

Department of Conservation and Natural Resources  
Nevada Division of Forestry

# State Natural Resource Assessment



2010



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## **Introduction**

This assessment identifies priority forest landscapes, threats to Nevada's natural resources, and describes the analysis used to determine priority landscapes, and the current forest conditions in Nevada. The analysis was conducted and priority landscapes identified across all ownerships.

Nevada's borders enclose about 70,745,600 acres, making it the seventh largest state in the United States. The federal government controls 60,863,345 acres or 86.1 percent of the land. Of the remaining 13.9 percent (or 9,882,250 acres), 11.5 percent is privately owned, 1.6 percent is tribal, 0.4 percent local, and 0.4 percent is state government owned (Figure 1). On a percentage basis, Nevada has more federal land by percentage than any other state. The state's size and diversity among land owners brings many challenges and thus opportunities, in managing the forest and natural resources of the state.

Forestland types cover approximately 8.5 million acres (12 percent) and can be divided into two major types, timberland and woodland. Timberland is comprised of conifer tree species (575,850 acres). Hardwoods and deciduous woodlands occupy about 283,865 acres. Mountain mahogany (535,500 acres) typically occurs above the Pinyon-Juniper (PJ) woodlands, mostly in the mountains of northern, central, and eastern Nevada. Pinyon-Juniper woodlands are the most common forest type in the state. More than 92 percent of the forestland occurs on Nevada's public lands and is managed primarily by the USFS and the BLM (NV Natural Resource Status Report, 2001). The state's rapidly increasing population is placing an unprecedented demand on Nevada forests and associated natural resources. As urban sprawl expands into the forest and other rural areas, less area becomes available for providing the traditional benefits of these lands. These challenges are not unique to Nevada. In fact, the changes that create these challenges are occurring in every state in the nation.

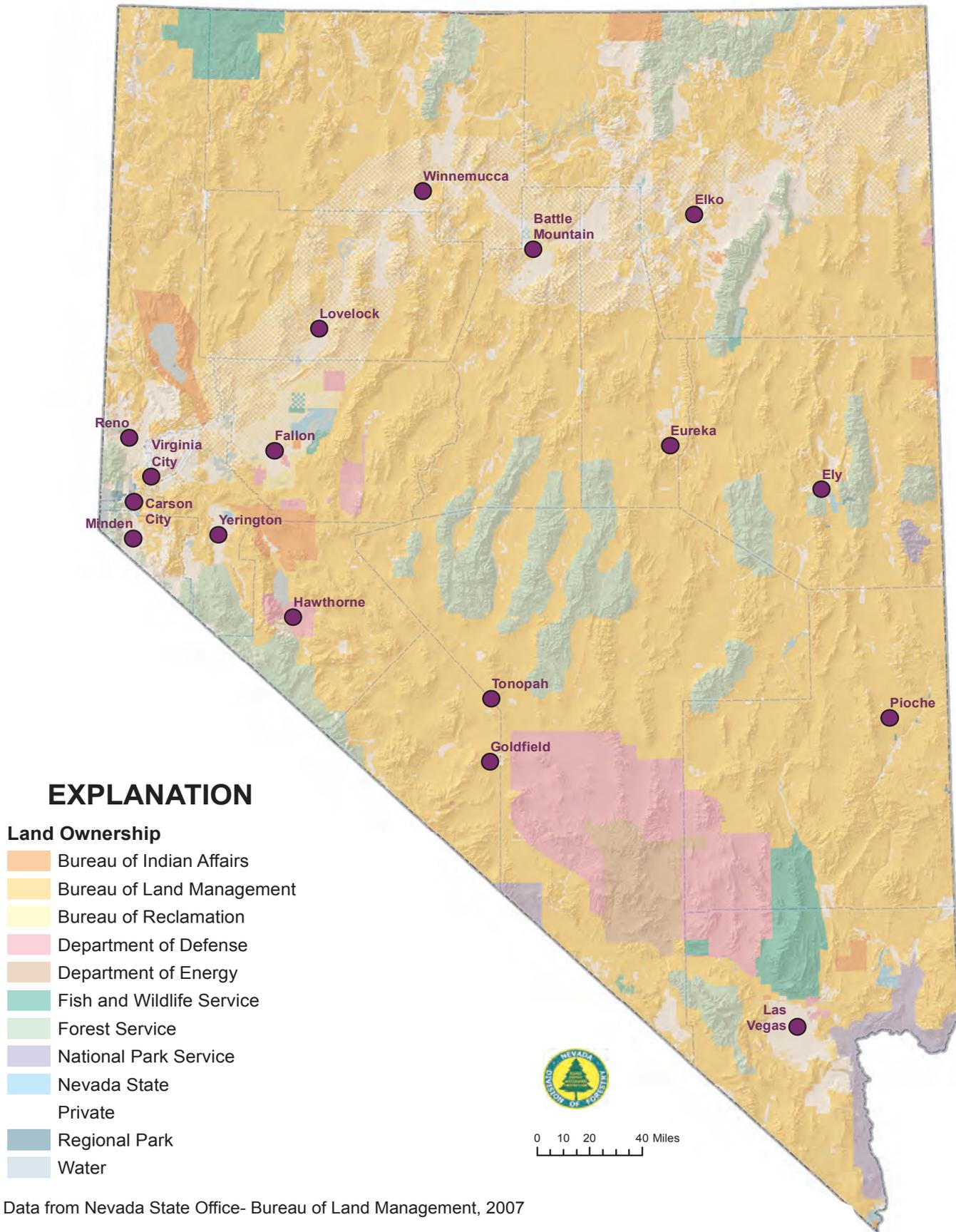
Significant threats to state natural resources, such as insects and diseases, catastrophic fire, and invasive weeds, point to the need for continued and intensified efforts to manage and conserve the forest resources. To have a meaningful beneficial impact on the Nevada's natural resources, the Nevada Division of Forestry (NDF) must optimize the way we delivery of our forestry programs. With the tightening of federal funds, Congress is demanding additional accountability on how federal funds are spent and demands assurances that funds are actually being used to produce positive benefits on the ground. In response to these circumstances, the USDA Forest Service is in the process of transforming how they and the states deliver the federally-funded State and Private Forestry (S&PF) programs.

## **State and Private Forest Program Redesign**

In 2008, the U.S. Forest Service began implementing a "Redesigned" S&PF program. The following explanation of the rationale and process is from a U.S. Forest Service summary of the redesign. (<http://www.fs.fed.us//spf/redesign/redesign-article.pdf>).

The S&PF Redesign effort was conceived in response to the combined impacts of increasing

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Data from Nevada State Office- Bureau of Land Management, 2007

Figure 1- Land ownership in Nevada

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pressures on our nation's forests and decreasing S&PF resources and funds. Significant threats to forests, such as insect and disease infestations, catastrophic fire, and the loss of critical forested landscapes to development, coupled with the pressure placed on local economies by the increasingly global nature of the forest products industry, point to the need for more progressive strategies for conserving our nation's forest resources.

The U.S. Forest Service has been working closely with the National Association of State Foresters (NASF) to:

1. Examine the current conditions and trends affecting forest lands,
2. Review existing S&PF programs to determine how to best address threats to our forests
3. Develop a strategy, including guiding principles and components of change, for delivering a relevant and meaningful set of S&PF programs, skills and opportunities.

The new Redesign approach will focus on three consensus-based S&PF National Themes:

- Conserve working forest landscapes
- Protect forests from harm
- Enhance public benefits from trees and forests

National and state resource assessments will be used to develop competitive proposals for S&PF funds; those projects that receive S&PF dollars will respond directly to the National Themes as well as annual national direction developed by the U.S. Forest Service. The amount of S&PF funds competitively awarded was 15% in 2008–2010.

The Redesigned S&PF includes an emphasis on transitioning to a more flexible and adaptive organization and will examine opportunities to integrate and maximize current programs with other, similar federal forestry programs.

The national S&PF office will report annually to Congress and partners on the progress of the Redesigned S&PF. New emphasis will be placed on improving our collective ability to demonstrate and communicate accomplishments.

## **2008 Farm Bill**

The 2008 farm bill requires that forestry assistance be aimed at conserving working forests, protecting and restoring forests, and enhancing public benefits from private forests. The Forestry Title of the 2008 Farm Bill addressed the redesign of S&PF as well. Relevant sections from the bill follow (<http://www.nationalaglawcenter.org/assets/crs/RL33917.pdf>):

- 1) National Priorities. The 2008 farm bill (§ 8001) establishes a new set of national priorities for federal assistance for private forest conservation. It adds a new subsection to § 2 of the CFAA:

**PRIORITIES** — In allocating funds appropriated or otherwise made available under this Act, the Secretary shall focus on the following national private forest conservation priorities, notwithstanding other priorities specified elsewhere in this Act:

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- Conserving and managing working forest landscapes for multiple values and uses
- Protecting forests from threats, including catastrophic wildfires, hurricanes, tornados, wind-storms, snow or ice storms, flooding, drought, invasive species, insect or disease outbreak, or development, and restoring appropriate forest types in response to such threats
- Enhancing public benefits from private forests, including air and water quality, soil conservation, biological diversity, carbon storage, forest products, forestry-related jobs, production of renewable energy, wildlife, wildlife corridors and wildlife habitat, and recreation

2) Statewide Assessments and Strategies. The 2008 farm bill (§ 8002) requires each state to conduct a statewide assessment of forest resource conditions, trends, threats, and priorities to receive federal forestry assistance funds. Each state also must prepare a strategy for addressing the identified threats, and describe the resources needed to address those threats.

The states are to prepare the initial assessment and strategy, with updates as needed, and to coordinate with specified agencies and groups. NDF must develop an assessment and strategy for addressing threats to the State's natural resources.

Beyond being a requirement of the Farm Bill, the Nevada Division of Forestry supports the idea of formalized planning to support the use of limited resources in addressing natural resource issues in the state.

### Process for Statewide Assessment of Natural Resources

Direction for the state assessment comes from the Redesign Implementation Council (RIC) and the 2008 Farm Bill. The “Farm Bill Requirement & Redesign Components: State Assessments & Resource Strategies” provides final guidance for developing the assessments and strategies. ([http://www.fs.fed.us/spf/redesign/state\\_assess\\_strategies.pdf](http://www.fs.fed.us/spf/redesign/state_assess_strategies.pdf)) Selected excerpts from the document follow:

There are three components of the assessment and planning required by the S&PF Redesign approach to identify priority forest landscape areas and highlight work needed to address national, regional, and state forest management priorities:

1. State-wide Assessment of Forest Resources—provides an analysis of forest conditions and trends in the state and delineates priority rural and urban forest landscape areas.
2. State-wide Forest Resource Strategy—provides long-term strategies for investing state, federal, and other resources to manage priority landscapes identified in the assessment, focusing where federal investment can most effectively stimulate or leverage desired action and engage multiple partners.
3. Annual Report on Use of Funds—describes how S&PF funds were used to address the assessment and strategy, including the leveraging of funding and resources through partnerships, for any given fiscal year. Each state is required to complete a State Assessment and Resource Strategy within two years after enactment of the 2008 Farm Bill (June 18, 2008) to receive

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funds under CFAA.

