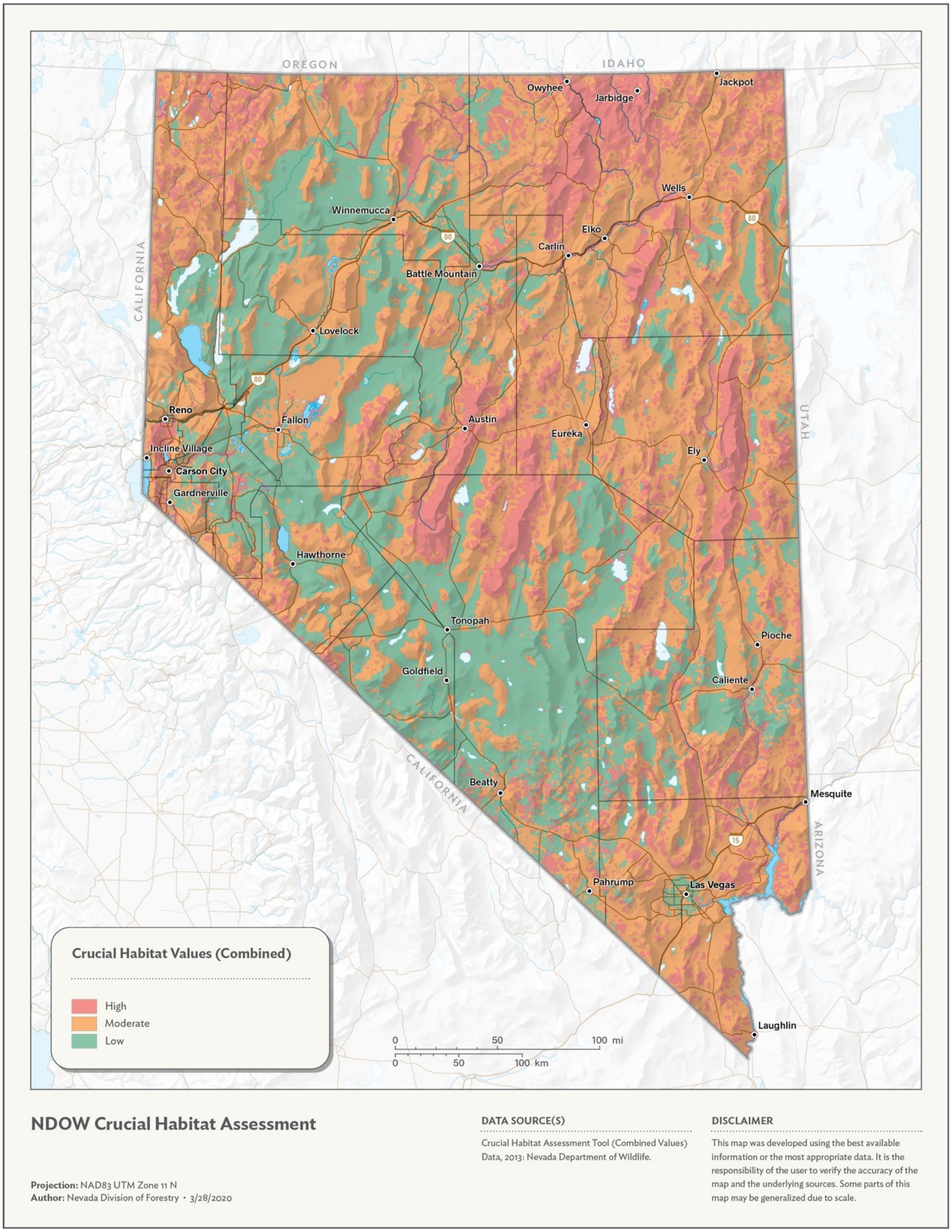


Figure 24. Map of Crucial Habitat Assessment values

4 - Sage-Grouse Priority Habitat Management Areas (SETT 2019)

The *2019 Sage-Grouse priority habitat management areas* data set was developed by the Sagebrush Ecosystem Program (SETT) and the USGS to model the suitable habitat areas within Nevada, as well as areas prioritized for landscape management and conservation. The data set contained three primary management areas, including General Habitat Management Areas (GHMA), Other Habitat Management Areas (OHMA), and Priority Habitat Management Areas (PHMA). Areas designated as PHMA were subset, as they represented the greatest priority for management and are potentially the locations where multi-agency landscape projects could have the most impact. The PHMA areas were converted from vector to raster at a spatial resolution of 30 meters and were then assigned a standardized value of 3. The table below shows the associated weight and final class.

Categories	Weights	Classes
Priority Habitat (PHMA)	3	Standardized

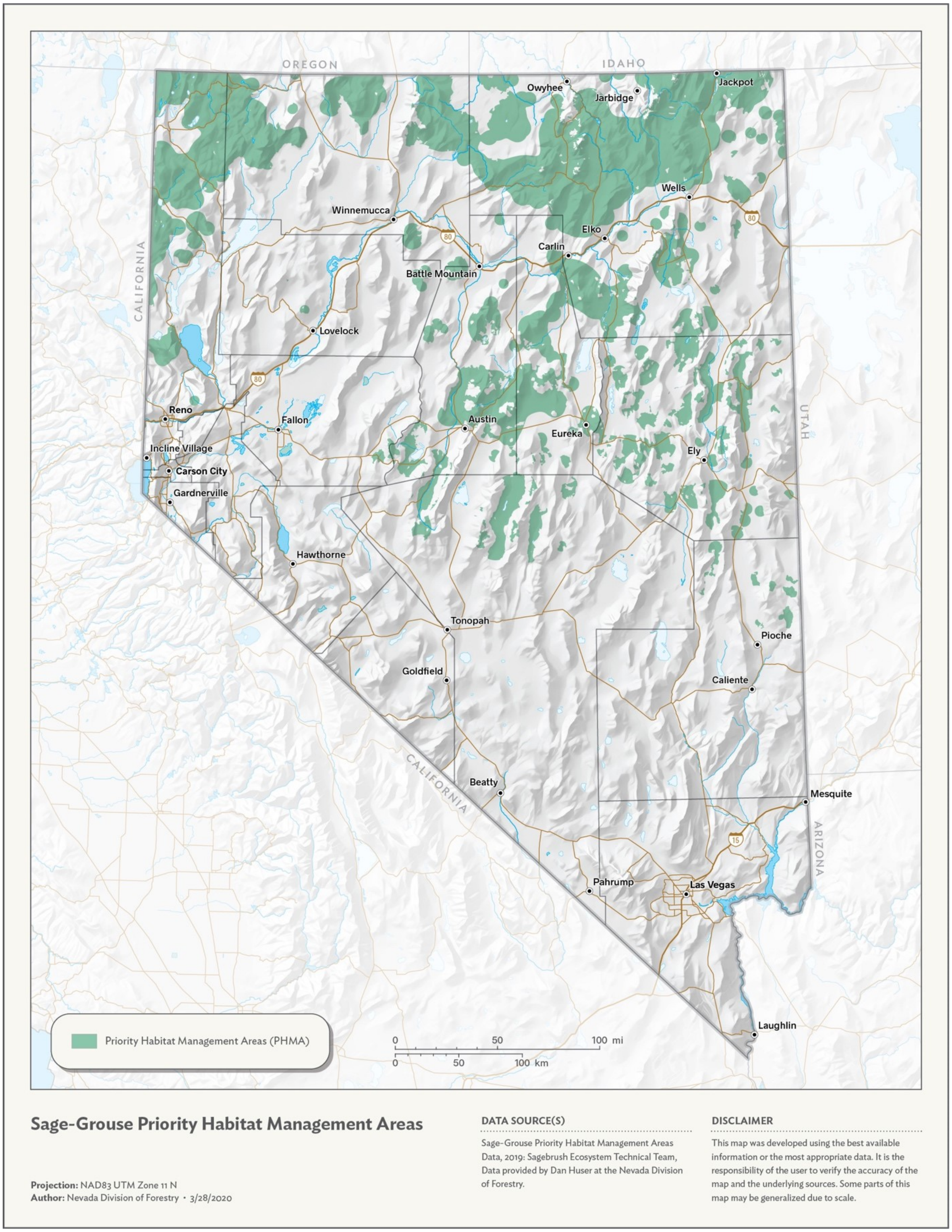


Figure 25. Map of Sage-Grouse habitat management areas

5 - Section 602 - Forest and Woodland Insects & Disease Areas (USFS 2014)

The 2014 *Section 602 - Forest and woodland insect and disease areas* data set was developed by the USFS to indicate designated areas requiring insect and disease treatment. The designated areas, or priority landscapes were a requirement included in the 2014 Farm Bill (Section 602) designed to reduce immediate risk to the public, infrastructure, and health and safety. The designated forest and woodland insect and disease areas for Nevada were converted from vector to raster at a spatial resolution of 30 meters and were then assigned a standardized value of 3. The table below shows the associated weight and final class.

Categories	Weights	Classes
Designated Areas	3	Standardized

Figure 26. Map of insect and disease treatment areas

6 - USFS Projects (USFS 2019)

The *2019 USFS fuels reduction projects* data set was provided by the GIS Coordinator for the Humboldt-Toiyabe National Forest and denotes areas where the USFS has planned projects for reducing fuel loads within the next five years. The project areas were converted from vector to raster at a spatial resolution of 30 meters and were then assigned a standardized value of 3. The table below shows the associated weight and final class.

Categories	Weights	Classes
USFS Fuels Project Areas	3	Standardized

Figure 27. Map of USFS fuels projects

7 - Wildlife Action Plan Focal Areas (NDOW 2017b)

The *2017 Wildlife action plan focal areas* data set was developed by the Nevada Department of Wildlife (NDOW) to denote areas with high biological diversity and where potential conservation efforts could be focused. The focal areas were created by evaluating important species habitats and species richness in relation to the natural basin and range geography and physiography. The 120 focal areas were converted from vector to raster at a spatial resolution of 30 meters and were assigned a standardized value of 3. The table below shows the associated weight and final class.

Categories	Weights	Classes
Wildlife Focal Areas	3	Standardized

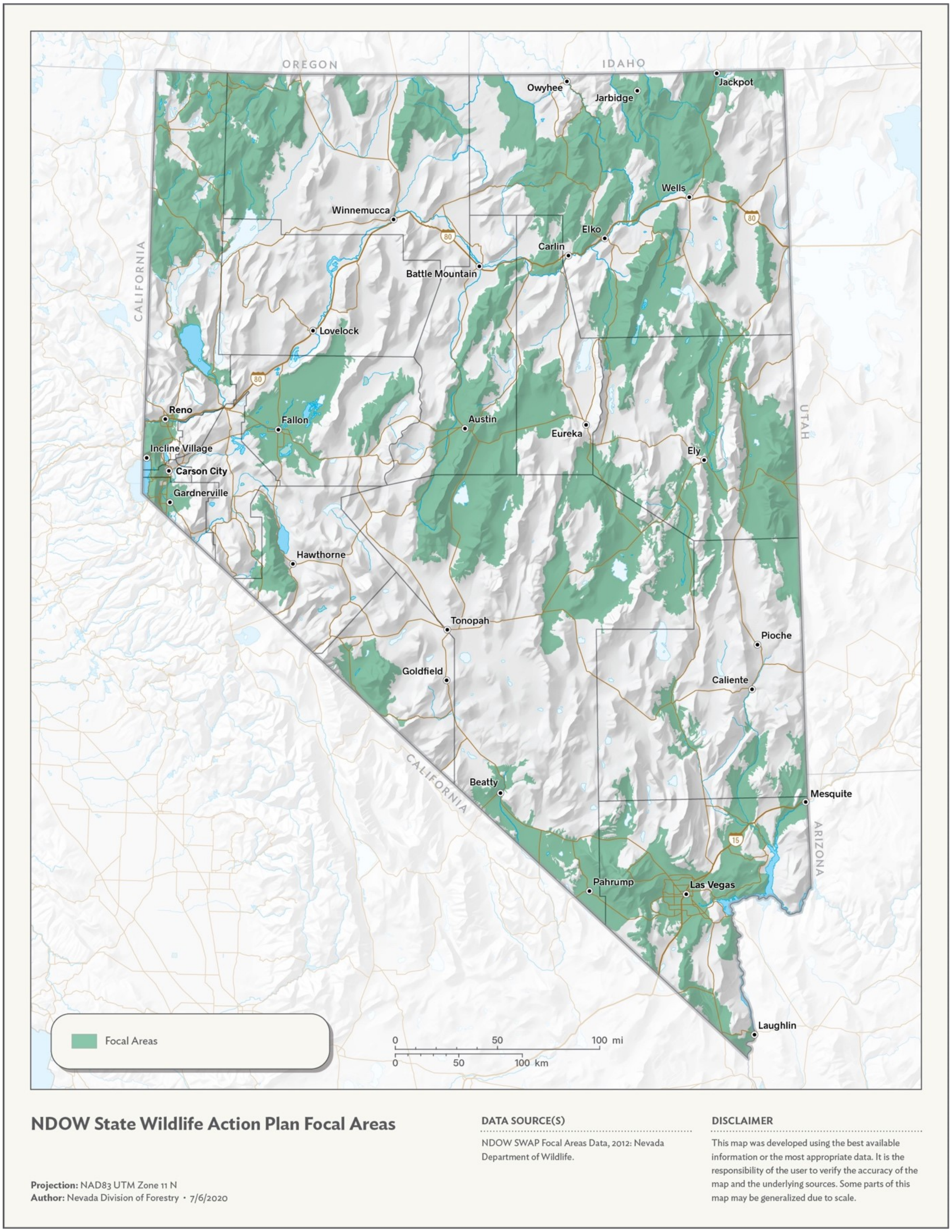


Figure 28. Map of NDOW focal areas

Eligible Forest Stewardship Program Lands Analysis

Data Inputs

Eligible Forest Stewardship Lands

Non-Federal Land Ownership with Parcels Greater than 10 Acres

- 2020 statewide parcel data provided by the Nevada Division of State Lands. (Esmeralda County does not have digitized parcel data. Instead, private, state, and local land ownership polygons were extracted for Esmeralda County from the 2019 BLM's Surface Management Area (SMA) data set.)

Existing and Potential Forested Lands

- 2020 Landfire Existing Vegetation (EVT) data.
- 2010 Landfire Environmental Site Potential (ESP) data.
- 2017 DRI Wetland Map of Nevada.
- 2020 U.S. Census Bureau Urban Area data.
- USGS NHD 24k Perennial Waterbodies.

Development Threat Potential

- 30-meter USGS Digital Elevation Model (DEM) data.

Priority/Federal Investment Areas of Eligible Forest Stewardship Lands

Interagency Priority Landscapes within Nevada

- Nevada FWRAP Priority Landscape data.

Methodology

To determine eligible Forest Stewardship Program lands and the priority areas within them, the 2020 Landfire Existing Vegetation (EVT) layer was used to denote areas considered tree-dominant, including Pinyon-Juniper Woodlands. From the EVT layer, the "Tree-dominated" attribute was selected from the EVT_Order field, describing areas where trees are the dominant vegetation type, and within the same selection, highly developed areas with abundant trees were excluded by not selecting records containing the "Developed" attribute from the SAF_SRM field. Then, the 2010 Landfire Environmental Site Potential (ESP) layer was incorporated by selecting records containing the "Upland Forest, Upland Woodland, and Wetland Forest" attributes from the ESPLF_Name field, which denote areas where, in the absence of disturbance, trees could become established given current suitable physical and climatic conditions. The results of the Existing Vegetation Type and Environmental Site Potential subset layers showing existing and potential tree-dominant areas were combined to produce a single raster layer indicating potential and current forested areas. Next, the 2017 Desert Research Institute's Wetland Map of Nevada was used to denote riparian areas. These areas are eligible stewardship lands due to their importance in watershed function and the potential for growing trees within them. The riparian area data were combined with the aforementioned raster layer showing potential and current forested areas. Since forest stewardship activities do not occur within waterbodies, perennial waterbody data extracted from the USGS National Hydrologic Dataset were used to mask waterbodies within the potential and current forested areas layer.

To further determine eligible Forest Stewardship Program lands, 2020 statewide parcel data was used to denote non-federal parcels greater than 10 acres. It was determined that eligible forested areas could not be within urban environments. Therefore, 2020 U.S. Census Bureau Urban Area data were used to remove non-federal parcels within urban areas. It is important to note that some larger parcels existed between urban and rural areas, which required an established breakpoint to determine what parcels were considered urban. A decision was made to only exclude parcels that were completely within the urban area boundaries. The resulting non-federal land ownership layer that excluded urban parcels was then used to subset the potential and current forested areas layer, resulting in a new layer showing forested and riparian areas on non-federal parcels greater than 10 acres outside urban areas.

Next, NDF determined that the development potential and threats for lands decreases with increasing slope; therefore, a slope analysis was run on a 30-meter digital elevation model to determine areas with a slope greater than 40%. The resulting layer showed lands with slopes less than 40%, which were used to further subset the potential and current forested areas layer. The final result showed potential and current forest and riparian areas on non-federal parcels greater than 10 acres with a slope of less than 40%.

To determine high priority and/or federal investment areas within the eligible Forest Stewardship Program areas, the Priority Landscape data developed for the Nevada Forest, Range and Watershed Action Plan was used to separate eligible stewardship areas into priority/federal investment areas and non-priority/non-federal investment areas. It is important to note that the Priority Landscape data has five relative priority classes, including low, low-moderate, moderate, moderate-high, and high, which represent areas determined to have varying threats, values, and the potential for collaborative opportunities on the physical landscape. The areas represented by the two highest classes, including moderate-high and high, were extracted from the data and used as a mask to select high priority and/or federal investment areas from all eligible Forest Stewardship Program lands.

Data Outputs

Eligible and High Priority/Federal Investment Forested Areas

Final Geospatial Product

- A 30-meter raster showing three categories, including non-stewardship potential, stewardship potential, and high stewardship potential lands (Figure 29).

Raster Classes

- 0 – No Stewardship Potential (Not Eligible)
- 1 – Stewardship Potential/Non-Federal Investment Areas
- 2 – High Stewardship Potential/Federal Investment Areas

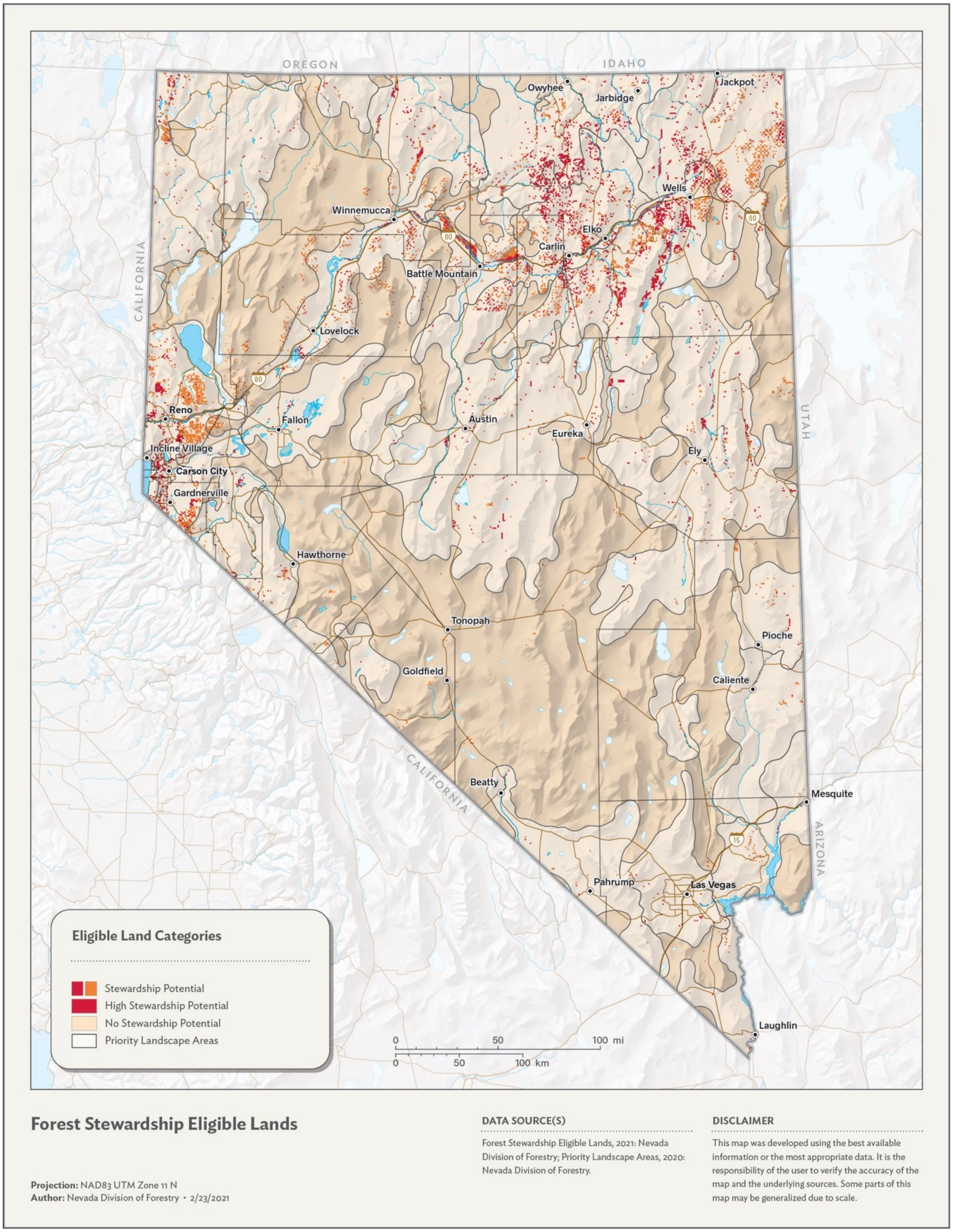


Figure 29. Forest Stewardship Program Important Forest Resource Areas in Nevada.