To ensure that federal and state resources are being focused on important landscape areas with the greatest opportunity to address shared management priorities and achieve measurable outcomes, each state and territory will work collaboratively with key partners and stakeholders to develop a statewide forest resource assessment. The state forest resource assessment should provide a comprehensive analysis of the forest-related conditions, trends, threats, and opportunities within the state.

At a minimum, state assessments will:

- Provide an analysis of present and future forest conditions, trends, and threats on all ownerships in the state using publicly available information.
- Identify forest related threats, benefits, and services consistent with the S&PF Redesign national themes.

Delineate priority rural and urban forest landscape areas to be addressed by the state resource strategy. States can also identify linkages between terrestrial and aquatic habitat, as appropriate.

- Work with neighboring states and governments to identify any multi-state areas that are a regional priority.
- Incorporate existing statewide plans including Wildlife Action Plans, Community Wildfire Protection Plans, and address existing S&PF program planning requirements. States can also utilize relevant national and regional assessments as appropriate.

A combination of qualitative, quantitative, and geospatial data can be used in the statewide assessment to provide information relevant to key state issues and national themes. In addition, non-geospatial information can be used in combination with geospatial data to identify priorities. States may identify separate priority areas for different programs and issues.

The national direction also specifies that the assessment should build on and utilize existing analyses whenever possible. Finally, the national direction identifies potential data layers to include in the analysis and potential sources for the data while allowing states some flexibility to use other data layers and data sources as appropriate for state needs.

### Process for Statewide Natural Resource Strategy

Following completion of the statewide assessment, states are to complete a statewide forest resource strategy to detail how priority forest landscapes will be addressed and how S&PF funds can contribute to that effort.

There is national direction from the RIC regarding the state resource strategies ([http://www.fs.fed.us/spf/redesign/state\\_assess\\_strategies.pdf](http://www.fs.fed.us/spf/redesign/state_assess_strategies.pdf)): A state's forest resource strategy will provide a long-term, comprehensive, coordinated strategy for investing state, federal, and leveraged partner resources to address the management and landscape priorities identified in its assessment. The resource strategy should incorporate existing statewide forest and resource management plans and provide the basis for future program, agency, and partner coordination.

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At a minimum, state resource strategies should:

- Outline long-term strategies for addressing priority landscapes identified in the state forest resource assessment and the following national themes and associated management objectives.
  - Conserve Working Forest Lands: conserving and managing working forest landscapes for multiple values and uses.
    - Identify and conserve high priority forest ecosystems and landscapes.
    - Actively and sustainably manage forests.
  - Protect Forests From Harm: protect forests from threats, including catastrophic storms, flooding, insect or disease outbreak and invasive species.
    - Restore fire-adapted lands and reduce risk of wildfire impacts.
    - Identify, manage and reduce threats to forest and ecosystem health.
  - Enhance Public Benefits 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.
    - Protect and enhance water quality and quantity.
    - Improve air quality and conserve energy.
    - Assist communities in planning for and reducing wildfire risks.
    - Maintain and enhance the economic benefits and values of trees and forests.
    - Protect, conserve, and enhance wildlife and fish habitat.
    - Connect people to trees and forests, and engage them in environmental stewardship activities.
    - Manage and restore trees and forests to mitigate and adapt to global climate change.
- Describe how the state proposes to invest federal funding, along with other resources, to address state, regional, and national forest management priorities.
- Include a long-term timeline for project and program implementation.
- Identify partner and stakeholder involvement.
- Identify strategies for monitoring outcomes within priority forest landscape areas and how action will be revised when needed.
- Describe how the state's proposed activities will accomplish national S&PF program objectives and respond to specified performance measures and indicators.
- Describe how S&PF programs will be used to address priority landscape and management objectives.
- Incorporate existing statewide plans including Wildlife Action Plans, community wildfire protection plans, and address existing S&PF program planning requirements.

# Overview of Nevada<sup>1</sup>

## Population

The population of Nevada grew by 66 percent during from 1990 to 2000, indicating many people find the Silver State to be a desirable place to live, work, and enjoy vast open spaces. In 2000, the state’s population surpassed the two million mark (Table 1). Migration contributed to about 81 percent of the growth. The rate of growth in Nevada (51%) was the highest among all states (Nevada State Demographer’s Office, 2000). The state’s population rank rose from 39 in 1990 to 35 in 2000. Neighboring states are also growing rapidly. By comparison, during the 1990’s, the population of Arizona increased by 40 percent, Utah by 30, Idaho by 28 and Oregon by 20 percent. The population of California increased 14 percent, approaching 34 million in 2000 (U.S. Census Bureau, 2000a). By 2015, the population of Nevada and neighboring states is projected to increase from 48 million to 55 million (U.S. Census Bureau, 2000b).

**Table 1. Population Change in Nevada from 1990 to 2000 and Projected Change to 2010**

County	Population	Population Change 1990 to 2000	Projected Change 2000 to 2010
Clark	1,375,765	741,459	634,306
Washoe	339,486	254,667	84,819
Carson City	52,457	40,443	12,014
Elko	45,291	33,530	11,761
Douglas	41,259	27,637	13,622
Lyon	34,501	20,001	14,500
Nye	32,485	17,781	14,704
Churchill	23,982	17,938	6,044
Humboldt	16,106	12,844	3,262
White Pine	9,181	9,264	-83
Pershing	6,693	4,336	2,357
Lander	5,794	6,266	-472
Mineral	5,071	6,475	-1,404
Lincoln	4,165	3,775	390
Storey	3,399	2,526	873
Eureka	1,651	1,547	104
Esmeralda	971	1,344	-373
Nevada	1,998,257	1,201,833	796,424

Sources: 1. U.S. Census Bureau, Census 2000 Redistricting Data (P.L. 94-171) Summary File, Table PL1, and 1990 Census. (<http://www.census.gov/population/projections/state/stpjpop.txt>). 2. State Demographer’s Office, Nevada County Population Projections 2000 to 2010. June 2000.

Nevada has become highly urbanized, meaning most people live within a few metropolitan areas. The average population density of the entire state is 18 persons per square mile, but nearly 86 percent reside in major population centers within Clark (69%) and Washoe (17%) counties. Of the five largest cities, three are located in Clark County (Las Vegas, Henderson, and North Las Vegas) and the others are in Washoe County (Reno and Sparks). Urbanization is no longer confined only to these cities. 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 about 470,000 in 1999. In the south, the regional scope of urbanization encompasses Clark County and southern Nye and Lincoln counties. Population exceeds 1.4 million in the southern region. In the urban regions, and some rural areas, more residential, commercial, industrial, and public service developments are being

<sup>1</sup> The information is from the Nevada Natural Resources Status Report -September 2002. Published by the State of Nevada-Department of Conservation and Natural Resources. For a copy of the report, Please contact the Department of Conservation and Natural Resources.

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built outside “urban” boundaries. Urban sprawl expands the “urban/wildland interface,” adding to environmental pressures and placing more demands on state resource agencies.

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 function. 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 our Nevada.

A large number of 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. The population density of rural Nevada is about 1.4 persons per square mile. 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. Seven rural counties grew 25 percent or more and the population in four other rural counties declined during the 1990’s. Two counties, Esmeralda and Mineral, experienced population losses greater than 20 percent (U.S. Census Bureau, 2000c). Supplies of high quality water are limited and mining has been the leading employer in both. Increasingly, rural area resources will be sought to meet urban area needs for water supply, waste disposal sites, outdoor recreation, and industries with large pollutant discharges.

The Nevada State Demographer’s Office projects the statewide annual growth rate will average 2.6 percent from 2002 to 2010, essentially adding another city each year the size of Carson City (17 square miles). By 2010, the state’s population is anticipated to increase by another 644,000. Counties projected to grow an average of three percent or more each year are Douglas, Nye, Lyon, Churchill, and Pershing. Clark County is expected to add about 484,000 more residents by 2010, and Washoe County about 67,000. Combined, these two counties account for 86 percent of the projected growth over the first decade of the new millennium (Nevada State Demographer’s Office, 2000). The projections suggest the factors that made Nevada the most urbanized state will continue to strongly influence where people and businesses move here. 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.

## **Renewable Energy**

The State Energy Office and the National Renewable Energy Lab ranks Nevada as one of the best areas in the country for solar electric and solar thermal power as well as having substantial wind and geothermal energy potential. Geothermal and hydropower plants provide all of the renewable energy generated in Nevada today. Fourteen geothermal power plants have been built since the mid-1980's, with a combined capacity of 236 Mega-Watts (MW) (3.7 percent share of total in-state power generating capacity). The primary hydroelectric resource is the Nevada share of power produced from the Colorado River at Hoover, Parker and Davis dams (about 417 megawatts). Six hydropower units run on seasonal Truckee River diversions west of Reno and near Lahontan Reservoir. Hydropower provides 6.8 percent of the state's total power generating capacity.

The projected shortfall in Nevada's western region electric generating capacity produced modest interest in developing renewable resources in Nevada. Of the additional 10,200 MW of generating capacity that electric power companies proposed in 2000 and 2001, only 3.5 percent would expand use of renewable resources (350 MW wind, 12 MW geothermal). Small-scale solar photovoltaic use for residential, small commercial and public facilities has increased in recent years.

The state legislature has enacted two statutes encouraging renewable energy use and development. The "net metering" program enables utility rate payers to earn credits that lower their power bill proportionate to the electricity generated by small, grid connected solar or wind generators. The "renewable portfolio standard" requires Nevada's electric utilities to generate or acquire a minimum of 5 percent of electricity sold to retail customers from renewable energy systems in 2003 and 2004, and increases the standard by 2 percent biennially to 15 percent by 2013.

In the 2009 Legislative Session, the Governor and Legislature created and signed bills that makes a series of changes designed to ease the process of acquiring permits for green or renewable generating plants. It also calls for the state to adopt regulations favoring the purchase of efficient appliances, equipment and lighting. New generating stations that generate greenhouse gases would be restricted unless the energy is needed to provide reliable utility services to Nevada consumers.

Nevada Division of Forestry has created a state wide assessment (currently in draft form) related to biomass and is part of the Fuels for School grant from the U.S. Forest Service. Using a Geographic Information System (GIS), Forested/Woody vegetation from the National Land Cover Data 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. Nevada has two facilities that can use biomass for energy production, David E. Norman Elementary School located in Ely and the Northern Nevada Correctional Center in Carson City.

## **Land Status**

Nevada's borders enclose about 70,745,600 acres, making it the seventh largest state. The federal government controls 60,863,345 acres, or 86.1 percent of the land. Of the remaining 13.9 percent (or 9,882,250 acres), 11.5 percent is privately owned, 1.6 percent tribal, 0.4 percent local, and 0.4 percent state government owned. 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).

At the time of statehood in 1864, Nevada was granted 3.9 million acres, consisting of the 16th and 36th sections of each township. However, most of these sections of land were isolated from the state's 30,000 residents and were not surveyed. 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 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.

There are approximately 8,182,000 acres of private land in Nevada today, an area close to the size of New Hampshire. Assuming all Nevada residents live on private land, the estimated population density is about 150 persons per square mile of private land. (New Hampshire's statewide population density is about 137 persons per square mile.) Data from the Nevada Department of Taxation indicate that local government entities (municipal, county, and schools) own approximately 264,600 acres of land (Nevada Department of Taxation, 2001).