Appendix B - Example Actions Addressing National State and Private Forestry Priorities and Objectives

The 2008 Farm Bill, under Title VIII – Forestry, amends the Cooperative Forestry Assistance Act of 1978, to include the requirement that each state develop a long-term, state-wide assessment and strategies for forest resources. These assessments and strategies focused on three national priorities:

- Conserve and Manage Working Forest Landscapes for Multiple Values and Uses
- Protect Forests from Threats
- Enhance Public Benefits from Trees and Forests

Assessment and Strategy documents were developed with a comprehensive team of stakeholders to address cross-boundary, landscape scale actions that would be the most efficient activities to address threats to Nevada's natural resources and citizens identified during the assessment phase of the Forest, Range and Watershed Action Plan (FRWAP). This document serves as a record of strategic actions taken by Nevada stakeholders to implement Nevada's FRWAP and will be updated with any revisions to the FRWAP.

Conserve working forest landscapes for multiple values and uses

a. Identify and conserve high priority forest ecosystems and landscapes

Cottonwood and Johns Ranches (Nevada Conservation Credit System)

Priority Landscapes: Northeast Elko (Cottonwood Ranch) and Ruby-Cortez (Johns Ranch)
Key Issues/Threats:

- Forest and Woodland Health
- Wildfire Hazards
- Riparian-Wetland Systems
- Sagebrush Ecosystems
- Species Requiring Specialized Conservation
- Water Quality and Quantity

Goals/Strategies:

- Cooperative management and collaboration to maintain resilient forest in Nevada
- Prevent and manage exotic species invasions that respond to or drive wildfire risks and threats
- Maintain monitoring for invasive species and to apply management techniques at the landscape level

- Prevent and manage exotic species invasions that respond to or drive wildfire risks and threats
- Improve the health of wetland plant communities through outreach and education
- Implement conservation and preservation practices through partnerships to improve riparian function
- Use science-based strategies to improve riparian ecosystem function and expand riparian habitat through active project implementation
- Improve the resiliency of riparian systems to wildfires and climate change
- Improve sagebrush ecosystems by increasing site resistance and resilience
- Preserve Nevada's native plant and wildlife biodiversity and preclude legal protective species listings through effective stewardship of rare and unique populations and habitats
- Maintain Nevada's watersheds by performing necessary management that builds ecosystem community resistance and resilience and soil stability in the inevitable occurrence of disturbances; increase carbon sink and sequestration activities associated with wildland fire and natural resource management practices
- Increase agricultural water use efficiency and runoff or tail water quality

Project Description:

A multi-agency and NGO partnership with two family ranches enrolled in the Nevada Conservation Credit System. Partners include the Nevada Sagebrush Ecosystem Program, NDF, Nevada Conservation Districts Program, Nevada Department of Agriculture, Nevada Department of Wildlife, Nevada Division of State Lands, Northeastern Nevada Stewardship Group, Stewardship Alliance of Northeast Elko, Shoesole Resource Management Group, Bureau of Land Management, Northeast Elko Conservation District and Clover Valley Conservation District. Treatments include: Enhancing meadows through water management, improving soil health in meadows by applying organic fertilizer and chemical amendments, seeding forbs and grasses, planting sedges and rushes in disturbed meadows, planting nursery grown sagebrush originating from onsite seed collection, controlling invasive species, and improved livestock management. These actions ensure that high quality wildlife habitat is preserved and improved concurrent with economically sustainable family ranching operations, specifically by ensuring preservation of both high-quality late brood-rearing and upland habitat for greater sage grouse. The project results in long-term diversification of income for family livestock ranch operations and net conservation gain of greater sage-grouse habitat from anthropogenic disturbance within Nevada through CCS implementation and helps prevent listing of greater sage-grouse in the future.

b. Actively and sustainably manage forests

Mt. Wilson Hazardous Fuels Reduction

Priority Landscape: Wilson-Snake

Key Issues/Threats:

- Forest and Woodland Health
- Wildfire Hazards

Goals/Strategies:

- Cooperative management and collaboration to maintain resilient forest in Nevada
- Promote pro-active forest management for forest health statewide
- Improve monitoring and management of invasive species
- Collaborate with other fire and natural resource management stakeholders to reduce the size, frequency, intensity and costs of wildfire impacts in Nevada
- Increase public awareness and involvement in proactive wildfire prevention activities
- Prevent and manage exotic species invasions that respond to or drive wildfire risks and threats

Project description:

The Community of Mt. Wilson is in Lincoln County, situated on the lower west slope of Mt. Wilson. The community is comprised of 420 acres of individually owned lots ranging from 5 to 40-acre parcels. There are approximately 45 houses in the community as well as the Mt. Wilson Guest Ranch, which is around 120 acres in size and is the largest landowner. There is also a volunteer firefighter station on the Guest Ranch property with several pieces of apparatus available for use in the community. Vegetation inside the community is primarily phase 3 pinyon-juniper woodland with limited low sagebrush and native grass understory. The pinyon-juniper woodland inside the community is severely over stocked due to lack of management, leading to heavy fuel loading and forest health problems.

A fuel reduction program funded by the USDA State Fire Assistance program was initiated in 2003 which addressed improving escape routes and installing defensible space around the existing structures. There have been 3 other grants awarded for the community from 2003 until present, and fuel reduction and forest health work has expanded to cover almost the entire community. The Bureau of Land Management completed a shaded fuel break surrounding the community in 2004. Also, in 2004, the Nevada Fire Safe Council initiated the formation of a

chapter to promote fire safety and educational opportunities inside Mt. Wilson. To date, over 300 acres of private land have been treated for fuels reduction and forest health issues.
Forest health issues that are present inside the community include white pine blister rust, pinyon ips, dwarf mistletoe, juniper mistletoe, juniper borer, and occasional outbreaks of pinyon sawfly. By combining fuel reduction techniques and forest health practices, treated acres are significantly healthier today than in 2003, and safer from wildfire. A 19-acre forest health project was completed in 2017 to specifically address white pine blister rust on the Mt. Wilson Guest Ranch. This project focused on reducing the presence of the disease to protect adjacent stands from infection. Dwarf mistletoe pruning and removal of heavily infected pinyon trees in fuel reduction areas have served to reduce pinyon stress and promote healthier stands. Most of the treated lands were seeded in early winters to promote establishment of understory vegetation and add diversity to the sites. By using a team approach with private landowners, local, state and federal government agencies as well as Fire Safe Councils, buy in from community members has remained high, resulting in a healthier and safer community.

Protect Forests from Threats

a. Restore fire-adapted lands and reduce risk of wildfire impacts

Project Name: Camp Stimson Forest Health Improvement

Priority Landscape: Las Vegas Wash

Key Issues/Threats:

- Forest and Woodland Health
- Wildfire Hazards
- Riparian Wetland Systems
- Species Requiring Specialized Conservation
- Water Quality and Quantity
- Climate Change Mitigation

Goals/Strategies:

- Cooperative management and collaboration to maintain resilient forest in Nevada
- Promote pro-active forest management for forest health statewide
- Increase public awareness and involvement in proactive wildfire prevention activities
- Implement conservation and preservation practices through partnerships to improve riparian function
- Use science-based strategies to improve riparian ecosystem function and expand riparian habitat through active project implementation

- Improve the resiliency of riparian systems to wildfires and climate change
- Preserve Nevada's native plant and wildlife biodiversity and preclude legal protective species listings through effective stewardship of rare and unique populations and habitats
- Maintain Nevada's watersheds by performing necessary management that builds ecosystem community resistance and resilience and soil stability
- Create and distribute a unified message and education to the public and public officials about the importance of watershed protection and water resource conservation
- Reduce wildfires occurring more frequently and severely than ecosystem norms

Project Description:

Camp Stimson is a church youth camp and retreat in the shadow of Mt. Charleston, Southern Nevada's tallest peak (nearly 12,000'), with the camp property located in a mixed conifer forest dominated by ponderosa pine, white fir, limber pine, and aspen, with south facing slopes and ridges dominated by a pinyon-juniper and mountain mahogany community with a spring and creek running through the property.

The church community has been recreating here for years and the site is visited by thousands of youth each summer. They provide a rare opportunity for underserved youth from the Las Vegas Valley to experience and learn about a serene mountain environment. This ecosystem, with mature ponderosa trees, is fire adapted, but due to regional fire exclusion, climatic aberrations, and beetle outbreaks, there were decadent and diseased trees with negative impacts to forest health and significant safety threats to the camp visitors. USFS has implemented thinning activities surrounding the private land, partnering to improve regional forest health and catastrophic wildfire risk reduction.

Overgrown, decadent and diseased trees onsite increased the fire risk due to dead fuels likely to propagate diseases and pest outbreaks that further increase the chances of catastrophic wildfires in the mixed conifer and aspen communities. To reduce the fuel load and increase the forest health (thereby reducing the fire risk and improving resiliency) NDF removed insect and disease damaged trees, including trees that have hazardous limbs, or heavy leans that pose a threat to camp users. Another focus of the project was removal of encroaching conifers within aspen stands creating forest canopy openings to promote natural aspen regeneration while retaining the most dominant, healthiest aspen trees on the site. This helped create aspen stands that are well spaced and will be free of insect and disease as well as create a shaded fuel break with hazardous fuels removed.

Short-term benefits and impacts include improved forest health conditions of the residual stand. Elimination of the major insect and disease problems within the project area as well as a reduction of hazard trees. Long-term anticipated outcomes include promoting natural aspen regeneration, creating a safer environment for land users within and near aspen stands. Maintenance of the treated area will also be easier to maintain in the future and require less funding for future treatments.

b. Identify, manage, and reduce threats to forest and ecosystem health

South Fork River Stabilization and Meadow Rehabilitation Phase II

Priority Landscape: Ruby-Cortez

Key Issues/Threats:

- Forest and Woodland Health
- Wildfire Hazards
- Riparian-Wetland Systems
- Sagebrush Ecosystems
- Water Quality and Quantity
- Climate Change Mitigation

Goals/Strategies:

- Cooperative management and collaboration to maintain resilient forest in Nevada
- Promote pro-active forest management for forest health statewide
- Improve monitoring and management of invasive species
- Prevent and manage exotic species invasions that respond to or drive wildfire risks and threats
- Improve the health of wetland plant communities through outreach and education
- Implement conservation and preservation practices through partnerships to improve riparian function
- Use science-based strategies to improve riparian ecosystem function and expand riparian habitat through active project implementation
- Improve the resiliency of riparian systems to wildfires and climate change
- Improve sagebrush ecosystems by increasing site resistance and resilience
- Educate the public as well as decision and policy makers on the importance and value of sagebrush ecosystems, the importance of successful pre-suppression and restoration actions, the wildfire-cheatgrass cycle, wildfire prevention, and wildfire in general
- Maintain Nevada's watersheds by performing necessary management that builds ecosystem community resistance and resilience and soil stability in the inevitable

occurrence of disturbances; increase carbon sink and sequestration activities associated with wildland fire and natural resource management practices

Project Description:

The Nevada Division of Environmental Protection (NDEP) was one of the funding sources, through their authority to fund 319(h) Clean Water Act projects on Impaired (303d) watersheds within Nevada. To improve water quality in the South Fork of the Humboldt River and South Fork Reservoir, 319(h) projects implemented 2015 - 2019 focused on the following goals: 1) Control of noxious and invasive weeds which had invaded abandoned irrigated hay meadows at the time of state purchase of the land in 1987; 2) Reseed the meadows with native and introduced grasses, in order to control erosion occurring on denuded lands; 3) Stabilize with trees the cutbanks eroding along the South Fork of the Humboldt River, where it meanders for 3 miles through the meadows; 4) Augment beaver damming along the river by caching aspen branches that the beavers could use for dam construction; and 5) Monitor, manage, and maintain the treatment areas for goal attainment and maintenance needs.

Treatments applied to the 566-acre site within the South Fork State Recreation Area included: broadcast and drill seeding; out planting of trees and large shrubs in protective cages; transporting aspen cuttings from an offsite hazardous fuels reduction project; and herbicide by boom, wand and cut stump application. An 8:1 project match was achieved using NDF and State Parks labor match, with additional funding from a diverse group of community sponsors. Major financial match was provided by Nevada Gold Mines and the Humboldt Watershed Weed Management Area. At least 15 additional sponsors supported the project, ultimately allowing for a broader approach to ecosystem-wide remediation and restoration. Additional management techniques funded by match money included controlling algae blooms in the reservoir, soil testing and soil health improvement through organic fertilization, shrub plantings and sagebrush carcass cache reestablishment, equipment repair and replacement, and soil erosion control.

Through revegetation, the project has reduced non-point source pollution, sedimentation and eutrophication of the reservoir, originating from erosion of unvegetated banks of the river and from barren floodplain soils. It has reduced the acreage of noxious weeds which had invaded the site since 1988, after acquisition and abandonment of irrigated hayfields. It also serves as a collaborative restoration demonstration site for applying and teaching both proven and experimental restoration techniques.

Enhance Public Benefits from Trees and Forests

a. Assist communities in planning for and reducing wildfire risks

Town of Jarbidge Hazardous Fuels Reduction

Priority Landscape: Owyhee-Bruneau-Jarbidge

Key Issues/Threats:

- Forest and Woodland Health
- Wildfire Hazards
- Urban and Community Forests
- Riparian-Wetland Systems
- Water Quality and Quantity
- Climate Change Mitigation

Goals/Strategies:

- Cooperative management and collaboration to maintain resilient forest in Nevada
- Provide more landowner outreach to generate interest and support from communities in watershed and forest health conservation programs, projects, and education programs
- Promote pro-active forest management for forest health statewide
- Provide public education and financial assistance to promote implementation of timber stand and woodland improvement projects for mixed conifer and aspen stand health
- Prevent and manage exotic species invasions that respond to or drive wildfire risks and threats
- Develop and maintain strong partnerships
- Increase public awareness and environmental education to Promote urban and community forest stewardship
- Implement conservation and preservation practices through partnerships to improve riparian function
- Facilitate public-private partnerships to prioritize and implement management strategies along riparian corridors that cross multiple landownership categories
- Support improvement of riparian health in urban and community settings
- Reduce abundance of encroaching conifers in riparian areas to increase groundwater availability along riparian zones and reduce loss of deciduous riparian species

- Improve the resiliency of riparian systems to wildfires and climate change
- Implement wildfire prevention activities in watersheds to sustain watershed functions and avoidance of catastrophic wildfire and post-fire erosion events
- Protect water quality and quantity in urban and community environments
- Maintain Nevada's watersheds by performing necessary management that builds ecosystem community resistance and resilience and soil stability in the inevitable occurrence of disturbances; increase carbon sink and sequestration activities associated with wildland fire and natural resource management practices

Project Description:

Project partners include NDF, Humboldt-Toiyabe National Forest, Jarbidge Volunteer Fire Department, and seventy-six Jarbidge landowners. NDF provided project planning and management, with NDF inmate hand crews using chainsaws and brush chippers for biomass disposal. This project provided hazardous fuel reduction through the creation of defensible space around eighty-five structures within the town. Tree and brush thinning were done at the north and south ends of town as well as within the Bear Creek watershed for additional fire protection. Firewood was made available for removal by the landowners. The result has been a reduction in hazardous fuels which pose an extreme threat to this remote community. The project outcomes include positive impacts to residents by reducing the threat of wildfire, enhancing overall forest health, and providing protection to the community's water source.

b. Maintain and enhance the economic benefits and values of trees and forests

Galena

Priority Landscape: Sierra Front - Pyramid - Pine Nuts

Key Issues/Threats:

- Forest and Woodland Health
- Wildfire Hazards
- Urban and Community Forests
- Riparian-Wetland System
- Water Quality and Quantity
- Climate Change Mitigation

Goals/Strategies:

- Cooperative management and collaboration to maintain resilient forest in Nevada
- Promote pro-active forest management for forest health statewide

- Improve monitoring and management of invasive species
- Collaborate with other fire and natural resource management stakeholders to reduce the size, frequency, intensity and costs of wildfire impacts in Nevada
- Increase public awareness and involvement in proactive wildfire prevention activities
- Prevent and manage exotic species invasions that respond to or drive wildfire risks and threats
- Develop and Maintain Strong Partnerships
- Improve Urban and Community Forest Management, Maintenance, and Stewardship
- Increase public awareness and environmental education to Promote urban and community forest stewardship
- Improve the health of wetland plant communities through outreach and education
- Implement conservation and preservation practices through partnerships to improve riparian function
- Use science-based strategies to improve riparian ecosystem function and expand riparian habitat through active project implementation
- Improve the resiliency of riparian systems to wildfires and climate change
- Protect water quality and quantity in urban and community environments
- Maintain Nevada's watersheds by performing necessary management that builds ecosystem community resistance and resilience and soil stability in the inevitable occurrence of disturbances; increase carbon sink and sequestration activities associated with wildland fire and natural resource management practices
- Create and distribute a unified message and education to the public and public officials about the importance of watershed protection and water resource conservation
- Increase carbon sink and sequestration activities associated with wildland fire and natural resource management practices (e. g. rehabilitation, restoration etc.)

Project Description:

NDF partnered with private landowners, Galena Forests Estates, Washoe County, and the USFS to treat over 60 acres of native Jeffrey pine and riparian forest. The project was located on both private properties and county land. Galena Creek Regional Park is owned by Washoe County and is a popular recreation and wedding destination, and is the location of a historic hatchery, a fishing pond, and Camp WeChMe - used for environmental educational summer camps. The park is bordered by USFS land, which recently has been or will be treated, and highway 431, a scenic highway that connects Reno to Lake Tahoe. Treatments in the park included cable yarding, hand thinning and chipping, hand thinning and pile burning, and a firewood sale. Future treatments include hand thinning and pile burning in the riparian and

Jeffrey pine forests between the picnic area and the highway. Across the highway are several housing developments. Treatments occurred on Washoe County open space land, private property, and the Galena Forest Homeowners Association open space land and focused on riparian and Jeffrey pine forest stands where a popular hiking/biking path travels next to Galena Creek.

Treatments included hand thinning and pile burning overly dense trees and decadent and dead shrubs to reduce tree densities and fuel loading, restore riparian and aspen habitat, and improve the health and resiliency of the remaining forest. This project was able to generate revenue for the county park system through a firewood sale, as well as generate raw materials for park infrastructure.