Land ownership patterns in the state have changed little since 1985. Since then, the federal land base and state owned land base increased about 0.2 and 0.1 percent, respectively. An assumption in Table 2 values is that the federal land increase resulted in reduction of private land. Therefore, the decrease in private and local government owned land is calculated to be 0.3 percent, or about 212,000 acres.

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**Table 2. Estimated Nevada Land Status, 1985 and Recent (1995/2000/2001)**

Government Entity	1985	1995/2000/2001	% Of State
Federally Managed Land Total (a)	60,755,598	60,909,973	85.9
U.S. Department of Agriculture, Forest Service	5,149,684	5,805,129	8.2
U.S. Department of Interior	51,183,400	50,786,530	71.8
Fish & Wildlife Service	2,202,297	2,218,411	3.2
Bureau of Indian Affairs	6,244	3,982	<0.1
Bureau of Land Management	48,281,508	47,701,393	67.4
National Park Service	742,757	819,297	1.2
Bureau of Reclamation	429,213	88,075	0.1
U.S. Departments of Defense	Total 3,115,874	3,297,057	4.7
Air Force	2,896,954	2,903,606	4.1
Army	155,266	152,659	0.2
Navy	63,654	240,792	0.3
U.S. Department of Energy	823,989	806,653	1.1
Other Federal Agencies (b)	2,016	2,000	<0.1
Tribal Land Total			
(Held in Trust by Federal Government) (c)	1,152,672	1,161,685	1.6
State Land Total (d)	199,528	273,861	0.4
University of Nevada & Community Colleges	-	24,990	<0.1
Colorado River Commission	-	9,113	<0.1
Nevada Department of Transportation	-	300	<0.1
Division of State Lands (includes Divisions of State Parks and Wildlife)	-	239,458	0.3
Local Government Land Total (e)	8,639,818	264,585	11.9
Private Land Total (f)	8,137,496		11.5
Statewide Total	70,745,600	70,745,600	100

Notes: Acre values are most recent estimates from various sources.

(a) BLM acres are from 9/2000 BLM estimate. Except recently updated Navy acres, all other federal values are from a 1995 BLM and Division of State Lands estimate using BLM Fiscal Year 1995 data, U.S. General Services Administration data, and other sources.

(b) Other federal agencies include U.S. Geological Survey, Bureau of Mines, Postal Service, and others.

(c) The 1985 value is from the 1983 Nevada Indian Commission Directory and the most recent values are from 2001-2002 Nevada Indian Commission Directory.

(d) Division of State Lands.

(e) 2000-01 Statistical Analysis of the Roll, Nevada Department of Taxation.

(f) Private Land Total calculated as the difference between the Statewide Total and the sum of all other categories.

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. 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.

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 acquisition of environmentally sensitive private parcels throughout the state.

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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 as well by advising the federal agencies during the SNPLMA process. Recent and upcoming land transactions involving BLM are summarized in Table 3. The Federal Land Transaction Facilitation Act of 2000 is also expected to increase the amount of federal agency disposals and acquisitions in Nevada. The Act will create a new funding source and allow federal agencies to recover land transaction costs.

**Table 3. Recent and Pending BLM Land Transactions in Nevada**

Location	Transaction	Acres
Clark County,	Southern Nevada Public Land Management Act (SNPLMA) Disposal	8,773
Clark County,	Southern Nevada Public Land Management Act (SNPLMA) Acquisition	914
Lincoln County and Northeast Clark County (Mesquite)*	Disposal	25,000
Nye County*	Disposal	400
Washoe and Storey Counties, Laborde Exchange	Disposal	731
	Acquisition	11,600
Clark County* Ivanpah Airport,	Disposal	6,200
Esmeralda and Nye Counties* Timbisha Homeland Transfer,	Transfer	5,800

Note: \*Activities approved by Congress, 1999-2000 session, for implementation in the near future. Source: Nevada BLM, 2001. Newer Lands bills aren't included in this table

## Nevada Land Resources and Uses

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.

People often think of the landscapes around them in terms of the dominant land use or vegetation cover. Common terms include rangeland, forestland, farm and ranch land, mineral resource (mining) land, military land, urban and suburban developed land, and wilderness. Table 4 uses these terms to organize information about the land and resource use in Nevada. Land cover and land use types were mapped by Utah State University in collaboration with the BLM and USFS using circa 1990 satellite images (Gap Analysis Program, circa. 1995). Not surprisingly, the analysis shows that about 81 percent, or 57.5 million acres, of Nevada's landscapes can be described as rangeland. Forestland, including pygmy conifer (pinyon and juniper) woodlands, covers about 8.5 million acres, or 12 percent of the state. Wetlands and riparian zones cover about 0.7 percent of the state's land area. The estimate of 500,000 acres for this land cover type probably under reports the actual amount. Similarly, agricultural land estimated at 1.4 million acres, may be

understated, since irrigated fields are rotated and only a portion of farmland receives water each year.

## **Rangeland**

Rangeland covers an immense portion of the state and provides a variety of ecological and economic benefits. Benefits of healthy rangeland include watersheds for rural and urban uses, livestock products, wildlife habitat, and land for urban development. These lands also provide aesthetic value, open space, and outdoor recreation. 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 domestic livestock, large herbivores (e.g., mule deer, elk), and wild horses.

About 57 million acres (81 percent of the state) may be classified as rangeland. The vegetation zones include: sagebrush, mountain sagebrush, and sagebrush/perennial grass (sagebrush zone); salt desert scrub, greasewood, blackbrush, and Mojave mixed scrub (lowland shrub zone); dry meadows and perennial and annual grasslands (herbaceous and grasses zone); creosote/bursage (creosote zone); and, bitterbrush, mountain shrub, and Sierra mountain shrub (mountain shrubs). Streams, springs, and patches of wetlands and riparian zones, woodlands, and forested areas are interspersed throughout rangelands, adding to the diversity of wildlife and variety of human uses. Rangeland uses include livestock grazing, ranching and farming, outdoor recreation, wildlife and fish habitat, wild horse and burro habitat, mining, and urban and rural community development.

Herbaceous and grass type covers about 1.9 million acres dispersed throughout the state. The dry meadow type is most prevalent in the foothills and mountains of northern Great Basin, Columbia Plateau, and the Sierra Nevada ecoregions. The grassland type is a northern Nevada feature, consisting of cheatgrass monocultures or grasslands, introduced perennial grasslands, or patches of native grasslands. Well-represented native grass species include wheatgrasses, bluegrasses, needlegrasses, basin wildrye, blue gramma, squirreltail, and Indian ricegrass.

The lowland shrub zone includes 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 rice grass 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, 1972).

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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, bitterbrush, are present throughout. Unique shrub species in the Sierra Nevada ecoregion include varieties of manzanita, tobacco brush, chinquapin and other species in the *Ceanothus* genera. Patches of mountain mahogany, aspen, and conifers are common. The moister and cooler conditions at upper elevations help to sustain the vigor of native plants, giving them a competitive edge over aggressive annual grasses and weeds. More moderate environmental conditions also dampen the risk of large and severe wildfires. Pinyon pine and juniper stands are expanding 200,000 acres/yr (Tausch) in central and eastern Nevada and in some locations crowding out the shrub and grass understory. Overcrowded woodlands reduce forage, creating competition among big game population and livestock herds. They also are a product of the removal of natural wildfire regimes by humans, allowing tree species to dominate sites that are ecologically suited to rangelands. 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 pygmy conifers in the interest of resistant and resilient rangeland vegetation communities.

Sagebrush dominates the state, with subtly different shrub communities spanning 30.5 million acres. One or more of the twelve species and subspecies of sagebrush dominates over half of the state's rangeland. The sagebrush/perennial grass (also known as sagebrush steppe) and Great Basin sagebrush ecosystems are the two dominant types. Mountain sagebrush is prevalent above 6,500 feet in central and northern Nevada. Sagebrush steppe is more common in the Columbia Plateau ecoregion and mid-elevations in the central mountains in semi-arid micro climates. Associated shrubs may include bitterbrush, rabbit brush, currant, gooseberry or cliff rose. Grasses make up a significant portion of the steppe plant mix. The Great Basin sagebrush zone typically occurs above 4,500 feet and native grass species make a small percentage of the understory or do not occur at all. An exception is areas invaded by cheatgrass. Stands of juniper, pinyon pine, and possibly Jeffrey or ponderosa pine are intermixed. This lower elevation sagebrush ecosystem is the most widespread and abundant cover type in Nevada.

Scientists uncovering the natural prehistory of Nevada's ecoregions have 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 (Griffen, 2002). Since settlement, domestic livestock grazing has been the primary use of rangelands. The BLM and USFS, combined, manage about 85 percent of the rangelands in the state (Table 4). Cattle and sheep production on public rangeland is managed within grazing allotments by permittees and federal agency resource scientists. In 1999, the BLM held 700 permits for livestock grazing on 45 million acres of the 48 million acres administered by the agency (U.S. Bureau of Land Management, 2000). On Humboldt-Toiyabe National Forest (HTNF) land, the USFS administered 298 grazing allotments covering 4.7 million acres of

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the total 5.8 million acres in the national forest (Humboldt-Toiyabe National Forest, 2001). The allotment and acreage totals include HTNF land in Nevada and California, of which 92 percent lies in Nevada.

**Table 4. Changes in Non Federal Grazing Lands**

Changes in Non federal Grazing Land in Nevada, 1982 - 1997

Year	Pasture Land	Rangeland	Forest Land	Total Non-federal Grazing Land
1982	312,600	8,246,200	366,000	8,924,800
1987	313,000	8,280,600	374,400	8,968,000
1992	310,300	8,258,700	374,900	8,942,900
1997	279,000	8,372,400	305,000	8,956,400

Source: Modified from 1997 National Resources Inventory, Revised December 2000. Web site: <http://www.nrcs.usda.gov/technical/land/grazing.html>

The arid climate, low annual forage production, and small amount of private holdings with sufficient area to make livestock operations economically viable requires the use of forage resources available on surrounding public lands. Almost all of the cattle and sheep raised in Nevada are produced on ranches that make some use of public rangelands each year. The non-federal component of rangeland used for livestock grazing is significant. The total amount of non federal rangeland used for grazing has changed little since the early 1980's, but grazing on pasture and forestland has decreased (U.S. Natural Resources Conservation Service, 2000). Private range land contains valuable water resources and riparian habitat, and therefore is important to maintaining healthy watersheds and habitats for riparian dependent wildlife species. Livestock operations either own or lease private land and acquire a BLM and/or USFS permit for the federal public land. Compared with other states, Nevada ranches, supplemented with public grazing land, are large but capable of continuously supporting relatively small numbers of livestock.