This project maintained and enhanced the economic value of the trees and forest. Increased bark beetle activity and mistletoe infestations in the park in recent years were lowering the value of the trees and putting the forest at risk of decline or loss from wildfire. Galena Creek Regional Park is one of only a few natural forested parks in Washoe County and brings in revenue to the county park system as well as generating revenue for surrounding businesses. By improving the growth rate of residual trees through thinning treatments future forestry activities can potentially generate more revenue. The forest also contributes to increased economic activity through home construction and home sales. As one of the few remaining naturally forested areas in Reno the forest contributes to increased property values, increased recreation usage, and increased tourism.

c. Protect, conserve, and enhance wildlife and fish habitat

Virgin River Habitat Restoration

Priority Landscape: Moapa-Mead-Virgin

Key Issues/Threats:

- Forest and Woodland Health
- Wildfire Hazards
- Urban and Community Forests
- Riparian-Wetland Systems
- Species Requiring Specialized Conservation
- Water Quality and Quantity
- Climate Change Mitigation

Goals/Strategies:

- Cooperative management and collaboration to maintain resilient forest in Nevada.

- Improve monitoring and management of invasive species
- Collaborate with other fire and natural resource management stakeholders to reduce the size, frequency, intensity and costs of wildfire impacts in Nevada
- Prevent and manage exotic species invasions that respond to or drive wildfire risks and threats
- Improve urban and community forest management, maintenance, and stewardship
- Increase public awareness and environmental education to promote urban and community forest stewardship
- Improve the health of wetland plant communities through outreach and education
- Implement conservation and preservation practices through partnerships to improve riparian function
- Use science-based strategies to improve riparian ecosystem function and expand riparian habitat through active project implementation
- Improve the resiliency of riparian systems to wildfires and climate change
- Preserve Nevada's native plant and wildlife biodiversity and preclude legal protective species listings through effective stewardship of rare and unique populations and habitats

Project Description:

The Virgin River is a tributary river of the Colorado River with headwaters in southern Utah terminating at Lake Mead. Native people depended on the sustenance that perennial water sources in the desert provide, and as Europeans colonized the area land has been used for ranching and farming and small communities established on the river's banks. This rare naturally flowing river with its northeast-southwest riparian corridor and surrounding watershed serves as an essential migration corridor and rare desert riparian habitat for a wide variety of birds and fish, including Federally threatened or endangered species like the southwestern willow flycatcher, yellow-bellied cuckoo, virgin river chub, and woundfin.

Like many river systems in the southwest, invasive saltcedar (*Tamarix ramosissima*) establishment has resulted in habitat degradation as the invasive tree famously crowds out native tree and shrub species, forming an impenetrable monoculture. The duff created by the deciduous leaf drop along with its multibranched shrubby-tree shape with persistent dead branches forms a significant fire hazard. When salt cedar stands burn, they burn hot and destructively. When burned monocultures of the shrub eliminate nearly all vegetation in the area, degrade water quality, and endanger any nearby human establishments. The impact on wildlife habitats is devastating from both the dominance of the species displacing native vegetation and the destruction resulting from burns (which are increasingly common with increasing human populations). However, vegetation along the riparian corridor is remarkably resilient given the opportunity to reestablish with the removal of invasive species, and habitat restoration and creation is possible along the Virgin River.

NDF partnered with private landowners, HOAs, municipal landowners (City of Mesquite, Clark County Desert Conservation Program), and the BLM to strategically identify and select parcels of land where restoration may have the greatest impact and connectivity with the ongoing work of other agencies with the goal of restoring corridors of functioning habitat that supports wildlife use and improves water quality and quantity. We removed invasive saltcedar on 11 properties along the Virgin River corridor between Bunkerville and Mesquite, Nevada and planted native trees (including willow and cottonwood) along with upland desert vegetation to provide land cover bench sites denuded after decades of saltcedar dominance. While professional crews were utilized for the grueling work of saltcedar eradication, we had the opportunity to work with local community volunteer groups through *Partners in Conservation* to engage high-schoolers (an entire football team at one event) through retirees to replant their communities with beneficial native species after the invasive eradication (including a pollinator garden). Additionally, NDF developed and installed educational signage along a popular walking trail to educate community members about the risks of saltcedar invasion and the habitat restoration process. Eliminating the most dominant and destructive invasive species coupled with replanting beneficial species supports overall health over the river ecosystem and directly established habitat necessary for wildlife survival in the Virgin River watershed.

d. Connect people to trees and forests; engage them in environmental stewardship activities

Range 2 Fire Restoration

Priority Landscape: Ruby-Cortez

Key Issues/Threats:

- Forest and Woodland Health
- Wildfire Hazards
- Riparian-Wetland Systems
- Sagebrush Ecosystems
- Water Quality and Quantity
- Climate Change Mitigation

Goals/Strategies:

- Cooperative management and collaboration to maintain resilient forest in Nevada
- Prevent and manage exotic species invasions that respond to or drive wildfire risks and threats
- Improve the health of wetland plant communities through outreach and education

- Implement conservation and preservation practices through partnerships to improve riparian function
- Use science-based strategies to improve riparian ecosystem function and expand riparian habitat through active project implementation
- Improve the resiliency of riparian systems to wildfires and climate change
- Educate the public as well as decision and policy makers on the importance and value of sagebrush ecosystems, the importance of successful pre-suppression and restoration actions, the wildfire-cheatgrass cycle, wildfire prevention, and wildfire in general
- Maintain Nevada's watersheds by performing necessary management that builds ecosystem community resistance and resilience and soil stability in the inevitable occurrence of disturbances
- Increase carbon sink and sequestration activities associated with wildland fire and natural resource management practices

Project Description:

In 2018, a 10,000-acre fire ravaged some of the premier wildlife habitat in the Ruby Mountains at a time where a severe wildfire season left many fire restoration coffers strained or empty. As a result, partners formed a collaboration called the Lamoille Canyon Revegetation Working Group to address the imminent need for habitat restoration. The partners were a diverse group of stakeholders including NDF, Nevada Department of Wildlife, the Humboldt-Toiyabe National Forest, Partners in Wildlife, Humboldt Watershed Cooperative Weed Management Area, Northeastern Nevada Stewardship Group, Nevada Gold Mines, High Desert Imagery and many private contributors. NDF provides inmate labor, seasonal firefighter labor, resource management planning, media relations and nursery grown plants. Treatments applied include seed application by helicopter; harvesting and sowing mountain mahogany seeds; mechanical removal of noxious weeds, reseeding grasses; outplanting chokecherry, Wyoming and mountain big sagebrush and antelope bitterbrush; sagebrush carcass caching and fence repair. The benefits include hastening recovery of soil stabilizing plants and wildlife browse and preventing livestock trespass. The primary outcome from this project is achieving post-fire vegetation recovery which will protect the community of Lamoille from flooding. A secondary outcome is providing the greater Elko County community an opportunity to contribute money and volunteer labor to preserving the natural and cultural heritage of a significant scenic and recreational area (i.e. Lamoille Canyon).

e. Manage and restore trees and forests to mitigate and adapt to global climate change

Clear Creek

Priority Landscape: Priority Landscape: Sierra Front - Pyramid - Pine Nuts
Key Issues/Threats:

- Forest and Woodland Health
- Wildfire Hazards
- Urban and Community Forests
- Riparian-Wetland System
- Water Quality and Quantity
- Climate Change Mitigation

Goals/Strategies:

- Cooperative management and collaboration to maintain resilient forest in Nevada
- Promote pro-active forest management for forest health statewide
- Improve monitoring and management of invasive species
- Collaborate with other fire and natural resource management stakeholders to reduce the size, frequency, intensity and costs of wildfire impacts in Nevada
- Increase public awareness and involvement in proactive wildfire prevention activities
- Prevent and manage exotic species invasions that respond to or drive wildfire risks and threats
- Develop and maintain strong partnerships
- Improve urban and community forest management, maintenance, and stewardship
- Increase public awareness and environmental education to promote urban and community forest stewardship
- Improve the health of wetland plant communities through outreach and education
- Implement conservation and preservation practices through partnerships to improve riparian function
- Use science-based strategies to improve riparian ecosystem function and expand riparian habitat through active project implementation
- Improve the resiliency of riparian systems to wildfires and climate change
- Protect water quality and quantity in urban and community environments

- Maintain Nevada's watersheds by performing necessary management that builds ecosystem community resistance and resilience and soil stability in the inevitable occurrence of disturbances
- Increase carbon sink and sequestration activities associated with wildland fire and natural resource management practices
- Create and distribute a unified message and education to the public and public officials about the importance of watershed protection and water resource conservation
- Increase carbon sink and sequestration activities associated with wildland fire and natural resource management practices (e. g. rehabilitation, restoration etc.)

Project Description:

Clear Creek is the only year-round flowing tributary of the Carson River, an important water source in western Nevada for both human and wildlife use. The forests that surround Clear Creek sit at the ecotone between the vegetation communities of the dry mixed conifer forests of the Sierra Nevada and the sage brush of the Great Basin. As climate change in western Nevada is predicted to exhibit a warming and drying trend with more extreme weather conditions it is imperative to manage the forests to adapt to climate change while mitigating the impacts of climate change.

NDF partnered with the Nature Conservancy, the US Forest Service, Carson City Open Space, Clear Creek Tahoe, and other private landowners to treat over 350 acres of Jeffrey pine, mixed conifer, and aspen forests around Clear Creek and the north fork of Clear Creek. Treatments included mechanical thinning, cable yarding, hand thinning and chipping, hand thinning and pile burning, and mastication. These treatments reduced tree densities and fuel loading making the forests more resilient. A resilient forest is better able to adapt to climate change and survive wildfires. Due to historic logging, grazing and forestry practices the forests of the Sierra Front are at high risk of forest to non-forest conversion following wildfires. Much of the native forest has been lost in this area due to wildfires, reducing the landscapes ability to sequester carbon and offset the impacts of climate change. Large wildfires contribute to climate change through the large release of carbon emissions into the atmosphere. Forest loss and converting an area to a shrubland or grassland can raise temperatures, reduce water holding capability, and lower biodiversity. By lessening the wildfire hazard and reducing the potential of forest conversion by wildfires, the protection and improvements in the Clear Creek drainage will help mitigate climate change impacts into the future. A healthier and more resilient forest is also better suited to withstand the impacts of climate change such as rising temperatures, frequent droughts, and more severe wildfires.

Appendix C - Additional Nevada Shared Stewardship Agreement and Wildland Fire Cohesive Strategy details

NDF, USFS and other federal, state and local fire and resource management partners accepted the National Cohesive Strategy as Nevada's wildfire management strategy in 2015 along with the concepts of Shared Stewardship as a framework for collaborative implementation of the Cohesive and other strategies. Cooperators spent a week in 2019 reviewing progress made on Nevada Cohesive Strategy goals and objectives and revising the strategy to include current needs. NDF structured its agency strategic plan largely around the three tenets of the Cohesive Strategy:

- Resilient Landscapes
- Fire Adapted Communities
- Safe and Effective Wildfire Response

At the conclusion of the 2019 meeting, the State of Nevada, USFS, and Department of Interior signed the Nevada Agreement for Shared Stewardship. The agreement recognizes that all parties have a shared responsibility and commitment to collaboratively and actively address landscape scale natural resource and fire management challenges that do not stop at political boundaries. Cooperators will expand their working relationships, jointly set priorities, implement projects at the appropriate scale, co-manage risks, and share resources. These concepts will allow all cooperators to use all available tools for actively doing the most appropriate work, in the right place, at the right scale. Partners will collectively identify priority landscapes, coordinate investments, and implement projects that improve the health and productivity of forest, rangeland, watersheds and wildlife habitats in Nevada. Shared agreement priorities include ecological restoration, conserving and protecting Nevada's industries, sustainable recreation, conserving and protecting fish and wildlife, and enhancement of cultural and demographic diversity. All parties will use the best available science and models to inform decisions, science-based tools, focus on mutually beneficial priorities as outlined by existing plans and strategies, avoid duplicative efforts, and allocate resources to ensure partnership growth and goal achievement. The agreement requires the creation of an executive committee to review, resolve, report challenges and successes, and maintain a five-year work plan.

Since the Shared Stewardship approach and agreement are new in Nevada, the development and implementation strategy are in progress. The Executive Committee and Technical Advisory Committees (TAC) have been formed and are meeting regularly. The geospatial analysis from the Forest, Range, and Watershed Action Plan (FRWAP) was provided as starting place for the TAC in making specific Shared Stewardship Priority Areas, then the TAC requested additions that better represented the entire TAC and Executive Committee representative's interests. The analysis was thereby modified and made inclusive of the TAC recommendations and fully incorporated into the FRWAP analysis, mapping products, and priority landscape designations. In 2020, the Executive Committee accepted the TAC's recommended Shared Stewardship Priority Areas (13) and the recommended plan to further prioritize seven of the areas for action by 2025 and two of the seven areas for action by the end of 2021 (Figure 1). Later in 2020, agencies will be coordinating their local efforts to document past, current and planned projects for the two highest priority areas in order to focus and support more action in local areas as local work groups. There will be continuous coordination and collaboration at the field level that will assist in the development and updating of work plans and accomplishment reports while working toward the goal of implementing two projects by 2021 and a 50% increase in treated acres by 2025.

For more information on Shared Stewardship in Nevada, please contact:

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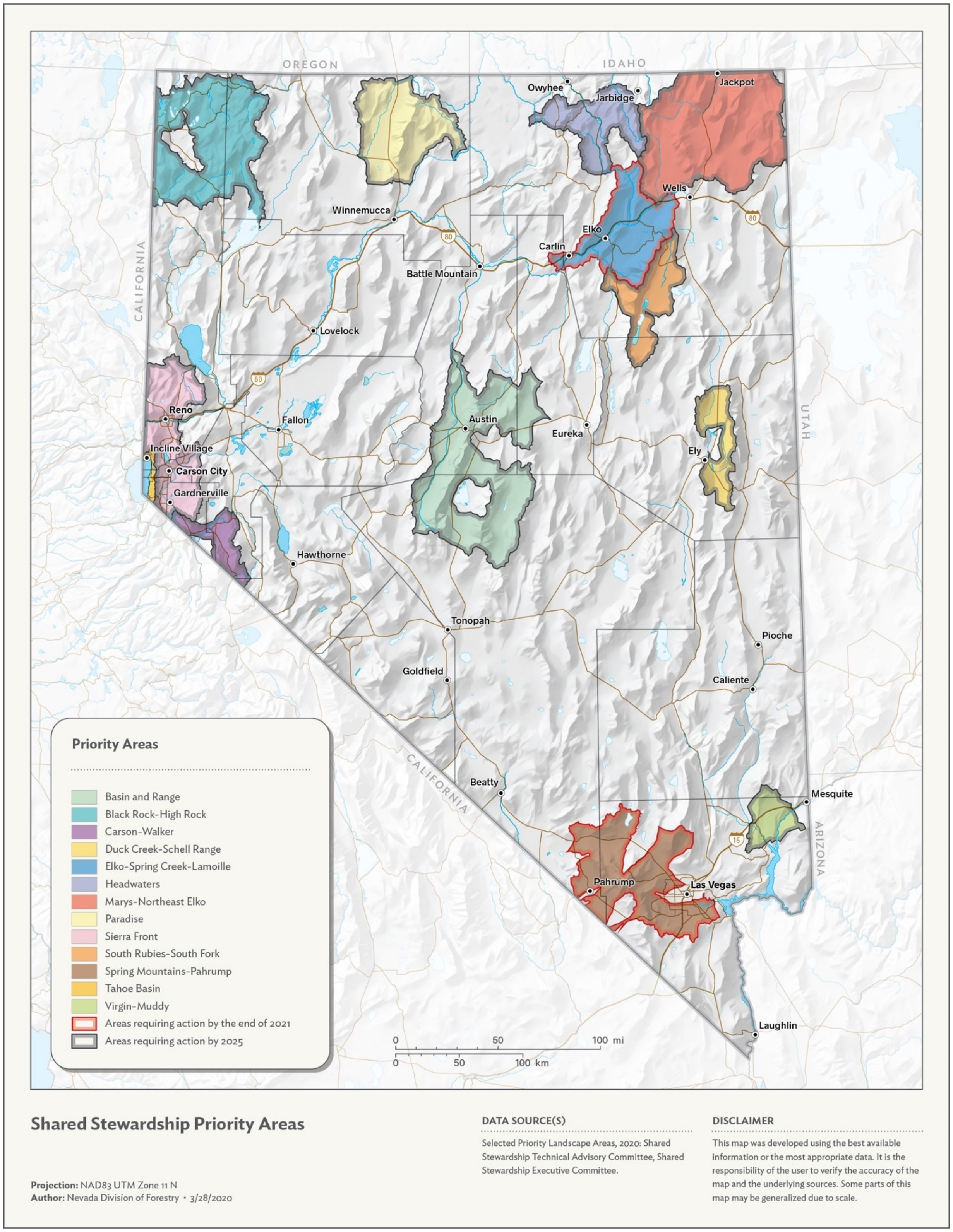

Figure 1. Nevada Priority Shared Stewardship Areas.

Appendix D – Forest Legacy Program Assessment of Need (AON) Components

Forest Legacy Area Eligibility Criteria

These criteria were based upon the Forest Legacy Program (FLP) purpose to protect environmentally important forest areas that are threatened by conversion to non-forest uses, and these criteria were further developed through the State Forest Action Plan. Nevada Division of Forestry (NDF) is responsible for determining what defines "threatened" and "environmentally important forest areas" in the State. Nevada adopted the national guidelines and environmentally important forest areas contain one or more of the following important public values:

a. Timber and other forest commodities;
b. Scenic resources;
c. Public recreation opportunities;
d. Riparian areas;
e. Fish and wildlife habitat;
f. Known threatened and endangered species;
g. Known cultural resources; and
h. Other ecological values.

Through consultation with existing plans, stakeholders and other agencies, the 2020 Forest, Range and Watershed Action Planning process was used to thoroughly analyze the following natural resource, social, economic conditions to inform the NDF's determination of qualifying Forest Legacy Areas:

a. Forest resources and benefits including:
    - Aesthetic and scenic values,
    - Fish and wildlife habitat,
    - Public recreation opportunities,
    - Soil productivity,
    - Forest products and timber management opportunities, and
    - Watershed values including water-quality protection.
b. The present and future threat—as defined by the State—of conversion of forest areas to non-forest uses;
c. Historic or traditional uses of forest areas, and trends and projected future uses of forest resources;
d. Current ownership patterns and size of tracts, and trends and projected future ownership patterns;
e. Cultural resources that can be effectively protected;
f. Outstanding geological features;
g. Threatened and endangered species;

h. Other ecological values;
i. Mineral resource potential;
j. Protected land in the State, to the extent practical, including Federal, State, municipal lands, and private conservation organization lands; and
k. Issues identified by NDF and through the public-involvement process

When the analysis was completed and compared against the eligibility criteria, the existing Forest Legacy Areas were modified (five were expanded and one was added) to better represent priority landscapes, goals and objectives of the Forest Legacy Program as defined by the national guidance [the program role is identified in Goals and Strategies located within the Key Issues, Threats and Strategies section of this 2020 Nevada Forest, Range and Watershed Action Plan (FRWAP)]. Table 1 shows the names, sizes and applicable eligibility criteria for each Forest Legacy Area selected and approved by the NDF Advisory Committee Members on April 30, 2020 (documentation of the Advisory Board Committee Meeting is available through NDF if requested).

Figure 1 shows their location geographically within Nevada and in reference to the priority landscape analysis levels as determined through a thorough geospatial analysis performed as part of the FRWAP process.

Table 1. Forest Legacy Areas, the approximate number of potentially qualifying acres for Forest Legacy Program Support, and the applicable eligibility criteria for each area.