The BLM manages and monitors forage and ecological conditions on lands within their jurisdiction. Forage production and utilization (i.e., proportion of plants removed) traditionally has been the focus of monitoring. In recent years, ecological site conditions have been assessed more sporadically than in the past. Ecological site condition monitoring is based on a comparison of existing soil, vegetation, wildlife, and physical site conditions to more natural conditions. The data from monitoring are used to evaluate post- or pre-grazing carrying capacity, select grazing management practices, and set priorities for special range improvement activities on public lands. To be consistent with multiple use principles, the BLM allocates available forage to each class of grazing animal, including domestic cattle and sheep, mule deer, elk, bighorn sheep, pronghorn antelope, and wild horses and burros. In 1999, the BLM used the combined results from ecological site and forage condition monitoring to characterize rangeland conditions. Of the 45 million acres covered under grazing allotments, five percent was rated in excellent condition and 12 percent poor. About 21 million allotment acres were rated as fair to poor (47 percent) and 13.6 million acres (30 percent) as good to excellent. Grazing, fires, and nonnative plants are factors in the proportionately large amount of grazed rangeland in fair to poor condition (U.S. Bureau of Land Management, 2000). Rangelands managed by the USFS are managed and monitored in similar ways as those of the BLM.

Historically, cattle and sheep repeatedly grazed sagebrush, salt desert shrub, mountain shrub, and riparian zones, exhausting the regenerative capacity of native grass and shrub species.

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Though improvements in grazing management practices have been made throughout the state, harsh environmental conditions ensure a slow rate of recovery of the natural vegetation. Ultimately, the extensive removal of perennial grasses, due to overgrazing, weed and invasive species and lack of low-severity wildfires substantially changed the sagebrush zone. Thickening shrub canopies and cheat grass understory have filled the voids. The flammability of cheat grass and closure of the shrub canopy has created conditions favorable to extreme wildfire (Young, 1985).

During the 1999 and 2000 fire seasons, wildfires burned more than one million acres in the sagebrush zone. The intensity of some fires completely destroyed much of the vegetation within burned areas and seeds stored in the upper soil layer. Without native seed sources nearby, burned sagebrush habitats are not capable of natural regeneration at a rate faster than weedy or undesirable species, and are therefore more susceptible to invasion by non-native plants. The spread of noxious weeds, some of which have been present in small numbers for decades, appears to have accelerated in recent years. In some areas, especially on private lands, the numbers of livestock may still exceed the carrying capacity of rangeland plant communities. Less vegetative cover and fewer deep rooted plants increases runoff and accelerates erosion, contributing to the high sediment and nutrient loads in water quality impaired reaches of major rivers. Additionally, soil erosion can leave upland sites with less vegetation production potential due to lower water holding capacities and fewer nutrients.

A related concern is the effects of wildfire on the distribution and abundance of vegetation consumed by game animals, livestock, and wild horses. Competition among the large grazing animals is likely to further degrade sagebrush ecosystems unless animal numbers are managed in proportion to acres of habitat burned. Wildfire and resulting over-use can impair living conditions for sensitive species as well. Special status wildlife species dependent on sagebrush habitats include the Sage Grouse, Burrowing Owl, Mountain Quail, Brewer's Sparrow, Pygmy Rabbit, Sagebrush Vole, and the Sagebrush Lizard.

The deterioration and conversion of millions of acres of sagebrush, riparian and other rangeland communities is a serious ecological event. The intensity of concern is evident in the number of 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, fire management, and invasive weed control.

Rangeland areas are undergoing more permanent changes too. Rangeland made up 78 percent of the total land in Nevada developed for residential, commercial, industrial, utility, and transportation uses from 1992 to 1997. Though the amount of land converted is less than 0.5 percent of the total rangeland area, other associated activities extend the influence of development beyond building footprints. Solid waste disposal; illegal dumping; hiking, biking, and motorized recreation trails; and, road and utility corridor construction are examples. Mining also constitutes a substantial and expanding use of Nevada's rangeland. Although, information on the amount of rangeland converted for historic and contemporary mineral development was not available, min-

ing companies are among the largest land owners in the state.

The use and management of public rangeland resources is becoming more challenging with the growing number and diversity of public land users. On today's federal public rangeland menu are livestock grazing, dozens of outdoor recreation pursuits, fish and wildlife habitat, riparian management, endangered species management, mining, hunting, cultural resource protection, wilderness, wild horse and burro habitat, energy development, and various special uses. Administration of large land areas is especially challenging as national offices of federal agencies make frequent changes in policies and enforcement of regulations. Meeting the multiple use mandate has created divisiveness in Nevada where competition among incompatible land use activities is high, but overall has allowed for a sharing of lands for many uses. Public pressure from interests on all sides has required the agencies to allow public input during their land use and resource planning processes, sometimes slowing down the decision making process. Because such a vast amount and diversity of Nevada's natural resources are found on the rangeland, special care is warranted in land management decisions. 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.

### Forestland

Forestland types cover approximately 8 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 fairly continuous forested areas, especially in the Sierra Nevada Mountains 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. Pinyon-Juniper woodlands are the most common woodland type in the state.

More than 92 percent of the 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). A large majority of non-industrial private forestlands are not adequately managed for their forest resource values.

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Few forested areas are representative of the range, density, and mix of species that existed prior to European-American settlement. Forests and their ecological conditions have been altered by commercial and domestic use, as well as to accommodate agricultural, urban, mining, and railroad development. As a result, a majority of the timberland resources during the 19th Century were depleted or high-graded for the most valuable timber. Second growth stands found today occupy higher elevation and steep terrain that is difficult to log or treat for fuel loading. The margins of some conifer forestlands that were clear-cut have not regenerated, likely the result of erosion of barren soils and drier, warmer micro climates across exposed slopes. Overcrowded conditions are widespread on conifer and pygmy conifer forestlands, the result of aggressive fire suppression tactics and reduced harvests. Overstocked forests produce less stream flow, reduce groundwater recharge, and may contribute to higher flood frequency and peak flow. They also provide less habitat diversity, which is needed to support a diversity of wildlife. One of the biggest threats of overstocked stand/forest is the cascading effect of unhealthy trees, insect and disease outbreaks, large scale tree mortality and subsequent large scale, high-intensity forest fires. The Nevada Bird Conservation Plan prepared by the Nevada Working Group of Partners In Flight, prioritizes 21 bird species in conifer, pinyon and 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 Natural Heritage Program. Several sensitive plant and animal species inhabit the area.

The forests in the Sierra Nevada ecoregion of western Nevada generally receive substantially more attention than other forested areas because of the association with the large continuous Sierran forests, higher timber production potential, 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. A majority of the timberland areas are overstocked, comprised of even-age class, and standing dead trees. Pine and fir beetles and mistletoe infestations are common in the Sierran forests.

Timber harvests ten years ago were permitted primarily for private commercial timberlands. Timber harvest production has declined from about 2.3 million to 150,000 board feet per year (Nevada Division of Forestry, 2000) statewide. Most tree harvesting permits now are for fuel management (e.g., thinning dense areas) to meet subdivision development requirements or for forest ecosystem health. The last timber harvest permit issued in the Sierra Nevada on private commercial timberland was in 2007. In the Carson Range, fuelwood production has declined from 3,162 cords in 1990 to 550 cords in 2000. The saw mills closer to northwestern Nevada in Truckee, Loyalton, and Pioneer, California, have closed. Now the closest saw mills are more than 80 miles away. Some potential commercial forest product uses have been identified, but markets have not emerged in the western Nevada region. One area that has been doing well is the use of

biomass from projects to power and heat the Northern Nevada Correctional Center.

## **Forest Resource Status**

Insects, disease, competing vegetation, climate, fire, and humans are the main factors that determine the health of forests. Overstocked conditions are a widespread problem on some Nevada forestlands.

A majority of the forested lands in Nevada are administered by the USFS, so federal agency reports were relied upon to compile forest health information. Currently the annual Nevada Pest Condition Report is written by the Nevada Division of Forestry (NDF) Forest Health Specialist with input from the Nevada Department of Agriculture's State Entomologist, Pathologist and Weed Specialist and edited by the USFS State and Private Insect and Disease specialists. This report in coordination with the annual Aerial Detection Survey data (collected by NDF's Forest Health Specialist, is used to annually monitor the overall health of Nevada's forests. It is available at <http://www.fs.fed.us/r1-r4/spf/fhp/conditions/entry1.html> . Other sources of information include state agency reports, scientific publications, and personal communication with experts. Detailed information is lacking on the condition of much of Nevada's forested lands. However, during summer 2000, the National Forest Health Monitoring (FHM) program was initiated by the USFS in Nevada. FHM will provide ongoing information on forest conditions in the state, and the first report became available in spring 2002 (U.S. Forest Service, 2002). The Annual Forest Health Monitoring Highlight web based report is developed by NDF's Forest Health Specialist in coordination with the USFS State and Private Forestry Forest Health Monitoring Coordinator. It is available on the web at: [http://www.fhm.fs.fed.us/fhh/fhh\\_09/nv\\_fhh\\_09.pdf](http://www.fhm.fs.fed.us/fhh/fhh_09/nv_fhh_09.pdf)

### **Subalpine Timberline Forests and Woodlands**

This high elevation ecosystem occurs in remote locations in the island mountain ranges in Nevada. Five needle pines (whitebark, limber, and bristlecone pines) are predominate species. The typical forest structure is open with older aged trees. Fires are infrequent in this forest type due to its open nature, low fuel accumulation, and cooler conditions. Fire return intervals vary widely and can be greater than 1000 years(Keey & Zedlar 1998) are likely over 100 years. Consequently fire suppression and large-scale catastrophic fires and insect outbreaks has impact on this type in northeast Nevada in the last 5 years Aerial surveys from 1999-2009, reveal fair amount of mortality caused by mountain pine beetle in the Toiyabe, Toiyabe, Shoshone, Jarbidge, Ruby and East Humboldt, Spruce, Cherry Creek, and Pequop, Ranges. This is the first time this level of outbreak has been documented in Nevada and the high elevation white pines have been significantly impacted in these areas. Five-needle pines are susceptible to white pine blister rust an exotic disease. This pathogen has only been found in the Jarbidge mountain whitebark pine and along the western border in all five-needle pine species.

#### **Engelmann Spruce - Subalpine Fir**

This forest type is found primarily in the Jarbidge, Pilot, Snake and Schell Creek ranges. Subalpine fir mortality is occurring at high levels in the Jarbidge Mountains due to a complex of

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insects and disease pathogens. Extended drought in the late 80's and early 90's stressed the trees, leading to increased insect and disease susceptibility and activity. High levels of subalpine fir mortality can significantly change the structure and composition of the sub alpine fir forests. Historically, fire regimes of mixed severity 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.

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 sub alpine fir range.

### **Quaking Aspen**

Quaking aspen is distributed throughout the State, occurring primarily along drainages, at springs and seeps, and on north facing slopes in mountainous terrain. 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 the state for different reasons. In upper montane locations, conifers are beginning to dominate and out-compete aspen stands. Without some form of disturbance to stimulate aspen suckering, and reduce shade tolerant conifers, these stands will continue to decline. In other areas wild and domestic grazing animals are consuming all suckers before they grow above browsing height are preventing the stands from regenerating. Without management, these aspen clones will disappear and the probability is high that significant amounts of aspen acreage will decrease. The lack of successful regeneration over large areas increases this risk. Continued heavy browsing pressure on existing quaking aspen and other forage species will result in habitat degradation for all species found within this type. Drought has also affected the lower elevation stands, reducing the size or causing a complete loss of the stand. This is often in combination with the other factors mentioned above. Since aspen communities are known to support a large diversity of vegetation and wildlife species, the loss of these stands would constitute the loss of a critical Nevada ecosystem.