Forest Legacy Areas	Potentially Qualifying Acres*	Timber and other forest commodities	Scenic resources	Public recreation opportunities	Riparian areas	Fish and wildlife habitat	Known threatened and endangered species	Known cultural resources	Other ecological values
Jarbidge River	306,613	●	●	●	●	●	●	●	
Mt. Charleston FLA	3,173	●	●	●	●	●	●	●	
Muddy River	1,394		●	●	●	●	●	●	
Santa Rosa Range	2,026		●	●	●	●		●	
Schell Creek	1,2461	●	●	●	●	●		●	
Tahoe-Sierra Front	331,346	●	●	●	●	●		●	
Riparian Areas**	305,976		●	●	●	●	●	●	

**Potentially qualifying project acres are non-federal lands, less than 40% slope on average, and greater than 10-acre parcels that have the necessary forest species cover (Table 11) of 75% or greater or can be restored to that level.*
***Eligible riparian areas (acreages) are omitted in other listed Forest Legacy Area designations.*

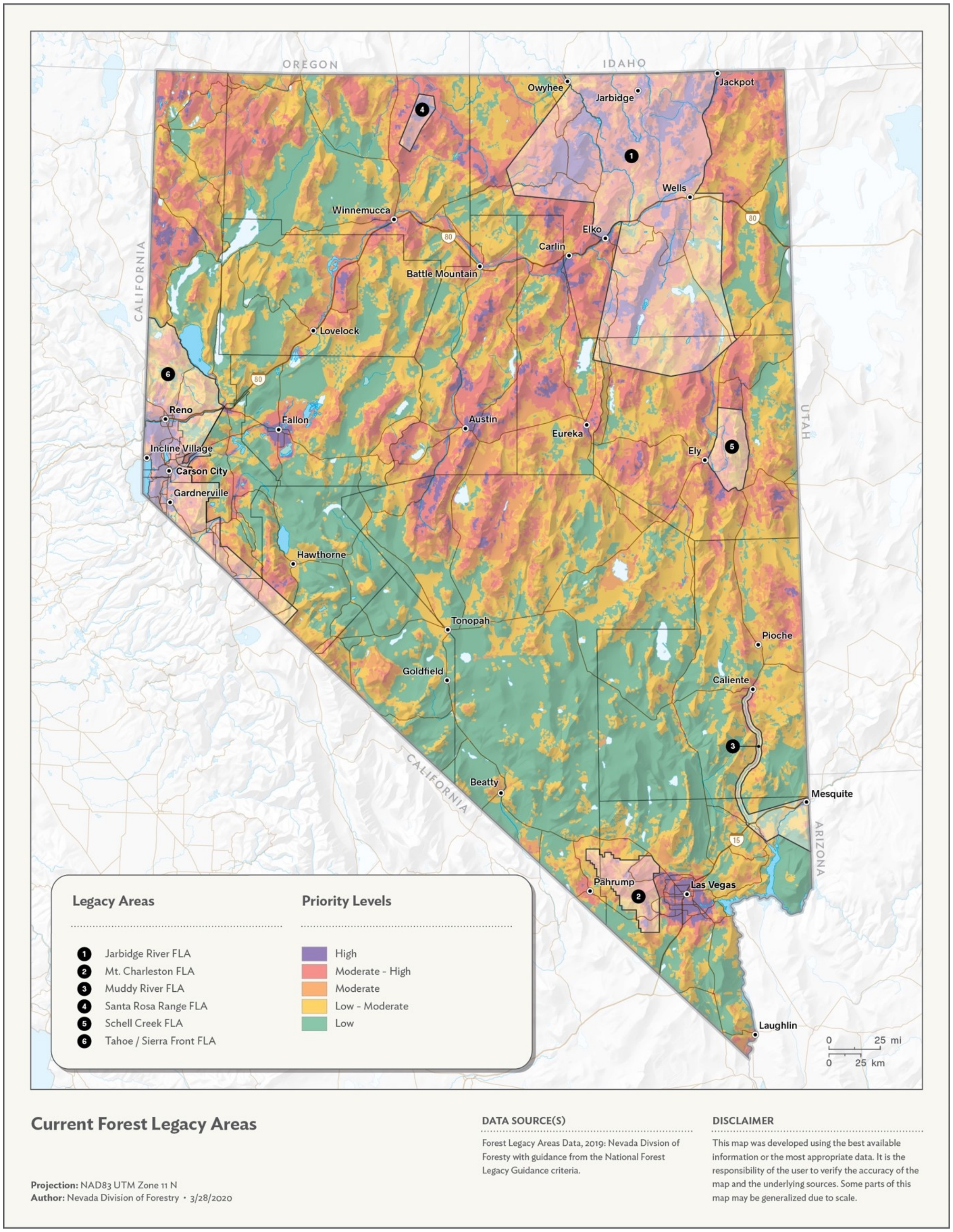

Figure 1. Location of Forest Legacy Areas as described in the Nevada Forest Action Plan.

Table 2. Includes details about each FLA as requested by the USFS review board in March 2021.

Forest Legacy Areas	Jarbidge River	Mt. Charleston FLA	Muddy River	Santa Rosa Range	Schell Creek	Tahoe-Sierra Front
Is it new, expanded, or existing?	Expanded	Expanded	Expanded	New	Expanded	Expanded
The priority landscape it is located within	North Fork-Middle Humboldt; Owyhee-Bruneau-Jarbidge; Ruby Cortez	Amargosa-Lower Sand Springs-Pahrump; Las Vegas Wash	Meadow Valley Wash	Santa Rosa-Paradise	Steptoe-White-Snake	Tahoe Basin; Sierra Front-Pyramid-Pine Nuts
Conservation Goals/Objectives	Wildlife migration corridor; at risk of development; Aesthetic and scenic values; Several watersheds to be protected; Outstanding geological features;	Protect rare riparian habitats; Elk migration corridor; Aesthetic and scenic values	Protect Riparian habitats; watershed protection; Unique ecosystem transition from Northern Mojave Desert to Great Basin ecosystem; wildlife migration	Aesthetic and scenic values; watershed protection	Aesthetic and scenic values; watershed protection; historical resource (ghost towns)	Protect riparian areas for watershed quality, forests for wildlife and fishing; cultural resources; Aesthetic and scenic values

Forest Legacy Areas	Jarbidge River	Mt. Charleston FLA	Muddy River	Santa Rosa Range	Schell Creek	Tahoe-Sierra Front
	watershed quality; historically important		corridor; culturally and historically important resource area			
Public Benefits	Recreation; water quality/quantity; wildlife/hunting; fishing; historically important-California Trail	Recreation; water quality/quantity; wildlife/hunting; fishing	Recreation; water quality/quantity; wildlife/hunting; fishing; culturally and historically significant/educational	Recreation; Agriculture; water quality/quantity; wildlife/hunting; fishing; historically significant/educational	Recreation; Agriculture	Maintain open space in rapidly developing area; recreation, wildlife and fishing habitats

The state of Nevada follows the Forest Legacy Program Implementation Guidelines. NDF was appointed lead agency, the guidance document also states, "Other State agencies and local units of government may participate in the FLP through agreements made with the State Lead Agency to help facilitate transactions, hold title to land or hold the conservation easements." FAP Page 361 states "Granting a perpetual conservation easement to the State of Nevada – or a State of Nevada designee– with the stated purposes of maintaining, enhancing, or conserving the forestland and conservation values of the property." State designees will depend on what project is brought forward and what designee is identified at that time. Any government entity (County, City, Municipality, State, etc.) may be the designee as agreed upon by all parties involved in the conservation easement and following the USFS guidelines.

See Page 417 Appendix M – USFS Statewide Forest Resource Assessments and Strategies Requirements Checklist Contents for required cross-checked information regarding the Forest legacy Program.

Forest Legacy Project Eligibility Criteria

Projects must be located within a designated Nevada Forest Legacy Area as identified in the Nevada Forest, Range and Watershed Action Plan. Identified Forest Legacy Areas were expanded and approved by the NDF Advisory Board (see Table 1 & Figure 1 above):

If you are uncertain if your property location is eligible, please contact the Legacy Program Coordinator for verification.

- Project must be sponsored by a land trust organization or local/tribal government agency
- Project property must be privately owned
- Project must be a minimum of 10 acres in size
- Project land must be less than 40% slope on average
- Projects must include a minimum 25 percent cash, in-kind, or property match that is NOT from a federal source. The FLP will fund up to 75 percent of total program costs (including acquisition costs plus other allowable expenses)
- Project area must be 75 percent forested; or have the potential to be reforested to 75 percent within 10 years

Landowners must agree to follow federal FLP requirements and implementation rules, which include, but are not limited to:

- Accepting a land appraisal that meets standard federal appraisal guidelines
- Managing the property under a Forest Stewardship Plan (FSP) approved through the NDF Forest Stewardship Program

- Agreeing that a funded project will not receive payment until federal funding has been secured
- Allowing annual conservation easement compliance monitoring
- Granting a perpetual conservation easement to the State of Nevada – or a State of Nevada designee – with the stated purposes of maintaining, enhancing, or conserving the forestland and conservation values of the property
- Abiding by additional conservation easement restrictions placed on construction, mineral extraction, installation of utilities, and any other activities that compromise conservation values within the easement

Criteria that Enhance Application Rankings:

- Project Readiness – including a completed Forest Stewardship Plan, draft conservation easement, completed title report, and recently conducted mineral, wildlife, and/or cultural surveys
- A non-federal match greater than 25 percent
- Large contiguous project areas: parcels smaller than 100 acres will rank as low priorities unless there are significantly unique environmental values to conserve
- Designated public access uses, except in cases where the primary goal is protection of threatened and endangered species
- Connectivity with other public or private protected lands
- Contribution to recognized conservation strategies/initiatives and local economies
- Protection of cultural, scenic or other public resources
- Imminent threat of conversion to non-forest uses

Process to be used by NDF to evaluate and prioritize projects to be considered for inclusion in the Forest Legacy Program:

Proposals will initially be reviewed by the Forest Legacy Program Coordinator for eligibility. Eligible proposals will be presented to the NDF Advisory Committee for evaluation and priority rankings. FLP proposals will be evaluated and prioritized based on the quality and completeness of each application. The Advisory Committee will select up to three proposals for development and submission to the USFS national selection committee by their designated due date each year. Projects that have been selected for funding will be announced in the spring/summer of the following year.

Appendix E – Stakeholder Scoping and Engagement

During the 2015 Forest Action Plan update process, NDF reached out to all stakeholder representatives to understand their needs from NDF. Stakeholders were requested to review the 2010 Forest Action Plan and provide comments to improve the plan as NDF developed the 2015 updates. Additionally, the inputs were used to inform the revision process that occurred throughout 2016-2017 in anticipation for meeting the 2020 revision requirement. A new stakeholder list was developed in 2019 for the drafting, review, editing and finalization of the 2020 FRWAP. The stakeholders were selected based on their potential to be cooperating entities with NDF while implementing the agency and USFS Cooperative Forestry mission areas. Three two-to-three-week long scoping periods provided by NDF to stakeholders occurred. The first was an internal departmental review that went to all sister agencies within the Nevada Department of Conservation and Natural Resources. The second went to the entities and all the other stakeholder and partners in natural resource and fire management. The third went to the stakeholder list through the Nevada Clearinghouse process, state website, social media and other outlets to ensure that the public had an opportunity to submit comments for consideration. During the process hundreds of comments were addressed and the plan was edited to enhance the quality of the plan.

Table 1: List of stakeholder involvement in the FRWAP review process.

Organization	Round 1	Round 2	Round 3
DCNR-Administration	●	●	●
DCNR-NDEP	●	●	●
DCNR-Heritage	●	●	●
DCNR-Sagebrush	●	●	●
DCNR-Conservation Districts and Local CDs	●	●	●
DCNR-Outdoor Recreation	●	●	●
DCNR-OHV	●	●	●
DCNR-Lands	●	●	●
DCNR-Parks	●	●	●
DCNR-Water	●	●	●
DCNR-Climate	●	●	●
NDF-Administration	●	●	●
NDF-Fire Program		●	●
NDF Camp Program		●	●
NDF Aviation Program		●	●
NDF Fiscal Program		●	●
NDF Safety Training Program		●	●

Organization	Round 1	Round 2	Round 3
NDF Human Resources Program		●	●
NDF Support Services Program		●	●
NDF Advisory Committee-UCF/Shade Tree Council		●	●
NDF Advisory Committee-Pinyon Juniper Partnership		●	●
NDF Advisory Committee-Tribes		●	●
NDF Advisory Committee-UCF		●	●
NDF Advisory Committee-BLM		●	●
NDF Advisory Committee-NRCS		●	●
NDF Advisory Committee-NDOW		●	●
NDF Advisory Committee-USFS		●	●
NDF Advisory Committee-USFS-SPF		●	●
NDF Advisory Committee-NDA		●	●
USFS Regional GIS		●	●
Tahoe Regional Planning Agency		●	●
UNR CABNR-NRES Climate and Ecosystems		●	●
UNR CABNR-UNCE		●	●
UNR-CABNR-NRES Forestry		●	●
UNR-CABNR-Range/Animal Science		●	●
UNR-CABNR-UNCE Living Withwith Fire		●	●
UNLV		●	●
Nevada Indian Commission and Tribes		●	●
BIA Western Nevada Agency		●	●
Nevada Division of Minerals		●	●
BIA Eastern Nevada Agency		●	●
NV State Climatologist		●	●
BLM-Range		●	●
BLM Fire		●	●
Fallon Naval Air Station		●	●
Nellis AFB		●	●
USFWS-Nevada		●	●
USFWS-National Wildlife Refuges		●	●
NPS-Great Basin		●	●
NPS-Lake Mead NRA		●	●

Organization	Round 1	Round 2	Round 3
NACO & County Managers/Natural Resources		●	●
Nevada Fire Chief's Association – Local FPDs		●	●
USFS Fire		●	●
Southern Nevada Arborist Group		●	●
Rural Nevada Water Association		●	●
Nevada Water Resources Association		●	●
American Water Works Association		●	●
The Nature Conservancy		●	●
Nevada Land Trust		●	●
Nevada Cattlemen's Association		●	●
Nevada Farm Bureau		●	●
Nevada Wool Growers Association		●	●
Nevada Mining Association		●	●
Barrick & Newmont (Nevada Gold)		●	●
Walker Basin Conservancy		●	●
Truckee Meadows Water Authority		●	●
Great Basin Fire Science Exchange		●	●
Carson Water Subconservancy District		●	●
California Tahoe Conservancy		●	●
Eastern Nevada Landscape Coalition			●
Intermountain West Joint Venture		●	●
Northeastern Nevada Stewardship Group		●	●
Society of American Foresters		●	●
Society for Range Management		●	●
Senator Rosen		●	●
Senator Cortez-Masto		●	●
Representative Amodei		●	●
Representative Titus		●	●
Representative Lee		●	●
Governor's Office		●	●
Western Chapter International Society of Arboriculture		●	●
Southern Nevada Water Authority		●	●
Clark County Desert Conservation Program		●	●

Organization	Round 1	Round 2	Round 3
Public - Facebook			●
Public - Website			●
Public - Clearinghouse			●
Public - Nevada Public Notice Website			●

Appendix F – Specific Existing Plans Considered and Used

Community Wildfire Protection Plans and Fuels Reduction Strategies

- Nevada Fire Safe Council-Nevada Community Wildfire Risk/Hazard Assessment Project (CWPP), 2004-2005
- Lake Tahoe Basin, Carson City, Smith Valley and ArrowCreek CWPPs
- Lake Tahoe Basin Multi-Jurisdictional Fuel Reduction and Wildfire Prevention Strategy, 2014-17. https://www. tahoelivingwithfire. com/ufaqs/lake-tahoe-basin-fuel-reduction-and-wildfire-prevention-strategy/
- Carson Range Multi-Jurisdictional Fuel Reduction and Wildfire Prevention Strategy 2008. https://www. fs. usda. gov/detail/htnf/home/?cid=fsm9_026841

Wildfire Management

- Nevada Wildland Fire Cohesive Strategy 2019
- National Cohesive Fire Management Strategy
- Secretarial Order 3372: Reducing Wildfire Risks on Department of the Interior Land Through Active Management

Land Use and Management Plans

- Bureau of Land Management - Ely Proposed Resource Management Plan/Final Environmental Impact Statement, 2007
- Bureau of Land Management - The Condition and Trend of Aspen Communities on BLM Administered Lands in Central Nevada, with Recommendations for Management. 2001
- Tahoe Regional Planning Agency-Pathway Regional Plan Revision. 2007
- U. S. Forest Service Humboldt Forest Plan - 1986 (revisions suspended). U. S. Forest Service Toiyabe Forest Plan - 1986 (revisions suspended)
- Nevada Agreement for Shared Stewardship – 2019

Multiple Species Habitat Conservation Plans (MSHCPs)

- Clark County, Coyote Springs Investment, Nye County, Pioneer Meadows, Southeastern Lincoln County, and Virgin River. https://www. fws. gov/nevada/es/hcp. html

Wildlife, Sage Grouse and Habitat Plans

- Bi-State Sage-Grouse Action Plan 2012 https://www. bistatesagegrouse. com/general/page/2012-bi-state-action-plan

- Nevada Greater Sage-grouse Conservation Plan 2008. http://sagebrusheco. nv. gov/uploadedFiles/sagebrusheconvgov/content/Meetings/2018/State%20Plan_2018%20for %205. 18. 18%20SEC%20Meeting(1). pdf

- BLM Nevada and Northeastern California Sage-Grouse Record of Decision and Approved Resource Management Plan

- Greater Sage-grouse Draft Record of Decision and Land Management Plan Amendment for National Forest System Land in Nevada on the Humboldt-Toiyabe National Forest

- Nevada Department of Wildlife, Wildlife Action Plan 2012

- Partners in Flight Pinyon Jay Working Group, Conservation Strategy for Pinyon Jay, Version 1 2020

- Secretarial Order 3362: Site-specific Management Activities to Conserve or Restore Big Game Habitat

Other Strategies and Plans

- Stewardship Alliance of Northeast Elko County – SANE Sagebrush Ecosystem Conservation Plan http://www.saneconservation.org/documents/SANE%20SECP%20CD%20v. 1. pdf

- Resource Needs Assessments developed by the following conservation districts were available at the time this document was drafted (http://www. nvacd. org/?page_id=471)

    - White Pine
    - Conservation District of Southern Nevada
    - Eureka
    - Mason Valley
    - Smith Valley
    - Lincoln County
    - Northeast Elko

- Source Water Protection Plans (70 in total)
- Nevada Nonpoint Source Management Plan 2015-2019

Addressing the Nevada Wildlife Action Plan and State Wildlife Resources

The State Wildlife Action Plan (SWAP) was incorporated into this Forest, Range and Watershed Action Plan in several different ways, including:

- Identifying dependent wildlife populations on the major ecosystems assessed.
- Identifying key habitats and focal areas that are the priority for conservation action.
- Providing wildlife habitat focal areas that were used as part of the spatial analysis used to designated Priority Landscape Areas.

NDF works with various non-governmental organizations to generate project ideas, proposals and implementation at local, regional and state-wide levels. These Include the Nevada Collaborative Conservation Network, Conservation Districts, Cooperative Weed Management Areas, Local Area Working Groups, the Northeastern Nevada Stewardship Group, Nevada Pinyon-Juniper Partnership, Southern Nevada Conservancy and the Stewardship Alliance of Northern Elko County.

Nevada Greater Sage-Grouse and Bi-State Conservation Plans

This Forest, Range and Watershed Action Plan incorporates the priorities relevant to NDF within the Nevada Sage-Grouse Conservation Plan, the culmination of years of work by many in the State of Nevada. In 2010, after the USFWS determined that listing the greater sage-grouse (GRSG) was "warranted but precluded" under the Endangered Species Act (ESA), GRSG were placed on the federal candidate species list. Consequently, the BLM and USFS set out to revise land use plans (LUPs) to better conserve GRSG and their habitats, inviting the States to be impacted by a potential GRSG listing to develop Environmental Impact Statement alternatives with state-specific regulatory mechanisms to conserve the species. Nevada's response included the 2012 State Plan, which recommended the creation of the Sagebrush Ecosystem Program (SEP), to consist of the Sagebrush Ecosystem Council (SEC) and Sagebrush Ecosystem Technical Team (SETT). Once established, the SEC directed the SETT to develop a more comprehensive and detailed Nevada Greater Sage-Grouse Conservation Plan, using the best available scientific information, as well as stakeholder input, to represent a GRSG conservation strategy specific to and supported by Nevada. The recently updated Nevada Greater Sage-Grouse Conservation Plan is available here, much of it was adopted in recent land use plan revisions. A key part of this strategy was the development of Nevada's Conservation Credit System (CCS), a compensatory mitigation program now required within the state to ensure impacts to GRSG habitats are mitigated with commensurate habitat protections and improvements. In 2015, in part due to the conservation efforts of western States, USFWS determined the GRSG was not warranted for listing, although future status reviews are planned.