### **Sierra Nevadan Forests**

Sierran coniferous forests below the subalpine type can be classified as red fir/lodgepole pine, mixed conifer, and eastside pine. The red fir/lodgepole pine type occurs between 7000 and 8500 feet. Composition varies from almost pure fir to pure pine; with less frequent associates being white fir, Jeffrey pine at lower elevations and western white pine and mountain hemlock at the upper elevations. Fire frequencies are low in these high elevation forests and consequently, fire suppression policies have had less effect here than within the lower, drier forest types in Nevada.

The insects commonly associated with the species are fir engraver beetle on true firs, California flathead borer, Jeffrey pine beetle, pine engraver on Jeffrey pine, and mountain pine beetle on lodgepole pine and white pines. Insect activity is at background levels currently. Earlier in the 1990's a prolonged drought combined with high stocking levels and annosus root disease led to high levels of mortality in red fir. Lodgepole pine at high elevations was not impacted by the

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drought, but has since become impacted in some areas by mountain pine beetle outbreaks. Where associated with locally high soil moisture conditions at lower elevations, mountain pine beetle caused significant mortality. Conditions such as overcrowding, each species' branch retention habit, and large numbers of beetle killed trees combine to create a significant wildfire hazard. In the Lake Tahoe Basin, much of this hazard is being addressed in multi agency cooperatively developed fuel reduction plans and Southern Nevada Public Lands Management Act (SNPLMA) funding.

Mixed conifer forests are located below the red fir/ lodgepole pine type. Depending on aspect, soil moisture regime and disturbance history, the forest can range in species composition from almost pure white fir to a well balanced mix of white fir, Jeffrey and ponderosa pines with a smaller complement of sugar pine and incense cedar. The elevation range of this type is roughly 5800 to 7000 feet. As in other forest types, fire suppression policies and the lack of active forest management has led to very high stocking levels, large fuel accumulations, and unsustainable species compositions over much of this type. Fire frequency within this type typically ranged from 5 to 30 years with fire behavior being moderate. Many of these areas have not experienced fire for over 100 years, putting much of the area far outside the natural range of variability for many characteristics required for sustainability. This situation places the forest at high risk of rapid change and large scale damages due to fire and insect activity.

The drought of the late 1980's to the mid 1990's triggered a bark beetle epidemic in the mixed conifer type that led to the death of millions of forest trees range-wide. The down and dead trees constitute a large fuel load. Current bark beetle activity is at endemic levels. Dwarf mistletoe is the most significant pathogen in these forests. The parasitic plants exist on all conifers in the ecoregion, except for incense cedar (which has a leafy mistletoe). Where levels of infestation are high, natural regeneration of the affected individuals is not possible, leading to species composition changes over time. Fire historically has been the greatest suppressor of dwarf mistletoe.

Below the mixed conifer type is the yellow pine type (e.g., Jeffrey and ponderosa pine). Historically this type was characterized by open "park like" conditions with multiple age classes distributed as small even aged groupings. Wildfire burned on a 5 to 12 year cycle removing brush and tree regeneration, and stimulating herbaceous plant growth. Fuel accumulations were spotty and insignificant. In Nevada, the southernmost occurrence of the yellow pine forest type is in the Spring and Sheep ranges in Clark County. Past cutting practices and fire suppression have left large portions of the yellow pine forests in overstocked, even-aged conditions. Basal areas exceed 250 square feet per acre, distributed among smaller size classes. Fuel accumulations are exceedingly high for this type and wildfire hazard is high. Risk of attack by Jeffrey pine and western pine beetles, and flat-headed borers are very high under current conditions. Western dwarf mistletoe is widespread across the type and infections are intense.

## **Pinyon-Juniper Woodlands**

The pinyon and juniper (PJ) type is the most widespread forest type in Nevada. 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.

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PJ woodlands have been harvested for fuel wood, posts and Christmas trees. PJ woodlands are found throughout the state, occupying about 7.1 million acres (10 percent of the state). The most extensive woodland areas occur in eastern Nevada, though western and central Nevada woodland areas are also large.

The range of the PJ woodland type has expanded and receded over the past 7,000 years, apparently the result of climate fluctuations. Over the past 500 years, the PJ populations have expanded further north, into the higher elevations, and down slope onto deep, well-drained soils on alluvial fans. The “migration” is believed to be a response to climate change as well as human induced changes. Aggressive wildfire suppression and deteriorated rangeland habitats have presented pinyon and junipers opportunities to become established in shrub and grass communities. These factors may also be creating favorable conditions for PJ stand density to increase and create a closed canopy conditions.

The rate of woodland expansion appears to have accelerated during this century, but has significantly decreased in recent years with in-filling of the existing woodlands (Dr. Robin Tausch personal communication). Wildfire in pre-settlement PJ woodlands is thought to have been comparatively frequent (10 to 30 year recurrence, compared to 30 to 50 year intervals for Great Basin sagebrush), burning small trees and lighter fuels and leaving more of this vegetation type open and thickets confined to rockier and more dissected terrain (Griffen, 2002). Risk of catastrophic wildfire is greater in the crowded conditions that are more commonplace in portions of eastern, central, and western Nevada. 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. As woodland cover and density increase, other plant communities disappear. The replacement of native shrub and grass communities corresponds with a loss in diversity of land uses, native wildlife and habitat diversity, and healthy watershed conditions. 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. Likely there have been some locally important conversions; however, insufficient data exists to determine the amount of PJ forest converted.

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 pinyon pine engraver beetle (*Ips confusus*) and other agents such as pinyon blister rust (*Cronartium occidentale*), pitch mass borer (*Dioryctria sp.*), etc. The most common destructive insects are pinyon ips bark beetle and defoliators such as pinyon needle scale (*Matsucoccus acalyptus*) and pinyon needle sawfly (*Neodiprion edulicohus*). Population increases in these insects are usually local and are triggered by some sort of disturbance. Dwarf mistletoe (*Arceuthobium divaricatum*) is widespread in the pinyon pines and is the trees’ most significant pathogen. The heavily infected trees are often the first trees 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 the type. True mistletoe is common in the juniper species, but its harmful effects are minimal.

## **Nevada Natural Resource Assessment**

Currently, commercial and domestic use of woodland resources is limited to fuel wood, fence post, and Christmas tree harvesting. Opportunities exist to 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, and the distillation of products from pinyon and juniper oils. 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. As an alternative to chaining, burning, or chemically treating woodlands, state and federal agencies are exploring and promoting productive uses.

### **Urban and Community Forests**

For trees to grow in Nevada's communities, someone must plant them, then nurture and care for them for life. 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. When the railroad was completed 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. Unfortunately, many of these are in poor condition from improper care, pruning practices and age. The protection and proper care of community trees is a major concern. For every tree planted in America, four die. The average life expectancy of an urban tree ranges from seven to 15 years.

NDF administers the state's Urban and Community Forestry Program as stated in Nevada Revised Statute (NRS) 528. Since 1991, almost one million dollars of Federal funding has been awarded by NDF to communities and groups in Nevada for tree planting and tree care education. The loss of federal funding for urban forestry programming would seriously impact tree planting and tree care education in Nevada and could have a long lasting detrimental effect on the health of the urban forests.

Receiving recognition from the National Arbor Day Foundation under the Tree City USA program is an indication of the ability of a community to sustain and manage its urban forests. In 1990, only three Nevada towns had received Tree City USA distinction – Boulder City, Las Vegas and Reno. The number increased to seven in 1995, but fell to six by 2000 when Las Vegas failed to re-certify in 1999. The eleven Tree City USA communities are Henderson, Boulder City, Reno, Sparks, Carson City, Las Vegas, Incline Village, Town of Gardnerville, Elko, Ely and Nellis Air Force Base. Each has a recognized person or group responsible for tree management, a street tree ordinance, an Arbor Day Proclamation and tree planting celebration, and spends \$2 per capita on their tree program. Non-incorporated towns in Nevada may have good tree care programs, but are difficult to enroll in the Tree City USA program. One reason is that county and a community's budget is difficult to separate; and, the county's tree budget may not meet the minimum \$2 per capita requirement consistently from year to year.

# **Nevada Natural Resource Assessment**

## **Scope and Approach**

Although this analysis is called a forest resource assessment, it in fact is an assessment of all types of lands that NDF provides assistance to. NDF provides assistance to non-forest land in the way of windbreak and urban tree plantings, streambank stabilization and other programs. Additionally, NDF has direct and cooperative fire management responsibility on approximately eight million of acres of non-forested land. Therefore, this assessment addresses all lands that NDF has been, or is likely to be, involved with in the future.

## **Contributing and Guiding Documents**

The following documents were used in developing the Nevada State Wide Forest Resource Assessment Plan.

- Nevada Department of Wildlife, Wildlife Action Plan 2006.
- Nevada Department of Conservation and Natural Resources Status Report 2002.
- 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.
- Carson Range Multi-Jurisdictional Fuel Reduction and Wildfire Prevention Strategy 2007.
- Lake Tahoe Basin Multi-Jurisdictional Fuel Reduction and Wildfire Prevention Strategy, 2007.
- Nevada Division of Forestry Spatial Analysis Project (SAP) 2007 .
- Nevada Division of Forestry State Wide Assessment for Fuels for School (draft) 2009.
- USFS/Nevada Division of Forestry Forest Pest Conditions in Nevada 2009.
- Tahoe Regional Planning Agency-Pathway Regional Plan Revision. 2007.
- Nevada Fire Safe Council-Nevada Community Wildfire Risk/Hazard Assessment Project (CWPP), 2004-2005.
- U.S. Forest Service Humboldt Forest Plan - 1986 (revisions suspended).
- U.S. Forest Service Toiyabe Forest Plan - 1986 (revisions suspended).

## Assessment Data Layers

NDF selected data layers for the analysis based on direction from the USFS as well as those the state felt were important. Some of the information and methodology used for the Spatial Analysis Project (SAP) was incorporated into the assessment as well. NDF selected seventeen layers for inclusion in the analysis. Brief descriptions and maps of the data layers follow. Please see Appendix A, for more detailed information on the methodology and creation of the data layers

### *Private Lands*

This layer was identified and used during the SAP analysis and is included in the state wide assessment. NDF has statutory responsibility for providing forestry assistance and regulation of forest harvest on state and private lands in the state. Although this assessment addresses “all lands”, laws limit our role on federal lands and the primary focus for our work will continue to be on private lands, while looking for opportunity to collaborate with federal partners for landscape scale impacts.

**National Theme:**

Conserve working forest lands.

**Strategic Objective:**

Identify and conserve high priority forest ecosystems and landscapes.

**National Direction:**

Assessments and strategies should attempt to identify, protect, and connect ecologically important forest landscapes.

### *Stream/Riparian Area*

Riparian areas and associated flood plains provide important peak flow attenuation and critical habitat for wildlife. This data set was originally created using a 300 foot buffer on the main rivers in Nevada and 100 foot buffer on all tributaries, streams and creeks that were perennial. In the final analysis, all perennial streams were converted to a raster data set from the linear feature instead of trying to use a buffer polygon around the stream. This was done to get a better representation of the data.

**National Theme:**

Conserve working forest lands.

**Strategic Objective:**

Identify and conserve high priority forest ecosystems and landscapes.