The bi-state distinct population segment (DPS) of greater sage-grouse has faced challenges that are relatively consistent with those of GRSG, and similar concerns regarding a potential listing. However, the bi-state DPS is represented in its own Bi-State Action Plan, authored by the Bi-State Executive Oversight Committee, which can be found here. The strategies, objectives, and actions within the plan are implemented through the Bi-State Local Area Working Group (Bi-State LAWG), a collaborative conservation network composed of various stakeholders.

Appendix G – Federal and State Listed Plant and Animal Species

Additional information for these and other rare or special status species can be found on the Nevada Division of Natural Heritage website at http://heritage.nv. gov/species_info

Common Name	Scientific Name	Organism Group	USESA Status*	Nevada Status**	Nevada Counties	Habitat	Major Ecosystems***
Columbia spotted frog (Great Basin pop)	*Rana luteiventris* pop. 3	Amphibian	C	P	Nye, White Pine, Elko, Eureka, Humboldt, Lander	Jarbidge-Independence Range, Ruby Mountains, and Toiyabe Mountains in pooled water with floating vegetation and some emergent vegetation	AF, CDGS, DA, HEF, MCF, OW, O, PJW, RA, SB, VDA, WHD
relict leopard frog	*Lithobates onca*	Amphibian	C	P	Clark	Springs, spring outflows, and associated marshes and wetlands generally in close proximity to the Colorado River	OW, PJW, RA, VDA, WHD
Bald Eagle	*Haliaeetus leucocephalus*	Bird	--	E	Churchill, Elko,Mineral, Lyon, Washoe, Douglas	Cliffs near bodies of water, thick cottonwood groves,conifers or other sheltered sites. distribution influenced by waterfowl concentrations or wetland sites. Increase in numbers in Carson Valley	No Data
Peregrine Falcon	*Falco peregrinus*	Bird	--	E	Clark, Elko, Mineral, Nye, Douglas, Lyon, Lincoln	Open water, desert shrub, and marshes usually in close to nesting cliffs, mountains, open forested regions, and human population centers	No Data
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Bird	E	E	Lincoln, Nye, Clark	Riparian habitat in Mojave river systems and tributaries	AF, DA, MCF, OW, PJW, RA, SB, VDA, WHD
Ash Meadows Amargosa pupfish	*Cyprinodon nevadensis mionectes*	Fish	E	T	Nye	Warm springs and outflows in Ash Meadows NWR	RA, WHD
Ash Meadows speckled dace	*Rhinichthys osculus nevadensis*	Fish	E	E	Nye	Cooler spring source pools and springbrook outflows in Ash Meadows	OW, RA, WHD
Big Spring spinedace	*Lepidomeda mollispinis pratensis*	Fish	T	T	Lincoln	Perennial streams through Meadow Valley Wash and Condor Canyon	VDA, WHD

* *E = Endangered; T = Threatened; C = Candidate species; P = Protected*
** *E = Endangered; T = Threatened; P = Protected*
*** *Aspen Forests = AF, Cold Desert Grass and Shrublands = CDGS, Developed Areas = DA, High Elevation Forests = HEF, Mixed Conifer Forests = MCF, Mixed Oak Forests = MOF, Open Water = OW, Other = O, Pinyon-Juniper Woodlands = PJW, Riparian Areas = RA, Roads = R, Sagebrush = SB, Vegetated Developed Areas = VDA, Warm and Hot Deserts = WHD*

Common Name	Scientific Name	Organism Group	USESA Status*	Nevada Status**	Nevada Counties	Habitat	Major Ecosystems***
bonytail chub	*Gila elegans*	Fish	E	E	Clark, White Pine	Found in the mainstream of the Colorado River and large tributaries. Habitats include slow areas, backwaters, and eddies	CDGS, DA, MCF, OW, PJW, RA, SB, VDA, WHD
Clover Valley speckled dace	*Rhinichthys osculus oligoporus*	Fish	E	E	Elko	Found in reservoirs and outflows of the three spring systems: Clover Valley Warm Springs, Wright Ranch Spring, and Bradish Spring	CDGS, O, PJW, SB, VDA
Colorado pikeminnow	*Ptychocheilus lucius*	Fish	E	E	Clark	Colorado River basin: mainstem Colorado River and major tributaries	No Data
Cui-ui	*Chasmistes cujus*	Fish	E	E	Washoe	Inshore areas of Pyramid Lake with shoals and shallow bars, spawning in Truckee River	CDGS, DA, OW, O, PJW, SB, VDA
Desert Dace	*Eremichthys acros*	Fish	T	T	Humboldt	Ten thermal springs in the warm springs and creeks of Soldier Meadow	CDGS, MCF, OW, O, PJW, SB, VDA
Devils Hole pupfish	*Cyprinodon diabolis*	Fish	E	E	Clark, Nye	Exist only in a deep limestone pool in Ash Meadows National Wildlife Refuge	DA, OW, RA, VDA, WHD
Hiko White River springfish	*Crenichthys baileyi grandis*	Fish	E	E	Lincoln, Mineral	Vegetated warm springs and their outflows and marshes	VDA, WHD
Independence Valley speckled dace	*Rhinichthys osculus lethoporus*	Fish	E	E	Elko	Springs and associated deep pools and shallow marshlands in the Independence Valley in Elko County	AF, CDGS, MCF, OW, O, PJW, RA, SB, VDA
Independence Valley tui chub	*Siphateles bicolor isolata*	Fish	--	E	Elko	Temperate, permanent desert stream and marshes in the Independence Valley	No Data
Moapa dace	*Moapa coriacea*	Fish	E	E	Clark, Nye, White Pine	Spring pools, spring feeders, small outflow streams, and main river channels, usually in warmer waters of the Muddy River	O, VDA
Pahranagat roundtail chub	*Gila robusta jordani*	Fish	E	E	Lincoln	Pahranagat River below the Ash Springs outflow	DA, RA, VDA, WHD
Pahrump poolfish	*Empetrichthys latos latos*	Fish	E	E	Clark, White Pine	Extirpated from all native habitats in Pahrump Valley. Now found only in transplanted populations in Desert National Wildlife Refuge, Shoshone Springs (Ponds), Spring Valley, and at Spring Mountain State Park	CDGS, DA, OW, O, PJW, RA, SB, VDA, WHD

Common Name	Scientific Name	Organism Group	USESA Status*	Nevada Status**	Nevada Counties	Habitat	Major Ecosystems***
Railroad Valley Springfish	*Crenichthys nevadae*	Fish	T	T	Nye, Mineral	Historically occurred in four springs and associated outflows near Lockes Ranch and two springs on the Duckwater Shoshone Indian Reservation	CDGS, DA, O, PJW, RA, SB, VDA, WHD
razorback sucker	*Xyrauchen texanus*	Fish	E	E	Clark	Found in the mainstream of the Colorado River and large tributaries. Habitats include slow areas, backwaters, and eddies	DA, MCF, OW, PJW, RA, VDA, WHD
roundtail chub	*Gila robusta robusta*	Fish	--	E		Throughout the Colorado River basin	No Data
Virgin River chub	*Gila seminuda*	Fish	E	E	Clark	Rocky runs, rapids, and pools, along the Virgin River	DA, OW, RA, VDA, WHD
Warm Springs Amargosa pupfish	*Cyprinodon nevadensis pectoralis*	Fish	E	E	Nye	Found in five low flow thermal springs in Ash Meadows National Wildlife Refuge	RA, WHD
Warner sucker	*Catostomus warnerensis*	Fish	T	P	Washoe	Found in twelvemile creek at the Oregon Border	No Data
White River spinedace	*Lepidomeda albivallis*	Fish	E	E	Nye, White Pine	Highly localized in a small area Pluvial White River System	AF, CDGS, DA, MCF, O, PJW, SB, VDA, WHD
White River springfish	*Crenichthys baileyi baileyi*	Fish	E	E	Lincoln	Ash Springs pool	DA, VDA, WHD
woundfin	*Plagopterus argentissimus*	Fish	E	E	Clark	Main channels in swift, highly turbid, extremely warm, small to medium rivers, with sandy, constantly shifting bottoms (Virgin River and tributaries)	DA, OW, RA, VDA, WHD
Ash Meadows naucorid	*Ambrysus amargosus*	Insect	T	--	Nye	Ash Meadows, rocks in riffle habitats in warm spring outflows	WHD
Carson wandering skipper	*Pseudocopaeodes eunus obscurus*	Insect	E	--	Carson City, Washoe, Douglas	Alkaline soils near hot springs with saltgrass present	DA, MCF, O, SB, VDA
Mt. Charleston blue	*Plebejus shasta charlestonensis*	Insect	E	--	Clark	Known only from two canyons at the northern end of the Spring Mountains	AF, HEF, MCF, PJW, RA, SB, WHD
spotted bat	*Euderma maculatum*	Mammal	--	T	All	Canyons, in the open, over riparian vegetation, over meadows, along forest edges, or in open coniferous woodlands throughout NV	No Data

Common Name	Scientific Name	Organism Group	USESA Status*	Nevada Status**	Nevada Counties	Habitat	Major Ecosystems***
Mojave desert tortoise	*Gopherus agassizii*	Reptile	T	T	Clark, Lincoln, Nye, Esmeralda	Flats and slopes dominated by creosote bush scrub at lower elevations to rocky slopes in blackbrush and juniper woodland ecotones (transition zone) at higher elevations	DA, OW, PJW, RA, SB, VDA, WHD
Amargosa niterwort	*Nitrophila mohavensis*	Plant	E	E	Nye	Open, moist, heavily alkaline and salt-crusted, otherwise nearly barren clay flats in low drainage and seepage areas surrounded by shadscale and saltgrass vegetation	RA, WHD
Ash Meadows blazing star	*Mentzelia leucophylla*	Plant	T	E	Nye	Open, generally dry, hard, salt-crusted alkaline clay or sandy-clay soils on low bluffs, swales, flats, and drainages in shadscale vegetation surrounding spring and seep areas with *Atriplex confertifolia, Haplopappus acradenius, Enceliopsis nudicaulis corrugata, Astragalus phoenix*, etc.	RA, WHD
Ash Meadows gumplant	*Grindelia fraxinopratensis*	Plant	T	E	Nye	Open, flat, whitish, strongly alkaline, moist and hard to sometimes dry and powdery clay soils in or bordering meadows and shallow drainages near springs and seeps, sometimes in disturbed areas and somewhat weedy, in the creosote-bursage and shadscale zones in ash-mesquite woodlands, shadscale scrub, or saltgrass meadows with Prosopis, Fraxinus, *Atriplex confertifolia, Centaurium namophilum, Distichlis spicata, Sporobolus airoides, Baccharis emoryi, Iva acerosa, Tamarix ramosissima, Cirsium mohavense, Suaeda*, etc.	PJW, RA, VDA, WHD
Ash Meadows milkvetch	*Astragalus phoenix*	Plant	T	E	Nye	Dry, hard, seasonally moist, white, barren flats, washes, and knolls of calcareous alkaline soils with Distichlis spicata, *Atriplex confertifolia, Mentzelia leucophylla, Haplopappus acradenius*, and *Enceliopsis nudicaulis* var. *corrugata*.	PJW, RA, WHD

Common Name	Scientific Name	Organism Group	USESA Status*	Nevada Status**	Nevada Counties	Habitat	Major Ecosystems***
Ash Meadows mousetails	*Ivesia kingii* var. *eremica*	Plant	T	E	Nye	Open, moist to saturated, whitish, heavy to chalky alkaline clay soils in meadows on flats, drainages, and bluffs near springs and seeps, in saltgrass meadow, shadscale, and ash-mesquite vegetation with *Atriplex confertifolia, Distichlis spicata, Juncus balticus, Prosopis, Cirsium mohavense, Centaurium namophilum, Fraxinus velutina, Anemopsis californica, Iva acerosa*, etc.	RA, WHD
Ash Meadows sunray	*Enceliopsis nudicaulis* var. *corrugata*	Plant	T	E	Nye	Dry to somewhat moist, open, hard, whitish, strongly alkaline silty to clay soils, often on or near low calcareous outcrops, in spring and seep areas in the creosote-bursage and shadscale zones with *Atriplex confertifolia, Haplopappus acradenius, Distichlis spicata, Gutierrezia sarothrae, Krameria, Cryptantha confertiflora, Arctomecon merriamii, Mentzelia leucophylla, Astragalus phoenix, Ivesia kingii eremica, Grindelia fraxinopratensis*, etc.	PJW, RA, VDA, WHD
Blue Diamond cholla	*Cylindropuntia multigeniculata*	Plant	--	E	Clark	Dry, open carbonate ledges, crevices, and rocky colluvium on gentle to steep slopes of all aspects, but predominantly on northerly exposures, canyon walls, or other cooler or more protected exposures, in close proximity to overlying gypsum beds up-slope, and associated with numerous other succulent and shrub species of the creosote bush, blackbrush and sagebrush vegetation zones	AF, CDGS, DA, HEF, MCF, MOF, O, PJW, RA, SB, VDA
Churchill Narrows buckwheat	*Eriogonum diatomaceum*	Plant	--	E	Lyon	Dry, relatively barren and undisturbed, white to yellowish tan, often gysiferous, clay to silty diatomaceous deposits of the Coal Valley Formation, with a variable volcanic cobble overburden, on rounded knolls, low ridges, slopes, and especially small drainages on all aspects with *Atriplex confertifolia, Stanleya pinnata, Sarcobatus baileyi, Artemisia spinescens, Kochia americana, Tetradymia glabrata*, and other shadscale zone associates	CDGS, O, SB

Common Name	Scientific Name	Organism Group	USESA Status*	Nevada Status**	Nevada Counties	Habitat	Major Ecosystems***
Las Vegas bearpoppy	*Arctomecon californica*	Plant	--	E	Mohave, Clark	Open, dry, spongy or powdery, often dissected ("badland") or hummocked soils with high gypsum content, often with well-developed soil crust, in areas of generally low relief on all aspects and slopes, with a sparse cover of other gypsum-tolerant species surrounded by *Larrea tridentata, Atriplex*, and *Coleogyne ramosissima* associations. On appropriate soil types, will often revegetate disturbances that have been allowed to recover if a soil seedbank remains	DA, PJW, RA, SB, VDA, WHD
Las Vegas catseye	*Cryptantha insolita*	Plant	--	E	Clark	Collection in Las Vegas: light-colored, alkaline clay flats and low hills in the creosote bush zone	DA, MCF, PJW, RA, SB, VDA, WHD
Monte Neva paintbrush	*Castilleja salsuginosa*	Plant	--	E	White Pine, Eureka	Damp, open, alkaline to saline clay soils of hummocks and drainages on travertine hot-spring mounds with *Sarcobatus vermiculatus, Chrysothamnus nauseosus, Sporobolus airoides*, etc.	No Data
obscure scorpionflower	*Phacelia inconspicua*	Plant	--	E	Pershing	Relatively deep, undisturbed, organic-rich soils on fairly steep, concave, N- to NE-facing slopes where snow drifts persist well into spring, on small, otherwise barren soil terraces in small clearings in shrub fields dominated by *Artemisia tridentata* ssp. *vaseyana* in association with *Holodiscus microphyllus, Symphoricarpos rotundifolius*, and *Leymus cinereus*	AF, CDGS, DA, HEF, MCF, O, PJW, RA, SB, VDA
Osgood Mountains milkvetch	*Astragalus yoder-williamsii*	Plant	--	E	Humboldt, Elko	Dry, open, coarse decomposed granodiorite soils among boulders on flats and gentle slopes (recently also found in loose silty soils on a moderate south slope) in healthy sagebrush steppe vegetation with *Artemisia arbuscula, A. tridentata* ssp. *vaseyana, Chrysothamnus nauseosus, Poa secunda var. secunda, Agropyron spicatum, Stipa thurberiana, Stipa comata, Festuca idahoensis, Elymus cinereus*, etc.	CDGS, PJW, SB, VDA
Sodaville milkvetch	*Astragalus lentiginosus* var. *sesquimetralis*	Plant	--	E	Mineral, Nye	Moist, open, alkaline hummocks and drainages near cool springs with *Distichlis*	No Data

Common Name	Scientific Name	Organism Group	USESA Status*	Nevada Status**	Nevada Counties	Habitat	Major Ecosystems***
						spicata, Sarcobatus vermiculatus, Sporobolus airoides, etc.	
spring-loving centaury	*Centaurium namophilum*	Plant	T	E	Nye	Open, moist to wet, alkali-crusted clay soils of seeps, springs, outflow drainages, meadows, and hummocks, with *Distichlis spicata, Pyrrocoma, Juncus balticus, Anemopsis californica, Nitrophila occidentalis, Atriplex, Cordylanthus tecopensis, Fraxinus, Prosopis, Tamarix, Baccharis, Typha, Cirsium, Iva*, etc.	PJW, RA, VDA, WHD
Steamboat buckwheat	*Eriogonum ovalifolium* var. *williamsiae*	Plant	E	E	Washoe	Young, shallow, poorly developed, dry soils derived from siliceous opaline sinter precipitated by past thermal spring flows, but not currently near surface water, in open areas with sparse *Atriplex confertifolia, Sarcobatus vermiculatus, Chrysothamnus nauseosus*, etc. Sometimes found on adjacent deeper and/or disturbed soils when competitive vegetation is lacking	No Data
sticky buckwheat	*Eriogonum viscidulum*	Plant	--	E	Clark, Lincoln	Deep loose sandy soils in washes, flats, roadsides, steep aeolian slopes, and stabilized dune areas, with *Ambrosia dumosa, Larrea tridentata, Pleuraphis rigida, Krameria parvifolia, Achnatherum hymenoides, Tamarix ramosissima, Tessaria sericea, Astragalus geyeri* var. *triquetrus, A. sabulonum, Eriogonum trichopes, Ephedra torreyana, Dicoria canescens, Pediomelum, Croton californicus, Sporobolus cryptandrus, Psorothamnus fremontii, Abronia, Tiquilia*, etc. Can withstand moderate temporary disturbance	RA, VDA, WHD
Sulphur Springs buckwheat	*Eriogonum argophyllum*	Plant	--	E	Elko	Shallow, light-colored, coarse-loamy, evaporite-crusted sandy soils along runoff channels on a hot spring mound, on gentle easterly slopes, with a sparse associated cover of *Senecio canus, Ivesia kingii, Bromus tectorum, Centaurium exaltatum*, and *Ericameria nauseosa*, surrounded by zonal big sagebrush vegetation	No Data

Common Name	Scientific Name	Organism Group	USESA Status*	Nevada Status**	Nevada Counties	Habitat	Major Ecosystems***
Sunnyside green gentian	*Frasera gypsicola*	Plant	--	E	Nye, White Pine	Open, dry, whitish, alkaline, often salt-crusted and spongy silty-clay soils on calcareous flats and barrens, with little if any gypsum content, in cushion-plant associations surrounded by sagebrush, greasewood, and occasionally barberry and swamp cedar (*Juniperus scopulorum*) vegetation, with *Artemisia pygmaea, A. tridentata, Eriogonum shockleyi, Physaria chambersii, Cryptantha welshii, Hymenopappus filifolius, Phlox tumulosa, Lepidium nanum*, etc.	SB, VDA, WHD
Tahoe yellowcress	*Rorippa subumbellata*	Plant	--	E	Douglas, Washoe, Carson City	Coarse sand and sandy soils of active beaches, stream inlets, beach dunes, and backshore depressions, generally within a few feet of the local water table, endemic to the shore zone of Lake Tahoe	No Data
threecorner milkvetch	*Astragalus geyeri* var. *triquetrus*	Plant	--	E	Clark, Lincoln	Open, deep sandy soil or dunes, generally stabilized by vegetation and/or a gravel veneer	DA, RA, VDA, WHD
Ute ladies tresses	*Spiranthes diluvialis*	Plant	T	E	Lincoln, White Pine	Moist to very wet, somewhat alkaline or calcareous native meadows near streams, springs, seeps, lake shores, or in abandoned stream meanders that still retain ample groundwater	No Data
Webber ivesia	*Ivesia webberi*	Plant	T	E	Douglas, Washoe	Shallow shrink-swell clay soils with a gravelly surface layer over volcanic, generally andesitic bedrock, on mid-elevation benches and flats, usually codominating with *Artemisia arbuscula* and *Elymus elymoides* in association with *Antennaria dimorpha, Balsamorhiza hookeri, Erigeron bloomeri, Lewisia rediviva, Viola beckwithii*, etc.	CDGS, DA, MCF, O, PJW, SB, VDA
Williams combleaf	*Polyctenium williamsiae*	Plant	--	E	Washoe, Nye, Douglas, Lyon, Mineral	Relatively barren sandy to sandy-clay or mud margins and bottoms of non-alkaline seasonal lakes perched over volcanic bedrock in the sagebrush, pinyon-juniper, and mountain sagebrush zones, with Carex douglasii, Muhlenbergia *richardsonis, Camissonia tanacetifolia, Iva axillaris, Myosurus minimus, Potentilla newberryi, Psilocarphus*	AF, CDGS, HEF, MCF, O, PJW, RA, SB, VDA, WHD

Common Name	Scientific Name	Organism Group	USESA Status*	Nevada Status**	Nevada Counties	Habitat	Major Ecosystems***
						brevissimus, Downingia sp. , *Eleocharis, Juncus balticus, Artemisia tridentata, A. cana*, etc.	