**National Direction:**

Assessments and strategies should attempt to identify, protect, and connect ecologically important forest landscapes, and open space, thus maintaining a green infrastructure, particularly around and within areas of population growth and developments.

# Nevada Natural Resource Assessment

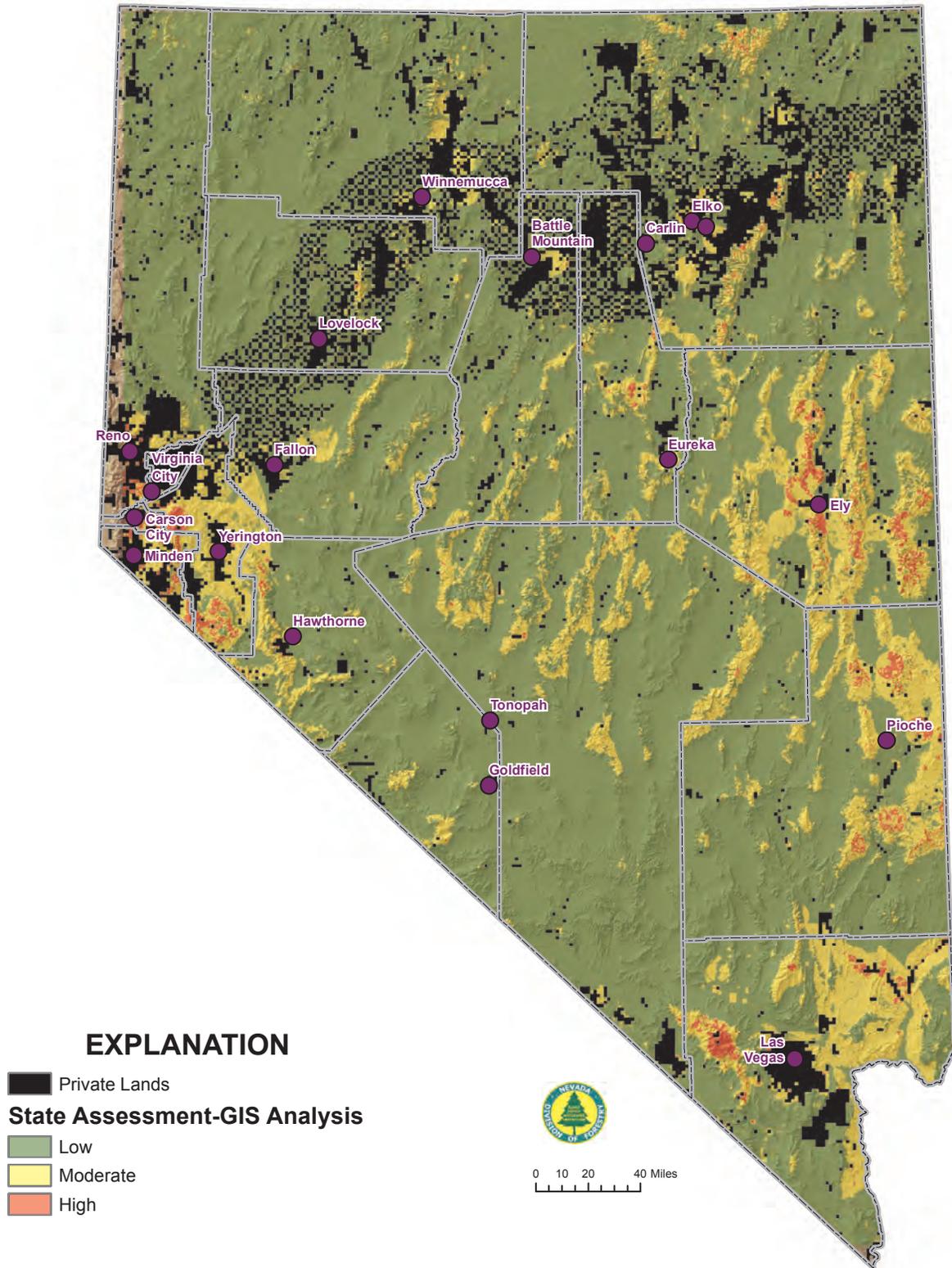


Figure 2. Private Lands overlaid on the final GIS analysis

# Nevada Natural Resource Assessment

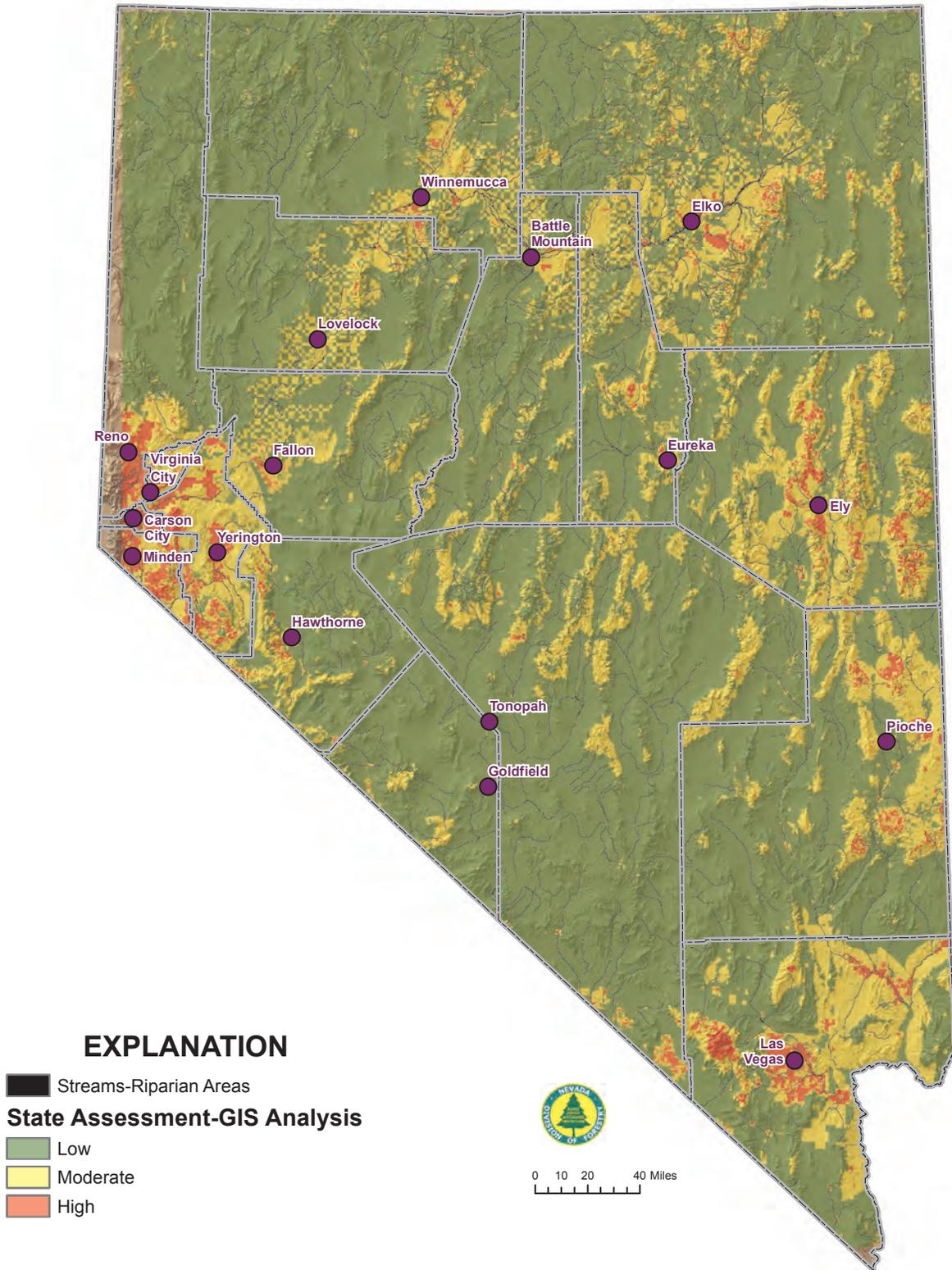


Figure 3. Streams-Riparian data layer overlaid on the final GIS analysis

## ***Forested Lands/Vegetation***

This data set uses the forest system classification attribute data from the GAP and Southwest ReGAP (SWReGAP) data sets to identify the forested lands in the state. The original data set was created from the 2000 National Land Cover Data set focusing on Deciduous Forest, Evergreen Forest and Mixed Forest. In the final analysis, based on input from the public, various groups and analysis of both the GAP and the Southwest ReGAP data, both data sets was used in this analysis. All system classifications that relate to forest or woodland cover type were used.

**National Theme:**

Conserve working forest lands.

**Strategic Objective:**

Identify and conserve high priority forest ecosystems and landscapes.

Actively and sustainably manage forests.

**National Direction**

Assessments and strategies should attempt to identify, protect, and connect ecologically important forest landscapes to ensure proper silviculture practices and forest health.

Assessment and strategies can identify viable and high potential working forests landscapes where landowner assistance programs can be targeted.

# Nevada Natural Resource Assessment

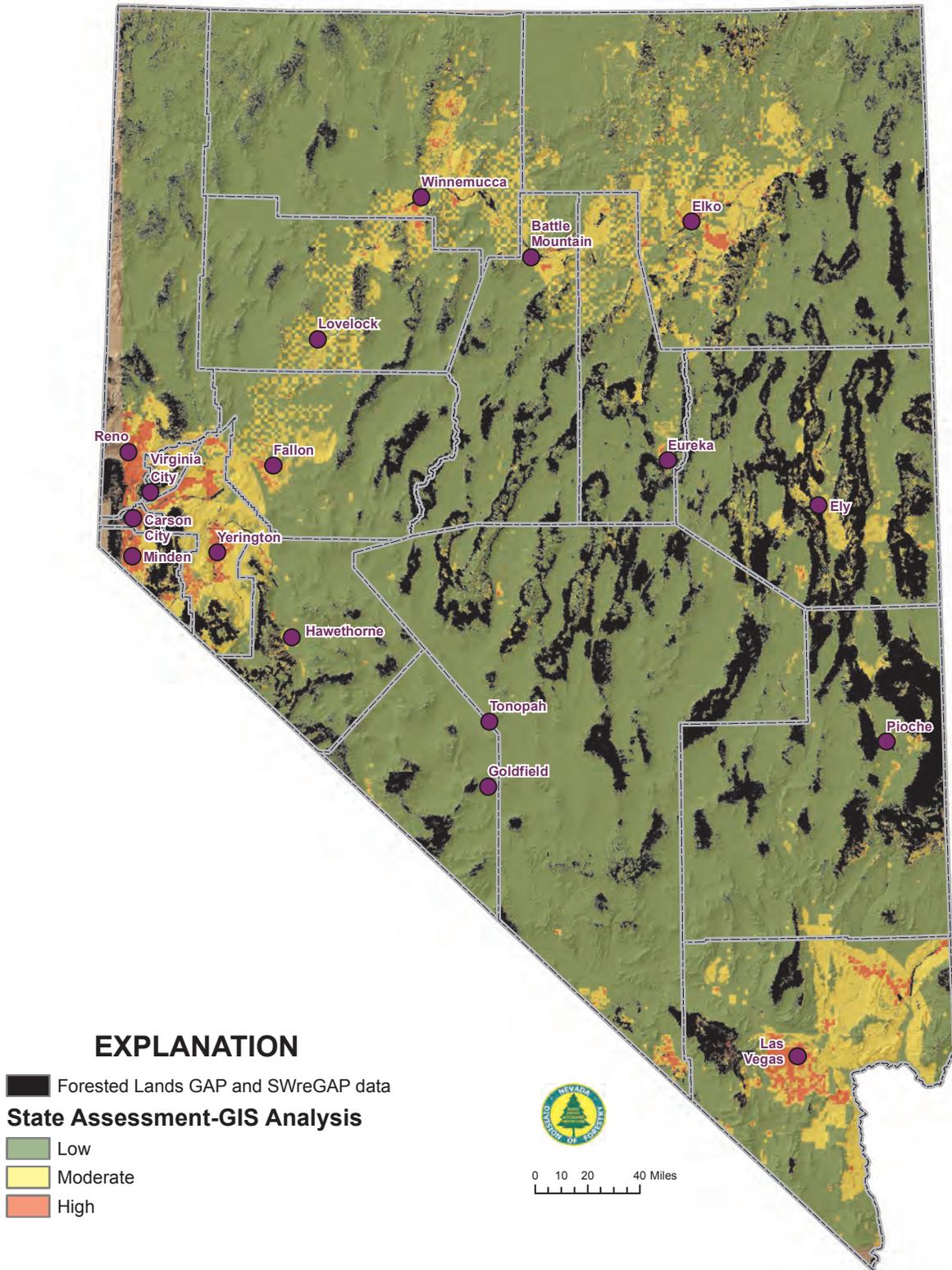


Figure 4. Forested Lands data overlaid on the final GIS analysis

## ***Annual Grasses***

NDF used the data developed by the Nevada Natural Heritage Program. Annual grasses are important due to the fuel load they produce, and their potential to dominate the native vegetation and influence natural fire regimes. These major ecologic changes have critical impacts on native plant communities and associated wildlife habitats. The Nevada Department of Agriculture is in the process of creating a state wide noxious weed data set. This data layer was not available when during this assessment process. This data set is composed of annual grasses. NDF used the 2005 annual grass data set from Nevada's Natural Heritage Program and selected areas where coverage of grasses was between 25 and 50 percent. These values represent the grass coverage where NDF could make the biggest impact in mitigating the expansion of the annual grasses because the grasses are not dominating the sites at a level that would require immense amounts of time, energy and funding to reverse a total site conversion. The Governor of Nevada has declared annual grasses to be a primary wildfire and ecological concern.

**National Theme:**

Protect forests from harm.

**Strategic Objective:**

Restore fire adapted lands and reduce risk of wildfire impacts.

**National Direction:**

Assessments should identify areas where management can significantly reduce the risk of catastrophic wildfire while enhancing multiple associated forest values and services.

# Nevada Natural Resource Assessment

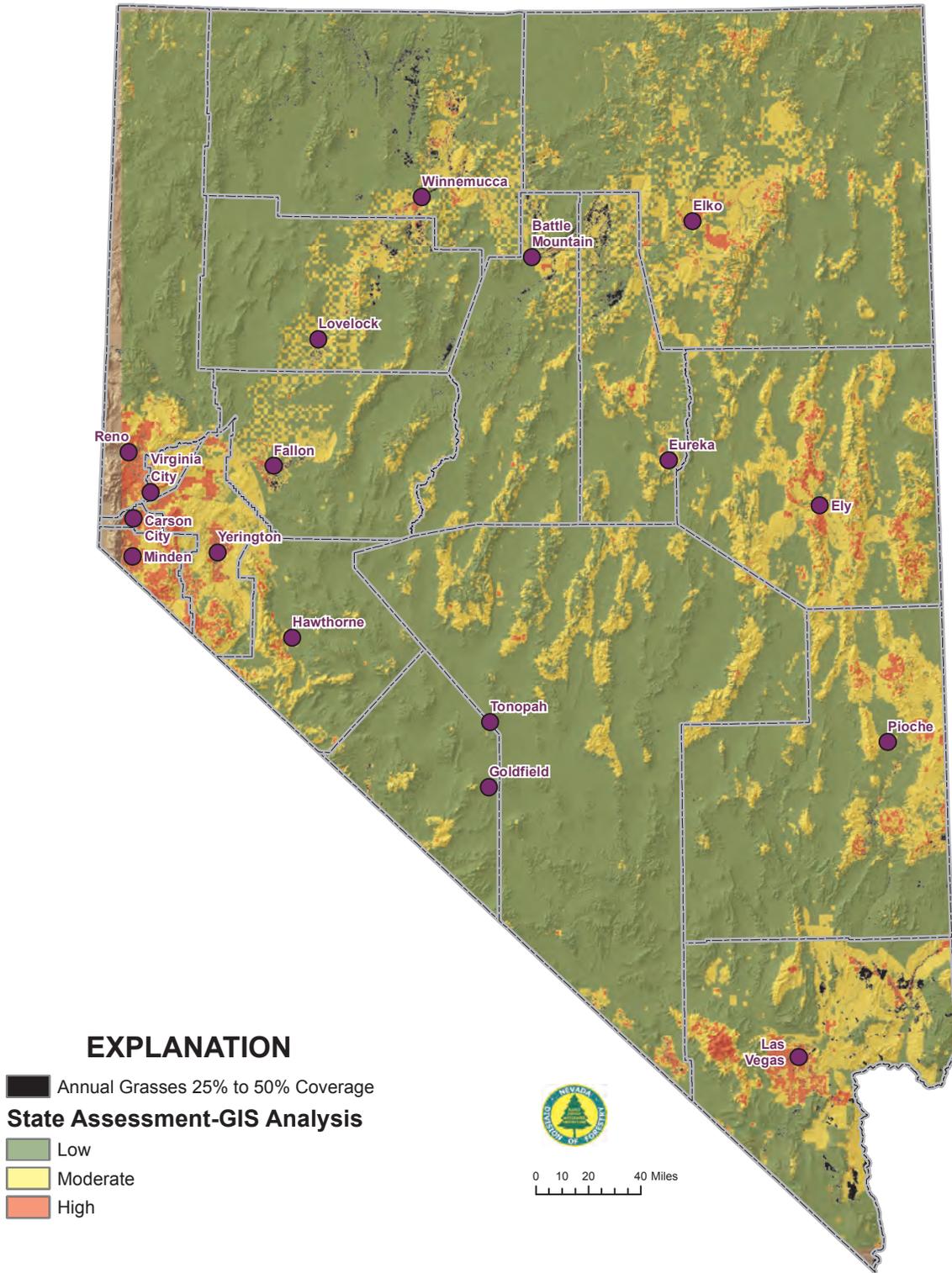


Figure 5. Annual grasses data overlaid on the final GIS analysis

## ***Development Risk***

Development Risk is intended to emphasize areas that are projected to experience increased urban expansion in the next 30 years. This layer was derived from Dr. David Theobolds work, and was described in the guidance from the U.S. Forest Service. This analysis uses the projected change between 2000 and 2030 to identify the areas experiencing the greatest population growth. The analysis shows that significant housing development is expected in many parts of the state over the next 30 years. The population in the west is growing rapidly and Nevada is no exception.

**National Theme:**

Conserve working forest lands.

**Strategic Objective:**

Identify and conserve high priority forest ecosystems and landscapes.

**National Direction:**

Assessments and strategies should attempt to identify, protect, and connect ecologically important forest landscapes, and open space, thus maintaining a green infrastructure, particularly around and within areas of population growth and development.

# Nevada Natural Resource Assessment

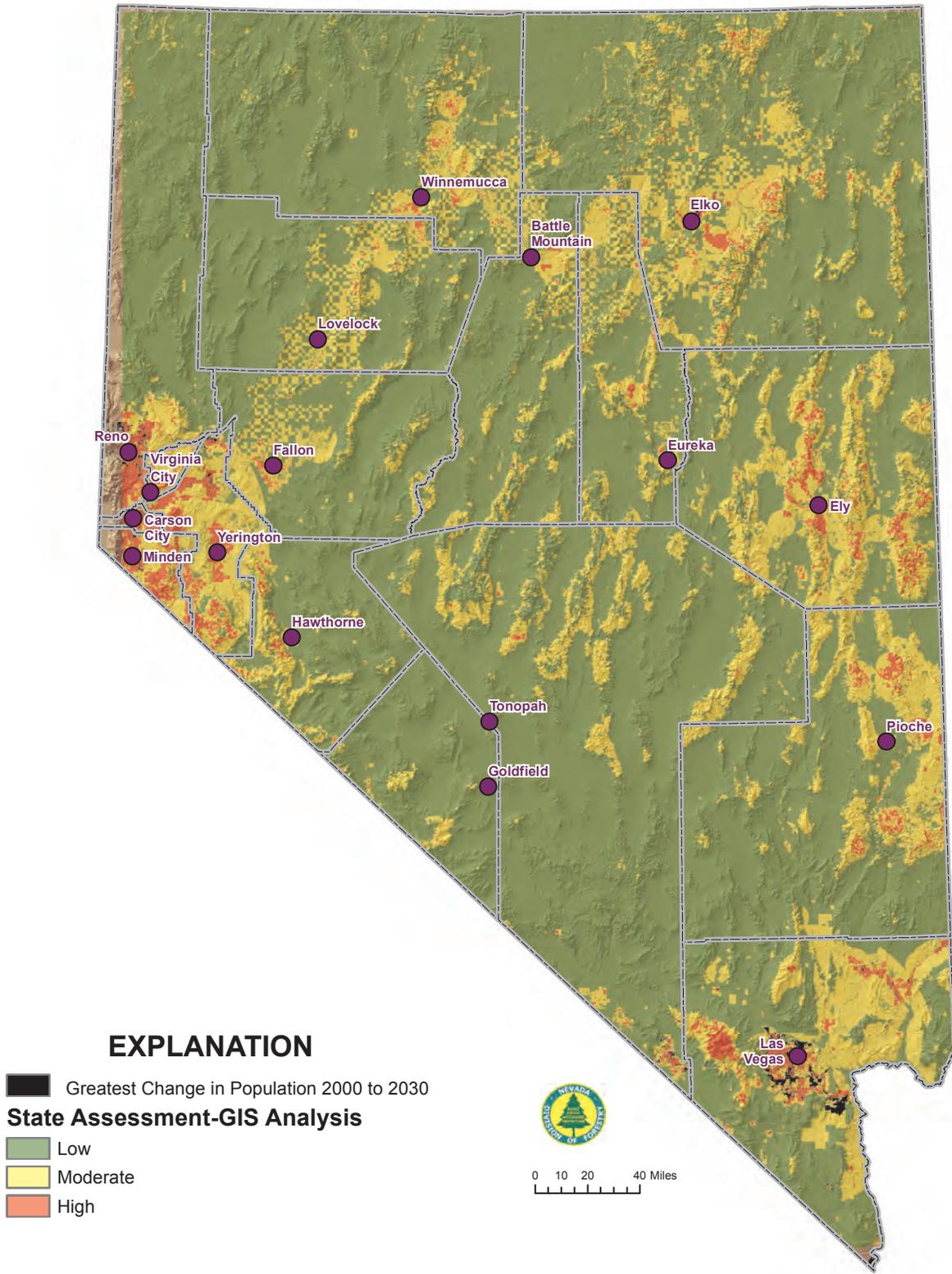


Figure 6. Population Change data overlaid on the final GIS analysis

## ***Forest Fragmentation***

This layer, taken from NDF's SAP analysis project, was included to emphasize areas where fragmentation and human activity makes a forest more susceptible to risk factors such as insects and disease and for conversion from timberland to non-timberland. Nevada is facing development pressure on its privately owned open spaces. Ranches and privately owned forest lands in particular, face economic pressure from high real estate prices as housing development occurs. Maintaining those privately held open spaces is critical to the concepts of conserving working landscapes, protecting forests from harm, and enhancing benefits of trees and forests.