Appendix H - USFS State and Private Forestry National Priorities and Objectives Applicable to Key Issues and Threats Strategies

This Forest, Range and Watershed Action Plan ensures that the USFS State and Private Forestry National Priorities and Objectives are considered while setting goals and selecting strategies to assist natural resource managers in reaching those goals. The three National Priorities and supporting objectives include:

1. Conserve Working Forest Lands (CWL): conserving and managing working forest landscapes for multiple values and uses

    a. Identify and conserve high priority forest ecosystems and landscapes
    b. Actively and sustainably manage forests

2. Protect Forests from Threats (PFT): protect forests from threats, including catastrophic storms, flooding, insect or disease outbreak, and invasive species

    a. Restore fire-adapted lands and reduce risk of wildfire impacts
    b. Identify, manage and reduce threats to forest and ecosystem health

3. Enhance Public Benefits (EPB) from Trees and Forests: Including air and water quality, soil conservation, biological diversity, carbon storage, and forest products, forestry related jobs, production of renewable energy and wildlife

    a. Assist communities in planning for and reducing wildfire risks
    b. Maintain and enhance the economic benefits and values of trees and forests
    c. Protect, conserve, and enhance wildlife and fish habitat
    d. Connect people to trees and forests and engage them in environmental stewardship activities
    e. Manage and restore trees and forests to mitigate and adapt to global climate change

Below is a table that identifies the intersection of these National Priorities and Objectives with the goals and strategies identified in this plan that are aimed at addressing the eight key issues and threats to Nevada's ecosystems.

USFS STATE AND PRIVATE FORESTRY - NATIONAL PRIORITIES AND OBJECTIVES VS NEVADA FOREST, RANGE AND WATERSHED ACTION PLAN - KEY ISSUES AND STRATEGIES	Priority 1. Conserve working forest lands (CWL): conserving and managing working forest landscapes for multiple values and uses.	A. Identify and conserve high priority forest ecosystems and landscapes.	B. Actively and sustainably manage forests.	Priority 2. Protect forests from threats (PFT): protect forests from threats, including catastrophic storms, flooding, insect or disease outbreak, and invasive species.	A. Restore fire-adapted lands and reduce risk of wildfire impacts.	B. Identify, manage and reduce threats to forest and ecosystem health.	Priority 3. Enhance public benefits (EPB) from trees and forests; including air and water quality, soil conservation, biological diversity, carbon storage, and forest products, forestry related jobs, production of renewable energy and wildlife.	Assist communities in planning for and reducing wildfire risks.	B. Maintain and enhance the economic benefits and values of forests.	C. Protect, conserve, and enhance wildlife and fish habitat.	D. Connect people to trees and forests and engage them in environmental stewardship activities.	E. Manage and restore forests to mitigate and adapt to global climate change.
#1 - Forest and Woodland Health												
Goal 1-1: cooperative management and collaboration to maintain resilient forest in Nevada.												
Strategy 1-1-1: engage the public through collaborative education and media events to increase awareness of linkages between forest health, sustainable community water supplies, and value of intact forest ecosystems to wildlife.	•	•		•		•	•	•	•	•	•	
Strategy 1-1-2: provide more landowner outreach to generate interest and support from communities in watershed and forest health conservation programs, projects, and education programs.	•		•	•		•	•		•	•	•	
Strategy 1-1-3: support and participate in the Nevada and National Cohesive Strategies, Shared Stewardship, Resource Needs Assessments and other Local Work Group efforts to protect forest ecosystems statewide from destructive wildfire and other threats to resilient landscapes	•		•	•	•	•						
Strategy 1-1-4: collaboratively create, find and utilize mutually supported forest and woodland conservation mechanisms that reduce fragmentation and increase landscape scale management.	•	•	•	•		•	•			•		
Goal 1-2: promote pro-active forest management for forest health statewide.												

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Strategy 1-2-1: provide public education and financial assistance to promote implementation of timber stand and woodland improvement projects for mixed conifer and aspen stand health.	•		•	•		•	•	•	•		•	
Strategy 1-2-2: collaboratively seek and find realistic ways to manage pinyon-juniper for ecosystem health and sustainability.	•		•	•		•	•		•			•
Strategy 1-2-3: further develop individual agency prescribed fire programs and encourage collaboration among all levels of government and NGO partners.	•		•	•	•		•			•		•
Strategy 1-2-4: research and develop markets and products that create value for wood and carbon-based by-products of forest and woodland restoration and management treatments.	•		•				•		•		•	•
Goal 1-3: maintain monitoring and management of invasive insects												
Strategy 1-3-1: maintain monitoring for invasive insects and work with cooperating agencies to manage establishment threats in Nevada and apply management techniques at the landscape level.	•	•	•	•		•						
Strategy 1-3-2: adapt monitoring systems, communication protocols, and data management systems as necessary to more accurately inform state-wide forest health assessments and treatment priorities.	•	•		•		•						
Goal 1-4: reduce conversion of forests and woodlands to non-forest and woodland uses.												

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Strategy 1-4-1: identify the areas at greatest risk of conversion, perform public outreach and protect areas to preserve forest and woodland cover types.	•	•		•		•	•			•	•	•
#2 - Wildfire Hazards												
Goal 2-1: collaborate with other fire and natural resource management stakeholders to reduce the size, frequency, intensity, and costs of wildfire impacts in Nevada.												
Strategy 2-1-1: protect existing assets and ecosystems from the destructive impacts of wildfire.				•	•	•	•	•		•		
Strategy 2-1-2: support, participate in, and implement the Nevada and national cohesive strategies.	•	•	•	•	•	•	•	•	•	•	•	•
Strategy 2-1-3: adopt and participate in the shared stewardship strategy for transboundary management of landscapes.	•	•	•	•	•	•	•		•	•	•	•
Strategy 2-1-4: implement interagency fire protection planning and cooperation for all phases of fire management.				•	•	•	•	•				
Goal 2-2: increase public awareness and involvement in proactive wildfire prevention activities.												
Strategy 2-2-1: provide public education and outreach to educate home and landowners in the wildland urban interface (WUI) focused on creating ignition resistant homes and communities.				•	•		•	•			•	

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Strategy 2-2-2: facilitate and support community ownership of wildfire threats and hazards, planning required and implementable mitigation.				•	•	•	•	•			•	
Strategy 2-2-3: collaborate to provide and maintain a statewide coordination and tracking to facilitate fire-adapted communities' Community Wildfire Protection planning, implementation, and maintenance				•		•	•	•			•	
Strategy 2-2-4: collaborate in the delivery of fire prevention activities and events.				•	•		•	•		•	•	•
Strategy 2-2-5: support the design, implementation, and enforcement of standards and codes for building construction and maintenance in the WUI. (IBC/IWUIC)							•	•				
Strategy 2-2-6: collaboratively implement preparedness and pre-fire mitigation actions in WUI communities and wildlands that focus on creating fire adapted communities.							•	•				
Strategy 2-2-7: collaboratively implement pre-fire mitigation actions in wildlands that focus on creating fire resistant and resilient landscapes (e.g. Fuel breaks, targeted, prescribed and outcome-based grazing, etc.).	•		•	•	•	•	•			•	•	•
Goal 2-3: maintain effective suppression capacity and response across all landscapes.												
Strategy 2-3-1: ensure that agency and cooperator personnel are properly trained and qualified for wildland fire suppression and prescribed fire operations.												

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Strategy 2-3-1: ensure that agency and cooperator personnel are properly trained and qualified for wildland fire suppression and prescribed fire operations.				•	•	•						
Strategy 2-3-2: ensure that agency and cooperator personnel are properly equipped for both wildfire suppression and prescribed fire operations.				•	•	•						
Strategy 2-3-3: establish a fully integrated interagency wildland fire communications system.				•	•	•						
Strategy 2-3-4: create an efficient and effective network of protection resources, processes, and agreements enabling sharing of resources between cooperators.				•		•	•	•				
Strategy 2-3-5: support volunteer fire departments and RFPAs capacity to assist with wildfire suppression and management activities state-wide.							•	•				
Strategy 2-3-6: support Interagency Type I, II and III Incident Management Teams with staff, equipment and fiscal support to ensure adequate complex fire management capacity is maintained.				•	•	•						
Goal 2-4: improve collection, reporting, storage and utilization of wildfire related data.												
Strategy 2-4-1: track accomplishments, demonstrate successes and document failure to ensure decision makers can make informed decisions on adjusting strategy and implementing effective actions.	•	•		•		•	•	•			•	

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Strategy 2-4-2: utilize scientifically based risk assessments in prioritization and decision making.	•	•		•	•	•	•	•		•		•
Goal 2-5: prevent and manage exotic species invasions that respond to or drive wildfire risks and threats.												
Strategy 2-5-1: ensure timely rehabilitation and restoration of fire disturbed landscapes, then monitor and report action successes and failures.	•		•	•	•	•	•		•	•		•
Strategy 2-5-2: encourage, support and participate in pre-fire mitigation actions where conditions will result in exotic invasions.	•		•	•	•	•	•	•		•		•
#3 - Urban and Community Forests												
Goal 3-1: develop and maintain strong partnerships with key stakeholders that can contribute to urban and community forest design, establishment, and maintenance.												
Strategy 3-1-1: increase connections and partnerships to collaborate on urban and community forestry program development and implementation.				•		•	•		•		•	
Strategy 3-1-2: continue engagement with the western urban and community forestry network to stay current with emerging issues and maintain peer education opportunities.	•	•		•		•	•		•		•	
Goal 3-2: promote the role of urban and community forestry in human health and wellness.												

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Strategy 3-2-1: expand opportunities and create connections for collaboration with the human health community.							•		•		•	
Strategy 3-2-2: Develop and distribute education and outreach tools to improve and highlight the relationship between improved public health, wellness, and other values supported through urban and community forestry, and green infrastructure.							•		•		•	
Goal 3-3: improve urban and community forest management, maintenance, and stewardship.												
Strategy 3-3-1: support tree workers, arborists, and landscape industry workers through workshop sponsorships and technical instruction.				•		•	•	•	•		•	
Strategy 3-3-2: work with partners in urban and community forestry to develop and encourage engagement with comprehensive programs, policies, and resources for enhancing urban forestry stewardship (e. G. Encourage tree city, campus, line, or campus health care USA recognition)				•		•	•	•			•	•
Strategy 3-3-3: increase the number of ISA certified arborists, ISA certified tree worker climber specialists and ISA certified tree worker aerial lift specialists.				•		•	•				•	•
Strategy 3-3-4: create and distribute tree selection, planting, and tree care resources.							•			•	•	

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Strategy 3-3-5: encourage and participate in local urban and community forestry assessment And management planning efforts.							•			•	•	
Strategy 3-3-6: develop comprehensive, statewide data sets (lidar, multi-spectral imagery) for use by partners for canopy analysis and tree inventories.	•	•		•		•	•	•	•		•	•
Strategy 3-3-7: encourage and support urban and community inventories and i-Tree report production in all communities in Nevada.				•		•	•		•		•	
Goal 3-4: diversify, leverage, and increase funding for urban and community forestry activities.												
Strategy 3-4-1: provide annual briefings to partners and stakeholders on the progress and value of urban and community forestry and opportunities to invest with a purpose.				•		•	•				•	•
Strategy 3-4-2: determine and communicate the value of urban forest products and services to inform decisions and investments in urban and community forests (e. G. I-Tree reports).				•		•	•				•	•
Strategy 3-4-3: develop and connect to urban wood utilization programs for timber products, chipping and biomass.							•		•	•		•

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Strategy 3-4-4: seek additional urban and community forestry program funding through public and private partnerships and connections with related departments or programs and the federal, state and local levels.	•	•		•		•	•			•	•	
Strategy 3-5-5: encourage and support urban and community inventories and i-Tree report production in all communities in Nevada.				•		•	•		•		•	
Goal 3-5: increase public awareness and environmental education to promote urban and community forest stewardship.												
Strategy 3-5-1: strengthen environmental education programs that focus on urban and community forestry through outreach materials highlighting the benefits of trees.				•		•	•			•	•	
Strategy 3-5-2: create and distribute tree selection, planting, and tree care resources.				•		•	•			•	•	
Strategy 3-5-3: increase outreach and educational opportunities for underserved communities to increase urban forestry stewardship.							•		•		•	
#4 Riparian-Wetland Systems												
Goal 4-1: improve the health of wetland plant communities through outreach and education.												

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Strategy 4-1-1: educate landowners about techniques to maintain healthy and functioning watersheds and waterways through the development and dissemination of best management practices for Nevada.	•	•		•		•	•			•	•	
Goal 4-2: implement conservation and preservation practices through partnerships to improve riparian function.												
Strategy 4-2-1: protect and enhance water quality, protect fish and wildlife habitat, maintain habitat connectivity by implementing management and restoration practices.	•		•	•		•	•			•	•	
Strategy 4-2-2: partner with and provide outreach to landowners and land users to promote sustainable land management practices that sustain healthy vegetation communities which are more resilient to problematic erosion and gullying.	•		•	•		•	•			•	•	
Strategy 4-2-3: facilitate public-private partnerships to prioritize and implement management strategies along riparian corridors that cross multiple landownership categories.	•	•	•	•		•	•			•	•	
Goal 4-3: use science-based strategies to improve riparian ecosystem function and expand riparian habitat through active project implementation.												
Strategy 4-3-1: implement strategies to reduce invasive species establishment in riparian corridors and remove existing populations.	•		•	•	•	•	•	•		•		

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Strategy 4-3-2: implement "early detection rapid response" (EDRR) actions, monitoring, and active EDRR education for landowners and communities.	•	•	•	•	•	•	•		•	•	•	
Strategy 4-3-3: reconnect waterbodies with floodplains and implement practices to raise water tables where decreases result from land management practices or environmental degradation.	•		•	•		•	•			•		•
Strategy 4-3-4: re-establish native tree and other vegetation canopies along riparian corridors to restore effective riparian ecosystem functions.	•		•	•		•	•			•		•
Strategy 4-3-5: support improvement of riparian health in urban and community settings.	•	•	•	•		•	•	•	•	•	•	
Strategy 4-3-6: reduce abundance of encroaching conifers in riparian areas to increase groundwater availability along riparian zones and reduce loss of deciduous riparian species.	•		•	•	•	•	•		•	•		•
Goal 4-4: improve the resiliency of riparian systems to wildfires and climate change.												
Strategy 4-4-1: implement wildfire prevention activities in watersheds to sustain watershed functions and avoidance of catastrophic wildfire and post-fire erosion events.	•		•	•	•	•	•	•		•		•

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Strategy 4-4-2: implement post-wildfire soil-stabilization and habitat restoration activities to improve vegetation recovery rates and reduce detrimental impacts to riparian systems.	•		•	•	•	•	•	•		•		•
Strategy 4-4-3: implement riparian health projects utilizing plant materials and techniques relevant for future climate projections.	•	•	•				•			•		•
Strategy 4-4-4: when possible, continue monitoring and reporting on riparian improvement efforts following established protocols and collaborate with partners to allow further evaluation of changes in vegetation communities resulting from a changing climate.	•	•					•			•	•	•
#5 - Sagebrush Ecosystems												
Goal 5-1: improve wildfire suppression response and effectiveness within sagebrush ecosystems.												
Strategy 5-1-1: continue and enhance efforts to suppress wildfire (e. g. Collectively identify and fill geographic gaps in suppression capacity).	•		•	•	•	•	•			•		•
Strategy 5-1-2: implement wildfire prevention and fuel reduction techniques in key locations to protect intact sagebrush ecosystems and areas with restoration treatment investments.	•	•	•	•	•	•	•	•	•	•		•
Goal 5-2: improve sagebrush ecosystems by increasing site resistance and resilience.												

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Strategy 5-2-1: maximize the implementation of restoration, rehabilitation and management projects that preserve and improve the resistance and resilience of sagebrush ecosystem lands.	•		•	•	•	•	•			•		
Strategy 5-2-2: educate landowners and land managers on the availability of opportunities for assistance through federal, state and NGO supported programs.	•		•	•		•	•	•	•		•	
Goal 5-3: educate the public as well as decision and policy makers on the importance and value of sagebrush ecosystems, the importance of successful pre-suppression and restoration actions, the wildfire-cheatgrass cycle, wildfire prevention, wildfire in general, and the need to find a reasonable pathway for wild horse populations to be reduced and maintained at Appropriate Management Levels (AML)												
Strategy 5-3-1: create unified messages and educational materials about these subjects in various distributable, consumable and understandable formats.				•		•	•	•			•	
Strategy 5-3-2: distribute, inform and educate the public and public officials using unified educational materials and messages produced.				•		•	•	•	•		•	
#6 - Species Requiring Specialized Conservation												
Goal 6-1: preserve Nevada's native plant and wildlife biodiversity and preclude legal protective species listings through effective stewardship of rare and unique populations and habitats.												
Strategy 6-1-1: ensure land management and project implementation plans consider and mitigate impacts to rare and listed species.	•	•										

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Strategy 6-1-2: seek to conserve lands with important habitats through promoting conservation easements and other natural resource protection measures.	•	•					•			•	•	
Strategy 6-1-3: support the Nevada conservation credit system that facilitates the exchange of debits and credits between entities that impact sagebrush ecosystems and entities that manage and conserve those habitats.	•	•	•	•	•	•	•			•	•	
Strategy 6-1-4: produce and distribute plant materials for critical habitat restoration projects.	•		•				•			•	•	
Strategy 6-1-5: develop and update species status reports and use them to educate the public and public officials about species at risk.				•		•	•			•	•	
Strategy 6-1-6: conduct adequate amounts of surveys, studies and research focused on increasing knowledge of the natural history, distribution and habitat requirements of species at-risk.	•	•					•			•		
Strategy 6-1-7: provide environmental review of proposed development projects within critical habitats and provide technical review of research proposals to further knowledge of at-risk species.	•	•					•					
Strategy 6-1-8: proactively review necessity of adding at risk species to the state list of fully protected species.	•	•					•					

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#7 - Water Quality and Quantity												
Goal 7-1: protect water quality and quantity in urban and community environments.												
Strategy 7-1-1: ensure urban and community environments have adequate green infrastructure water quality and quantity conservation practices implemented.	•	•	•				•			•		
Strategy 7-1-2: use of water efficient landscapes occupied by low water use vegetation.	•	•	•				•				•	
Goal 7-2: maintain Nevada's watersheds by performing necessary management that builds ecosystem community resistance and resilience and soil stability in the inevitable occurrence of disturbances (e. G. Wildfire, drought, insects and diseases, etc.)												
Strategy 7-2-1: collaborate with the nonpoint source water pollution management program, source water protection program, and local source water protection teams to identify priority areas, create plans, and implement protection strategies.	•	•		•	•	•	•	•	•	•	•	
Strategy 7-2-2: implement proactive watershed management practices that maintain adequate vegetative cover, reduce soil erosion, and fuel loading conducive to reducing non-point source pollutants.	•	•	•	•	•	•	•	•	•	•		•
Strategy 7-2-3: restore rivers, streams and other riparian area, flood plains and wetlands to proper functioning condition to increase groundwater recharge, reduce sedimentation of water supplies, and increase seasonal water flows.	•	•	•	•	•	•	•			•		

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Strategy 7-2-4: rehabilitation of wildland fire-impacted and abandoned agricultural lands to stabilize soils that will decrease erosion and sedimentation in riparian and wetlands areas.	•	•	•	•	•	•	•			•		
Goal 7-3: increase agricultural water use efficiency and runoff or tail water quality.												
Strategy 7-3-1: create riparian buffers along agricultural fields and other working lands to trap sediments and filter pollutants.	•	•	•	•		•	•			•		•
Strategy 7-3-2: increase irrigation efficiency to conserve water supplies and reduce agricultural return flows that decrease water pollution.	•	•	•	•		•	•			•		•
Goal 7-4: create and distribute a unified message and education to the public and public officials about the importance of watershed protection and water resource conservation.												
Strategy 7-4-1: increase wildland fire prevention education and messaging to reduce the number of human caused wildland fires.				•		•	•	•			•	•
Strategy 7-4-2: increase water resource conservation education and messaging to increase water use efficiency and decrease impacts to water quality.				•		•	•	•			•	•
#8 - Climate Change Mitigation												
Goal 8-1: increase carbon sink and sequestration activities associated with wildland fire and natural resource management practices (e. G. Rehabilitation, restoration etc.).												

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Strategy 8-1-1: use appropriate plant species for restoration and rehabilitation projects and scale up markets, businesses and facilities that produce the required plant materials.	•		•	•	•		•					•
Strategy 8-1-2: enhancing water use efficiency of plants growing through appropriate land management practices.	•	•	•				•					•
Strategy 8-1-3: restore, rehabilitate and manage soils to control erosion and increase soil quality.	•		•	•		•	•					•
Strategy 8-1-4: harvest and utilize forest and rangeland biomass products (including urban and community forests, for producing items or supporting practices that store carbon (e. G. Construction materials, biochar, etc.).	•		•				•					•
Strategy 8-1-5: maintain or increase the extent of forest and/or woodland ecosystems, including urban and community forests, to protect existing carbon stocks.	•	•	•	•	•	•	•					•
Strategy 8-1-6: promote, support, and increase urban reforestation and management.							•		•		•	•
Goal 8-2: reduce greenhouse gas emission from land use and management activities while preserving ecological processes.												
Strategy 8-2-1: prevent wildfires from occurring more frequently and severely than ecosystem norms.				•	•	•	•					•

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Strategy 8-2-2: increase the use of fire surrogates for land management.	•		•				•	•		•	•	•
Goal 8-3: facilitate the creation and participate in a carbon market and incentivize participation in existing programs that support carbon management as part of their objectives and outcomes.												
Strategy 8-3-1: provide an inventory of the emissions from ecological processes under various land management scenarios.							•					•
Strategy 8-3-2: provide an inventory of carbon sinks.							•					•
Strategy 8-3-3: provide incentives for partners and cooperators engaging in programs that result in marketable carbon, carbon sequestration or less carbon emissions.							•					•
Goal 8-4: create and distribute technical and educational materials to inform policy development, management decisions, and the public.												
Strategy 8-4-1: scale down climate change predictive models to determine regional trends and impacts in the state.	•	•		•		•	•					•
Strategy 8-4-2: create climate change susceptibility models to inform land user and manager decisions and actions.	•	•		•		•	•					•
Strategy 8-4-3: create and make a comprehensive menu of climate change mitigation tools and techniques available for natural resource, land, and fire managers.	•		•	•		•	•					•

Appendix I - Multi-State Priority Landscapes

Nevada Division of Forestry is coordinating with neighboring states to obtain and incorporate their priority landscape designations for inclusion in this reference. States independently develop, refine and update their priority landscapes as needed; therefore, the contents of this appendix reflect the current state and status of Nevada's and its adjoining neighbor State's current priority landscapes as they have been published and shared.

Figure 1 shows the multi-state priority landscapes for all surrounding states. Table 1 lists the key characteristics and concerns that were used by the neighboring states to select those priority areas, as well as their association with Nevada's adjoining priority landscapes.

For more information on state priority landscapes, please visit:
stateforesters.org/forest-action-plans/

Table 1. Multi-State priority landscapes and their key characteristics and concerns.

Nevada Priority Landscape Map Number / Name*	Adjoining State(s)	Priority Landscape Key Characteristics and Concerns
4 – Lake Tahoe Basin	California	Reducing wildfire risk to forest ecosystem services, Reducing wildfire threats to communities.
6 – Meadow Valley Wash	Utah	Existing-to-high stewardship potential, including all forested and woody wetland areas located on private lands.
7 – Moapa-Mead-Virgin	Arizona, Utah	Climate change focus area, Water focus area, Fire focus area, Economic focus area, People and landscape focus area, Existing-to-high stewardship potential, including all forested and woody wetland areas located on private lands.
10 – North Washoe-Sheldon	California, Oregon	Reducing wildfire risk to forest ecosystem services, Restoring forest ecosystem services damaged by wildfire, Forestland priority landscapes, Forestlands vulnerable to losing timber markets, Fish and wildlife habitat conservation areas, Communities at risk to wildfire.
11 – Northeast Elko	Idaho, Utah	Fire risk, Forest Health, Development, Forest products and economics, Water quality/quantity, Air quality, Wildfire and biodiversity, Existing-to-high stewardship potential, including all forested and woody wetland areas located on private lands.

Nevada Priority Landscape Map Number / Name*	Adjoining State(s)	Priority Landscape Key Characteristics and Concerns
12 – Owyhee-Bruneau-Jarbidge	Idaho	Fire risk, Forest Health, Development, Forest products and economics, Water quality/quantity, Air quality, Wildfire and biodiversity.
14 – Piute-Eldorado	Arizona	Climate change focus area, Water focus area, Fire focus area, Economic focus area, People and landscape focus area.
17 – Sierra Front-Pyramid-Pine Nuts	California	Reducing wildfire risk to forest ecosystem services, Reducing wildfire threats to communities, Restoring pest and drought damaged areas, Restoring forest ecosystem services damaged by wildfire.
19 – Walker	California	Reducing wildfire risk to forest ecosystem services, Reducing wildfire threats to communities, Restoring pest and drought damaged areas, Restoring forest ecosystem services damaged by wildfire.
20 – White-Silver Peak	California	Restoring pest and drought damaged areas.
21 – Wilson Snake	Utah	Existing-to-high stewardship potential, including all forested and woody wetland areas located on private lands.

** The Nevada priority landscape area numbers/names are in reference to the priority landscapes depicted in figure 47. To review Nevada's priority landscape area descriptions, please see the section titled "Priority Landscape Areas Needing Management" in Nevada or select the area names in table 1 above.*

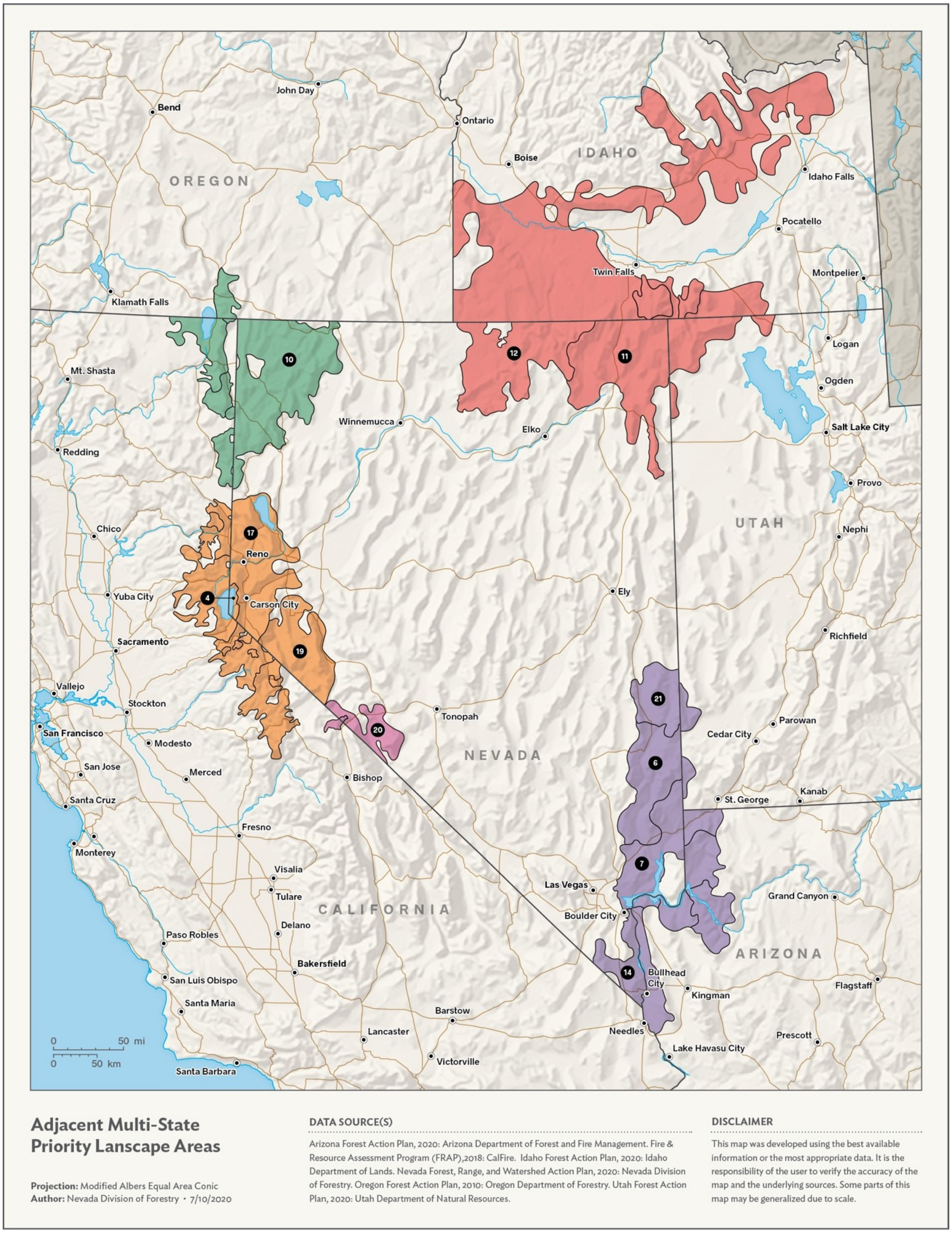

Figure 1. Map of multi-state priority landscape areas adjacent to Nevada's priority areas.

Appendix J – A Guide for Collaborative Natural Resources Management

Natural resource management inherently involves overlapping and competing interests, threats, cultures, experiences, knowledge, and jurisdictional responsibilities requiring natural resource users, managers and regulators combine their efforts to address issues collectively to be effective in achieving their goals and solving problems.

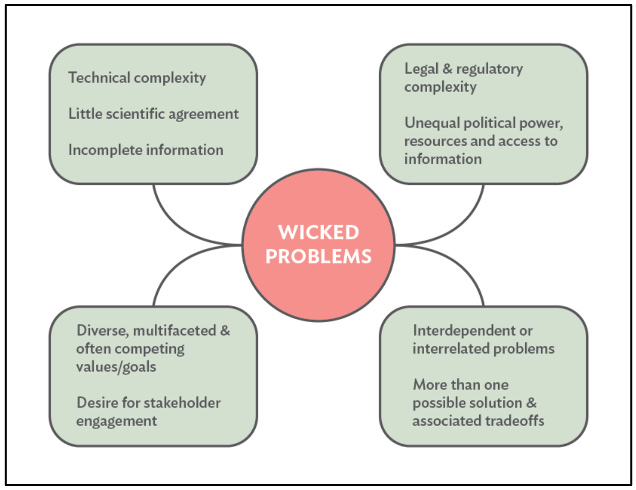

Figure 1. Factors associated with controversial or highly politicized (wicked) problems are extremely difficult to impossible to solve with a collaborative approach (Van Riper 2020).

Collaborative problem solving is effective when the right people are brought together to be constructive with access to good information. While science helps inform these decisions by speaking to the level of uncertainty, tradeoffs, benefits, risks and costs associated with different options, science alone cannot determine what is socially, politically or economically feasible or valued. With these values, groups pursuing collaborative natural resource management have developed a reciprocal understanding, shared knowledge, and mutual trust to collectively produce better outcomes. Ultimately, human capital (skills, knowledge and experiences), social capital (relationships) and mobilization of resources (labor, funding, materials, skills, and knowledge) may result in collective actions that have created significant natural resource management advancements at large scales. To create impactful actions, collaborators pay close attention to scale and the nature of the challenges so that they match capabilities and resources of the group to the size and specific subject matter of the challenges. Impactful successes such as increases in capacity, synergistic solutions, common visions, collective action, and sustainable solutions are more limited when collaborative efforts lack the appropriate participation, processes, and facilitation in place (Van Riper 2020).

Participation

When assembling a collaborative group, it is important to invite decision makers and people who generally could be considered "doers". Champions participating can also help motivate and inspire the group to stay committed and feel productive as collaborative processes move slower than single entity problem solving and project development. Basically, the goal is to create networks (relationships) across all levels of various agencies and partner organizations at the appropriate scale. When thinking about 'linkages,' or critical participants, it's important to consider those who are needed to contribute to or advance a collaborative effort, as well as those who can sabotage it. It is also important to consider the scale at which issues can be addressed. In some instances, key decision makers and partners extend to the level of a field office, while others may be more regional or national in scope (Van Riper 2020).

Process and Frequency

If the issue addressed is both information and value-based (as most natural resource issues are) then the successful negotiation and resolution requires ongoing dialogue and deliberation between scientific, regulatory experts, and stakeholders who not only use technically correct information, but also engage in processes that address the human and social dimensions of resource issues. When this type of dialogue and deliberation is not an 'event' but rather a continuous activity, it can build trust and legitimacy for public action and decisions by building familiarity with the issues, the diversity of viewpoints, and the complexity of social and ecological systems involved. The key here is having ongoing engagement, so that relationships, trust and common understanding is built before there is a crisis. As this process matures, the general conditions move from low agreement on values and information gaps toward high agreement on values and well-developed information and knowledge. The process generally becomes natural to the extent that it is regularly engaged, with positive participation, and participants view, believe and act with trust and relationships as the foundation of any business conducted by the group.

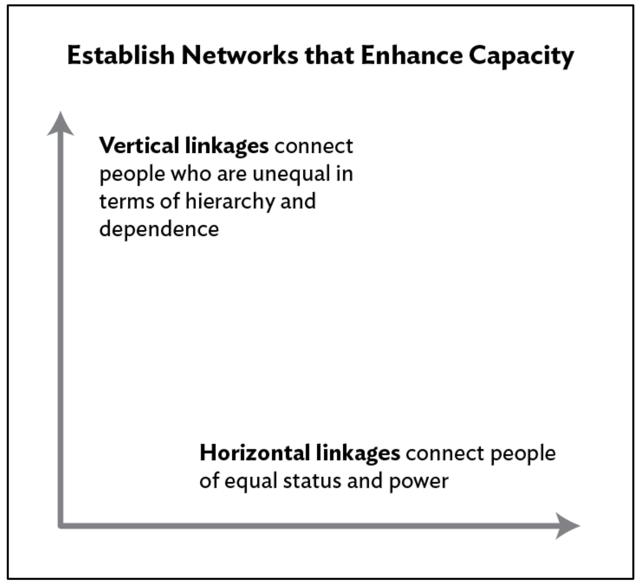

Figure 2. Designing and implementing arrangement where proper relationships between horizontal and vertical networks are present can enhance our capacity for collective action. Vertical linkages connect people who are unequal in terms of hierarchy and dependence, while horizontal linkages bring together people of equivalent status and power (Van Riper 2020).

Trust and relationships are born from open, honest, transparent, respectful communication and reinforced by things like understanding, benevolence, reliability, credibility and competence. Creating this safe atmosphere encourages participants to jointly find facts, to learn, and to build a common understanding of faceted challenges. This is critical when it comes to trying to create and develop mutually beneficial and implementable solutions. The process provides different ways to for people to get what they want, while also giving others what they want. This type of interest-based negotiation is the basis for most collaborative and consensus-based processes because it provides more room for a win-win versus win-lose outcome. The process requires the investment of people listening to and learning from each other to gain a new and richer perspective or understanding of the situation; individually and collectively articulating their values and priorities (interests v positions); seeing how different decisions and options affect others; identifying challenges to fulfilling those priorities; and developing possibilities and solutions to address those challenges that were hidden before. The returns on investment are shared visions and synergistic solutions that were often times impossible to achieve without going through a collaborative process and solutions derived outside of the process are often less sustainable than those that are derived in a collaborative environment (Van Riper 2020).

Most of today's natural resource managers have had some experience with collaboration, though few have been offered or required to attend skill-building trainings (e. g. peer-to-peer learning, immersion, mentoring, internships, professional trainings, workshops, webinars, etc.) that would lead to successful outcomes as a facilitator, leader, or primary participant of a collaborative effort. Six skills needed to effectively participate are: 1) listening and communicating, 2) interpersonal relationship management, 3) facilitating and decision making, 4) understanding other's interests, 5) collaboration 101 (process), and 6) leadership. Three tools needed for successful collaborations addressing natural resource needs are: 1) financing and fundraising, 2) legal, regulation and policy information, and 3) non-profit and executive director 101 courses or experience (CCC 2017).

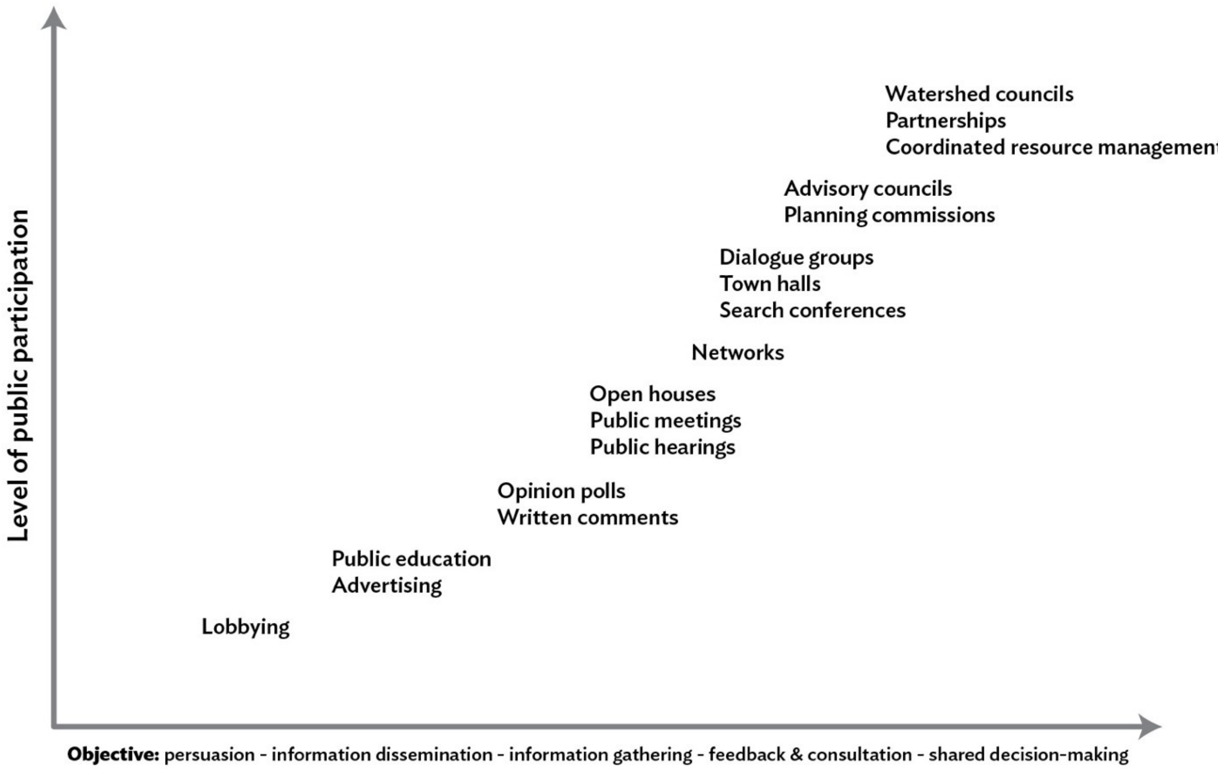

Figure 3. Collaboration on the ladder of public participation. Activities that would commonly be considered collaborative have high levels of participation and encourage information exchange and learning among participants. These include most networks, dialogue groups, advisory councils, partnerships, and watershed councils (NAU 2008).

Facilitation

One of the frequently noted reasons why collaborative efforts fail is due to a lack of focus on process or process management. Although distinctions can be made between different types of collaborative efforts, they do share several common characteristics in so far as they are multi-party, participatory processes designed to facilitate communication, establish trust, build relationships, express concerns, exchange knowledge, foster social learning, develop common understanding, establish shared vision or goals, encourage creative problem solving, and leverage resources. This person also typically shepherds the group to maintain momentum and promote accountability, they engage in shuttle diplomacy between parties as needed, and coordinate logistics. In some instances, usually when you have a controversial situation marked by a history of bad relationships and low trust among parties, it is often necessary to have a trained and neutral facilitator or conflict resolution specialist. In other instances, a partnership convener's vision itself and their history as a community champion may be a key part of what keeps people working together (Van Riper 2020).

Costs and Investments

While many collaborative resource management efforts have resulted in tangible products that are expected to improve resource conditions, collaboration also has very real costs in terms of participants' time and energy, which frequently results in frustration and burnout among collaborative group participants. These costs, which sociologists refer to as transaction costs, reflect the challenges inherent to building and maintaining communication among several different organizations, individuals and interests, and the unpredictability of collaborative process. Other costs of collaboration occasionally reported include a tendency to focus on the easiest problems first, increased conflict, and increased economic costs (NAU 2008).

The broad variables that have been highly associated with success or failure of collaborative resource management are 1) adequate resources (particularly funding), 2) a common purpose, 3) recognized authority, 4) stakeholder's ability and willingness to work together, and 5) a fair and effective process. Adequate, consistent funding to support operations, usually including paid staff, is almost always linked to successful collaboration. In addition to money and staffing, adequate time is a critical ingredient because collaborative groups rarely achieve measurable outcomes during their first three years, suggesting that it is unrealistic to expect measurable outcomes any sooner. Participants' time and patience are also important factors influencing success (NAU 2008).

Appendix K – Tree and Shrub Lists for Nevada's Urban and Community Forest Areas

Northeastern Nevada
Suggested Tree Species for Northeastern Nevada
http://forestry.nv.gov/wp-content/uploads/2009/03/suggested-northeastern-nv-trees1.pdf

Suggested Shrub Species for Northeast Nevada
http://forestry.nv.gov/wp-content/uploads/2009/03/suggested-northeastern-nv-shrubs1.pdf

Boron and Salt Tolerant Trees and Shrubs for Northern Nevada
https://wrcc.dri.edu/washoeEt/docs/Tolerant_Trees-NV.pdf

Southern Nevada
Southern Nevada Guide – Tree Selection and Care
http://www.lvsnag.org/pdf/trees.pdf

Southern Nevada Regional Planning Coalition – Regional Plant List
http://www.lvsnag.org/pdf/SNRPCRegionalPlantList063011.pdf

Plant Characteristics Plant List – Las Vegas Area
http://forestry.nv.gov/wp-content/uploads/2019/07/Plant-Characteristics-LV.pdf

Cleaner Air, Tree by Tree – A Best Management Practices Guide for Urban Trees in Southern Nevada
http://forestry.nv.gov/wp-content/uploads/2009/03/ndf_bmp_guide07_.pdf

Northwestern Nevada
Reno Urban Forestry Commission Approved Street Tree Species List
https://www.reno.gov/home/showdocument?id=28407

Plant Characteristics list for species produced by the State Conservation Nurseries
http://forestry.nv.gov/wp-content/uploads/2018/03/Characteristics-2018.pdf

Truckee Meadows Community Forestry Coalition Recommended List of Trees
http://communityforestry.org/wp-content/uploads/2010/12/tmcfc_tree_list_final.pdf

Home Landscaping Guide for Lake Tahoe and Vicinity
https://tahoercd.org/wp-content/uploads/2016/02/LandscapingGuide.pdf

Statewide Information

Resources for Growing Plants in Nevada

http://forestry.nv.gov/ndf-state-forest-nurseries/planting-information-resources/Appendix L - Crosswalk of NDF Forest, Range and Watershed Action Plan Ecosystems to NDOW Key Habitats and NatureServe Ecological Systems of Nevada

Appendix L - Crosswalk of NDF Forest, Range and Watershed Action Plan Ecosystems to NDOW Key Habitats and NatureServe Ecological Systems of Nevada

NDF FRWAP Ecosystem	Ecological System	NDOW Key Habitat
High Elevation Forests	Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland	Intermountain conifer forests and woodlands
High Elevation Forests	Mediterranean California Subalpine Woodland	undefined
High Elevation Forests	Northern California Mesic Subalpine Woodland	undefined
High Elevation Forests	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	Intermountain conifer forests and woodlands
High Elevation Forests	Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	Intermountain conifer forests and woodlands
High Elevation Forests	Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland	Intermountain conifer forests and woodlands
Mixed Conifer Forests	California Montane Jeffrey Pine - (Ponderosa Pine) Woodland	Sierra conifer forests and woodlands
Mixed Conifer Forests	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	Sierra conifer forests and woodlands
Mixed Conifer Forests	Mediterranean California Mesic Mixed Conifer Forest and Woodland	undefined
Mixed Conifer Forests	Mediterranean California Red Fir Forest	Sierra conifer forests and woodlands
Mixed Conifer Forests	Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	undefined
Mixed Conifer Forests	Rocky Mountain Lodgepole Pine Forest	undefined
Mixed Conifer Forests	Rocky Mountain Poor-Site Lodgepole Pine Forest	undefined
Mixed Conifer Forests	Sierra Nevada Subalpine Lodgepole Pine Forest and Woodland	Sierra conifer forests and woodlands
Mixed Conifer Forests	Sierran-Intermontane Desert Western White Pine-White Fir Woodland	undefined

NDF FRWAP Ecosystem	Ecological System	NDOW Key Habitat
Mixed Conifer Forests	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	undefined
Mixed Conifer Forests	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	undefined
Mixed Conifer Forests	Southern Rocky Mountain Ponderosa Pine Savanna	undefined
Mixed Conifer Forests	Southern Rocky Mountain Ponderosa Pine Woodland	undefined
Other Cold Desert Shrublands and Grasslands	Columbia Plateau Scabland Shrubland	undefined
Other Cold Desert Shrublands and Grasslands	Columbia Plateau Steppe and Grassland	undefined
Other Cold Desert Shrublands and Grasslands	Great Basin Semi-Desert Chaparral	Lower montane chaparral
Other Cold Desert Shrublands and Grasslands	Inter-Mountain Basins Greasewood Flat	Intermountain (cold desert) scrub
Other Cold Desert Shrublands and Grasslands	Inter-Mountain Basins Mixed Salt Desert Scrub	undefined
Other Cold Desert Shrublands and Grasslands	Inter-Mountain Basins Semi-Desert Grassland	Grasslands and meadows
Other Cold Desert Shrublands and Grasslands	Inter-Mountain Basins Semi-Desert Shrub-Steppe	Intermountain (cold desert) scrub
Other Cold Desert Shrublands and Grasslands	Inter-Mountain Basins Wash	Intermountain (cold desert) scrub, Mesquite bosques and desert washes
Other Cold Desert Shrublands and Grasslands	Mediterranean California Alpine Bedrock and Scree	Alpine and tundra
Other Cold Desert Shrublands and Grasslands	Mediterranean California Alpine Dry Tundra	undefined
Other Cold Desert Shrublands and Grasslands	Mediterranean California Alpine Fell-Field	undefined
Other Cold Desert Shrublands and Grasslands	Mediterranean California Subalpine Meadow	undefined
Other Cold Desert Shrublands and Grasslands	North Pacific Montane Grassland	Grasslands and meadows

NDF FRWAP Ecosystem	Ecological System	NDOW Key Habitat
Other Cold Desert Shrublands and Grasslands	Rocky Mountain Alpine Bedrock and Scree	Alpine and tundra
Other Cold Desert Shrublands and Grasslands	Rocky Mountain Alpine Dwarf-Shrubland	undefined
Other Cold Desert Shrublands and Grasslands	Rocky Mountain Alpine Fell-Field	undefined
Other Cold Desert Shrublands and Grasslands	Rocky Mountain Alpine Turf	undefined
Other Cold Desert Shrublands and Grasslands	Rocky Mountain Lower Montane-Foothill Shrubland	undefined
Other Cold Desert Shrublands and Grasslands	Rocky Mountain Subalpine-Montane Mesic Meadow	Grasslands and meadows
Other Cold Desert Shrublands and Grasslands	Sierra Nevada Alpine Dwarf-Shrubland	undefined
Other Cold Desert Shrublands and Grasslands/Warm and Hot Deserts	Inter-Mountain Basins Shale Badland	undefined
Pinyon-Juniper Woodlands	Columbia Plateau Western Juniper Woodland and Savanna	undefined
Pinyon-Juniper Woodlands	Great Basin Pinyon-Juniper Woodland	Lower montane woodlands
Pinyon-Juniper Woodlands	Inter-Mountain Basins Curl-leaf Mountain-mahogany Woodland and Shrubland	Lower montane woodlands
Pinyon-Juniper Woodlands	Inter-Mountain Basins Juniper Savanna	Lower montane woodlands
Quaking Aspen	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	Aspen woodland
Quaking Aspen	Rocky Mountain Aspen Forest and Woodland	Aspen woodland
Riparian and Wetland Ecosystems	Columbia Basin Foothill Riparian Woodland and Shrubland	undefined
Riparian and Wetland Ecosystems	Columbia Plateau Silver Sagebrush Seasonally Flooded Shrub-Steppe	undefined
Riparian and Wetland Ecosystems	Columbia Plateau Vernal Pool	undefined

NDF FRWAP Ecosystem	Ecological System	NDOW Key Habitat
Riparian and Wetland Ecosystems	Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	Intermountain rivers and streams
Riparian and Wetland Ecosystems	Inter-Mountain Basins Alkaline Closed Depression	undefined
Riparian and Wetland Ecosystems	Inter-Mountain Basins Interdunal Swale Wetland	undefined
Riparian and Wetland Ecosystems	Inter-Mountain Basins Playa	Desert playas & ephemeral pools
Riparian and Wetland Ecosystems	Mediterranean California Subalpine-Montane Fen	Wet Meadows
Riparian and Wetland Ecosystems	North American Arid West Emergent Marsh	Marshes
Riparian and Wetland Ecosystems	North American Warm Desert Cienega	undefined
Riparian and Wetland Ecosystems	North American Warm Desert Lower Montane Riparian Woodland and Shrubland	Mojave rivers and streams
Riparian and Wetland Ecosystems	North American Warm Desert Riparian Mesquite Bosque	Mesquite bosques and desert washes
Riparian and Wetland Ecosystems	North American Warm Desert Riparian Woodland and Shrubland	Mojave rivers and streams
Riparian and Wetland Ecosystems	Rocky Mountain Alpine-Montane Wet Meadow	Wet Meadows
Riparian and Wetland Ecosystems	Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland	Intermountain rivers and streams
Riparian and Wetland Ecosystems	Rocky Mountain Subalpine-Montane Fen	undefined
Riparian and Wetland Ecosystems	Rocky Mountain Subalpine-Montane Riparian Shrubland	undefined
Riparian and Wetland Ecosystems	Rocky Mountain Subalpine-Montane Riparian Woodland	undefined
Riparian and Wetland Ecosystems	Temperate Pacific Subalpine-Montane Wet Meadow	Wet Meadows
Sagebrush Ecosystems	Columbia Plateau Ash and Tuff Badland	undefined

NDF FRWAP Ecosystem	Ecological System	NDOW Key Habitat
Sagebrush Ecosystems	Columbia Plateau Low Sagebrush Steppe	undefined
Sagebrush Ecosystems	Great Basin Xeric Mixed Sagebrush Shrubland	Sagebrush
Sagebrush Ecosystems	Inter-Mountain Basins Big Sagebrush Shrubland	Sagebrush
Sagebrush Ecosystems	Inter-Mountain Basins Big Sagebrush Steppe	Sagebrush
Sagebrush Ecosystems	Inter-Mountain Basins Montane Sagebrush Steppe	Sagebrush
Warm and Hot Deserts	Inter-Mountain Basins Active and Stabilized Dune	Sand dunes and badlands
Warm and Hot Deserts	Inter-Mountain Basins Cliff and Canyon	Cliffs and Canyon
Warm and Hot Deserts	Inter-Mountain Basins Volcanic Rock and Cinder Land	undefined
Warm and Hot Deserts	Mogollon Chaparral	Lower montane chaparral
Warm and Hot Deserts	Mojave Mid-Elevation Mixed Desert Scrub	Intermountain (cold desert) scrub, Mojave mid-elevation mixed desert scrub, and Mojave/Sonoran (warm desert) scrub
Warm and Hot Deserts	North American Warm Desert Active and Stabilized Dune	Sand dunes and badlands
Warm and Hot Deserts	North American Warm Desert Bedrock Cliff and Outcrop	Cliffs and Canyon
Warm and Hot Deserts	North American Warm Desert Pavement	Sand dunes and badlands
Warm and Hot Deserts	North American Warm Desert Playa	Desert playas & ephemeral pools
Warm and Hot Deserts	North American Warm Desert Volcanic Rockland	Cliffs and Canyon
Warm and Hot Deserts	North American Warm Desert Wash	undefined
Warm and Hot Deserts	Sierra Nevada Cliff and Canyon	Cliffs and Canyon

NDF FRWAP Ecosystem	Ecological System	NDOW Key Habitat
Warm and Hot Deserts	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Mojave/Sonoran (warm desert) scrub
Warm and Hot Deserts	Sonora-Mojave Mixed Salt Desert Scrub	Mojave/Sonoran (warm desert) scrub
Warm and Hot Deserts	Sonora-Mojave Semi-Desert Chaparral	Mojave/Sonoran (warm desert) scrub
Warm and Hot Deserts	Sonoran Fan Palm Oasis	undefined
Warm and Hot Deserts	Sonoran Granite Outcrop Desert Scrub	undefined
Warm and Hot Deserts	Sonoran Paloverde-Mixed Cacti Desert Scrub	undefined

Appendix M – USFS Statewide Forest Resource Assessments and Strategies (State Forest Action Plans) Requirements Checklist Contents Reference

US Forest Service Checklist Items as outlined in the Cooperative Forestry Assistance Act SEC. 2A. [16 U.S.C. 2101a] (amended by the 2008 and 2014 Farm Bills).	Bookmarked location within the 2020 Nevada Forest, Range and Watershed Action Plan.
Statewide Forest Resource Assessment Includes:	
The conditions and trends of forest resources in the state	• Assessment of Nevada's Forest, Rangelands and Watersheds
The threats to forest lands and resources in the state consistent with national priorities	• Key Issues, Threats and Strategies for Managing Nevada's Forests, Rangelands and Watersheds • Appendix H - USFS State and Private Forestry National Priorities and Objectives Applicable to Key Issues and Threats Strategies
Areas or regions of the state that are a priority	• Priority Landscape Areas Needing Management in Nevada
Any multi-state areas that are a regional priority	• Appendix I - Multi-State Priority Landscapes
Statewide Forest Resource Strategy Includes:	
Long-term strategies to address threats to forest resources in the state	• Key Issues, Threats and Strategies for Managing Nevada's Forests, Rangelands and Watersheds
Description of resources necessary for state forester to address statewide strategy	• Implementation of this Forest, Range, and Watershed Action Plan
Strategy addresses national priorities for state and private forestry	• Appendix H - USFS State and Private Forestry National Priorities and Objectives Applicable to Key Issues and Threats Strategies
Stakeholder Groups Coordinated with for the Statewide Assessment and Strategy:	

US Forest Service Checklist Items as outlined in the Cooperative Forestry Assistance Act SEC. 2A. [16 U.S.C. 2101a] (amended by the 2008 and 2014 Farm Bills).	Bookmarked location within the 2020 Nevada Forest, Range and Watershed Action Plan.
State Forest Stewardship Coordinating Committee (required)	• Appendix E – Stakeholder Scoping and Engagement – Occurred via email on 3/5/2020, Regularly Scheduled NDF Advisory Committee Meeting on 4/30/2020, and email again on 6/8/2020
State Wildlife Agency (required)	• Appendix E – Stakeholder Scoping and Engagement – Occurred via email on 3/5/2020, NRCS State Technical Advisory Committee Meeting on 3/27/2020, Regularly Scheduled NDF Advisory Committee Meeting on 4/30/2020, and email again on 6/8/2020
State Technical Committee (required)	• Appendix E – Stakeholder Scoping and Engagement – Occurred via email on 3/5/2020, NRCS State Technical Advisory Committee Meeting on 3/27/2020, Regularly Scheduled NDF Advisory Committee Meeting on 4/30/2020, and email again on 6/8/2020
Lead agency for the Forest Legacy Program (if not the state forestry agency) (required)	• N/A: NDF is the lead for the Forest Legacy Program
Applicable Federal land management agencies (required)	• Appendix E – Stakeholder Scoping and Engagement – Occurred via email on 3/5/2020, NRCS State Technical Advisory Committee Meeting on 3/27/2020, Regularly Scheduled NDF Advisory Committee Meeting on 4/30/2020, and email again on 6/8/2020
Military installations (as appropriate and feasible)	• Appendix E – Stakeholder Scoping and Engagement – Occurred via email on 3/5/2020, NRCS State Technical Advisory Committee Meeting on 3/27/2020, Regularly Scheduled NDF Advisory Committee Meeting on 4/30/2020, and email again on 6/8/2020
Other Plans Incorporated in the Statewide Assessment and Strategy:	
Community wildfire protection plans (required)	• Appendix F – Specific Existing Plans Considered and Used
State wildlife action plans (required)	• Wildlife Habitats and Populations

US Forest Service Checklist Items as outlined in the Cooperative Forestry Assistance Act SEC. 2A. [16 U.S.C. 2101a] (amended by the 2008 and 2014 Farm Bills).	Bookmarked location within the 2020 Nevada Forest, Range and Watershed Action Plan.
	• High Elevation Forests – Dependent Wildlife Populations • Quaking Aspen – Dependent Wildlife Populations • Mixed Conifer Forests – Dependent Wildlife Populations • Pinyon-Juniper Woodlands – Dependent Wildlife Populations • Riparian and Wetland Ecosystems – Dependent Wildlife Populations • Sagebrush Ecosystems – Dependent Wildlife Populations • Other Cold Desert Shrublands and Grasslands – Dependent Wildlife Populations • Warm and Hot Deserts – Dependent Wildlife Populations • Urban and Community Forests – Dependent Wildlife Populations • Key Issues/Threat #1 Forest and Woodland Health – Plant and Animal Habitats Under Pressure • Key Issues/Threat #2 – Wildfire Hazards – Plant and Animal Habitats Under Pressure • Key Issues/Threat #3 – Urban and Community Forests - Plant and Animal Habitats Under Pressure • Key Issues/Threat #4 – Riparian-Wetland Ecosystems - Plant and Animal Habitats Under Pressure • Key Issues/Threat #5 – Sagebrush Ecosystems - Plant and Animal Habitats Under Pressure • Key Issues/Threat #6 – Species Requiring Specialized Conservation • Key Issues/Threat #7 – Water Quality and Quantity - Plant and Animal Habitats Under Pressure

US Forest Service Checklist Items as outlined in the Cooperative Forestry Assistance Act SEC. 2A. [16 U.S.C. 2101a] (amended by the 2008 and 2014 Farm Bills).	Bookmarked location within the 2020 Nevada Forest, Range and Watershed Action Plan.
	• Key Issues/Threat #8 – Climate Change Mitigation - Plant and Animal Habitats Under Pressure • Appendix L - Crosswalk of NDF Forest, Range and Watershed Action Plan Ecosystems to NDOW Key Habitats and NatureServe Ecological Systems of Nevada
Other	• References • Appendix F – Specific Existing Plans Considered and Used
All required Forest Legacy components are integrated into the State Forest Action Plan (Assessment and/or Strategy):	
Eligibility Criteria to identify Forest Legacy Areas	• Appendix D – Forest Legacy Program Assessment of Need (AON) Components
Delineation of Forest Legacy Areas	• Other Priority Areas – Forest Legacy Areas and Assessment of Need • Appendix D – Forest Legacy Program Assessment of Need (AON) Components
Outline of the State's project evaluation and prioritization procedures.	• Appendix D – Forest Legacy Program Assessment of Need (AON) Components

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