**National Theme:**

Conserve working forest lands.

**Strategic Objective:**

Identify and conserve high priority forest ecosystems and landscapes.

**National Direction:**

Assessments and strategies should attempt to identify, protect, and connect ecologically important forest landscapes, and open space, thus maintaining a green infrastructure, particularly around and within areas of population growth and development.

# Nevada Natural Resource Assessment

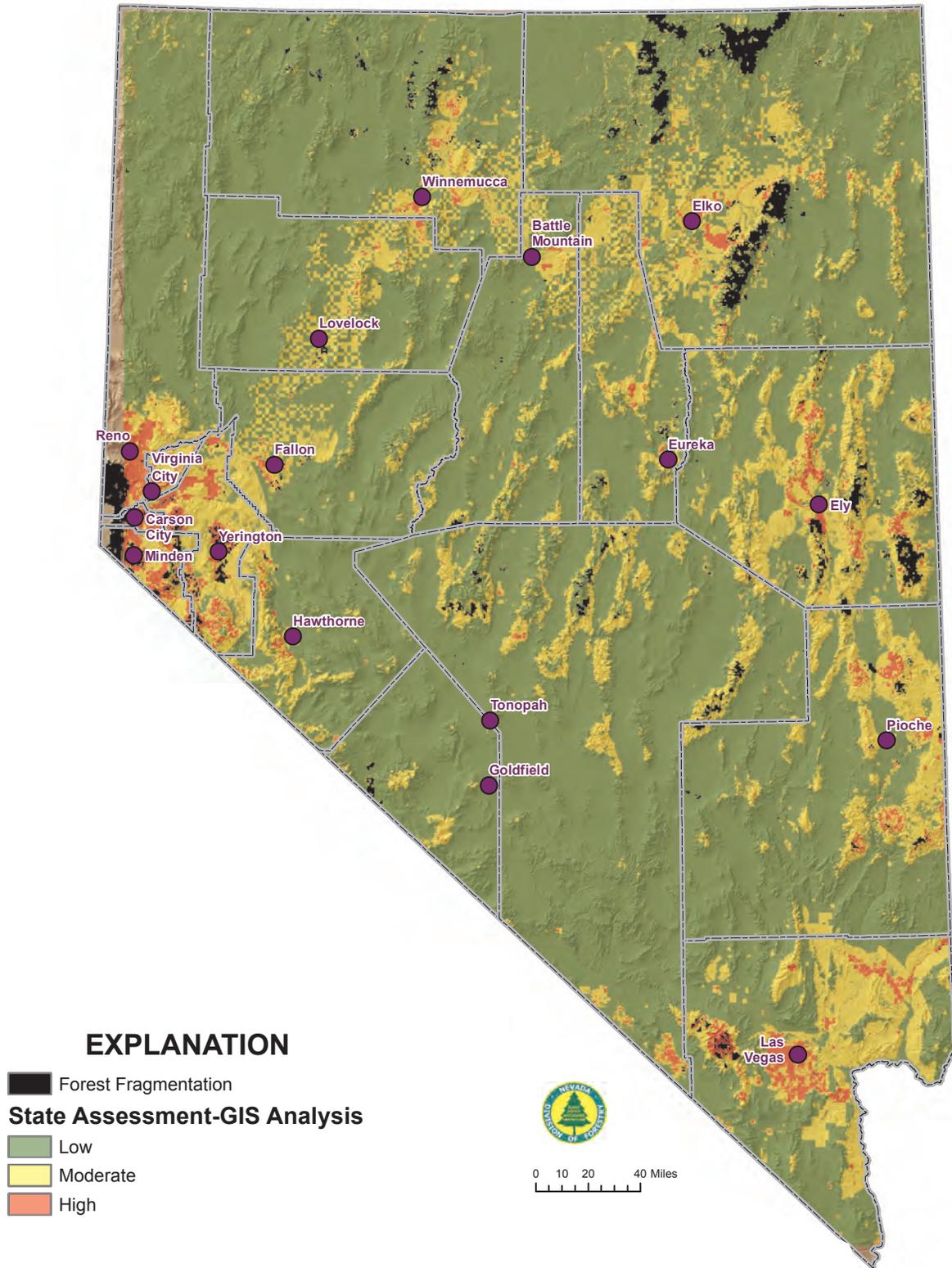


Figure 7. Forest Fragmentation data overlaid on the final GIS analysis

## ***Wildland Urban Interface***

Development in the wildland/urban interface (WUI) is growing in Nevada, like most of the West. A significant percent of new home construction is adjacent to or intermixed in areas of wildland vegetation. WUI fires pose great challenges to the fire service. Efforts to address the fire hazard associated with this development have focused on homeowner education, fuel reduction, and defensible space development. Cooperative projects across ownership boundaries are critical to mitigate fire risk around a community. Such projects are becoming more common in Nevada, but the WUI still presents a place that has major forest and resource concerns because of vegetation management and disturbance.

Fire suppression in the WUI is a high priority due to the risk to public and firefighter and other values. WUI fires also tend to be expensive because of the level of effort given to suppression of those fires. NDF used the WUI attributes of high, medium, and low intermix for the analysis.

Wildfire risk is a significant contributor to many of the priority areas. Efforts to address the wild-fire risk would be beneficial to the priority areas.

**National Theme:**

Protect forests from harm

Enhance public benefits from trees and forests.

**Strategic Objective:**

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

Assist communities in planning for and reducing wildfire risks.

**National Direction:**

Assessments should identify areas where management can significantly reduce the risk of catastrophic wildfire while enhancing multiple associated forest values and risks.

Assessments should identify areas where the effects of fire exclusion can feasibly be mitigated or countered through sound management, particularly where there are opportunities for federal, state, and community partnerships. Assessments should incorporate existing CWPP's and identify communities in especially vulnerable areas that need a CWPP.

# Nevada Natural Resource Assessment

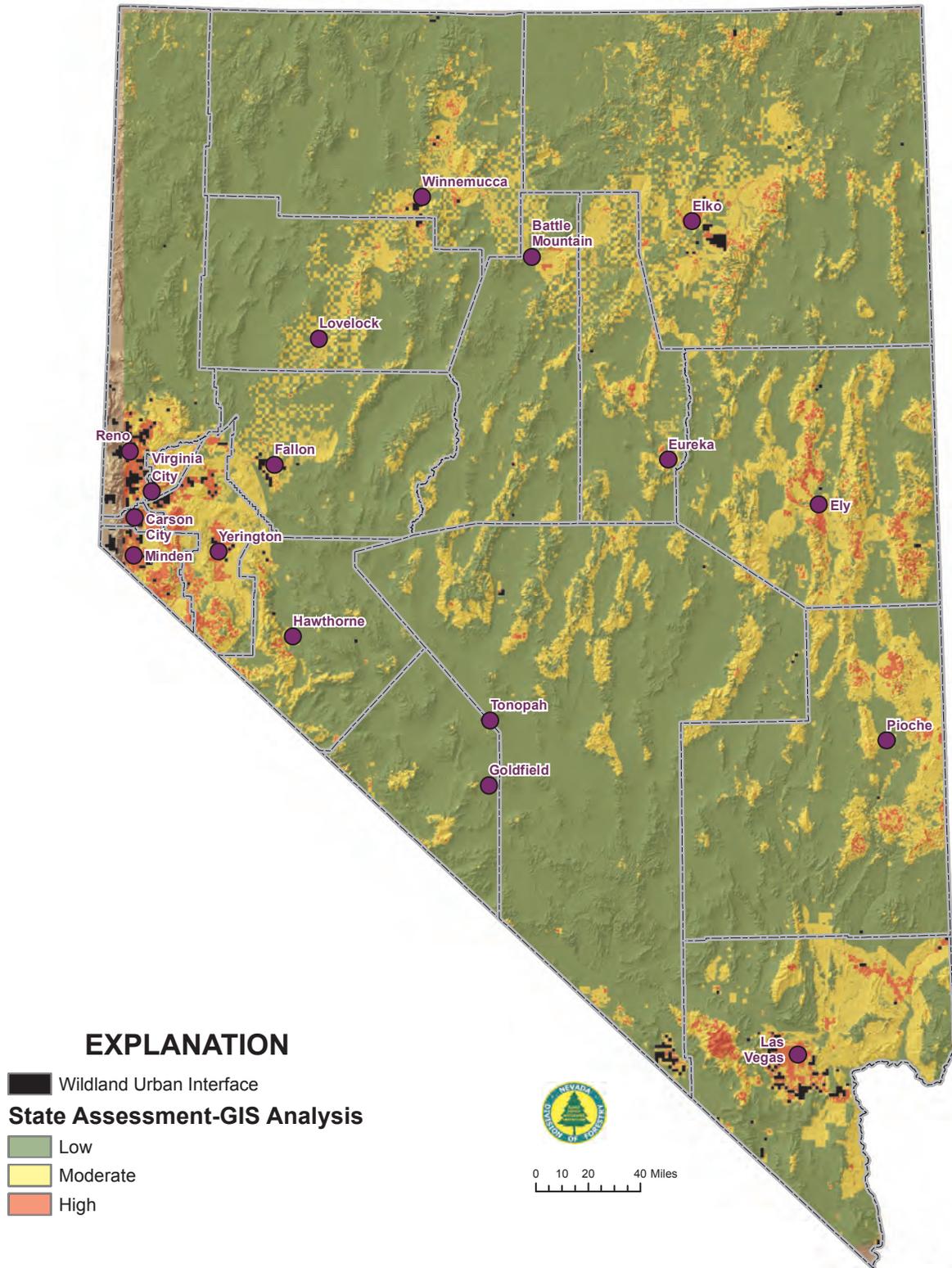


Figure 8. Wildland Urban Interface data overlaid on the final GIS analysis

## ***Wildfire Risk – Fire Regime Condition Class***

Fire Regime Condition Class (FRCC) data was used to address wildfire hazards outside of the wildland-urban interface. This data came from the Landfire National Data set. FRCC is a classification of the degree of departure in the vegetation community from the historic reference condition. There are three classes, with Class 2 and Class 3 indicating moderate and high departure respectively from the historic condition. Although FRCC is strictly a measure of ecological trends, and not a fire hazard metric, inferences about current fire hazard can be made using FRCC. According to the GIS analysis, Nevada has about 14,938,446.95 acres of FRCC Class 2 and Class 3 lands. In some cases, those lands would benefit from treatment prior to returning fire to the system to avoid the loss of ecosystem components.

**National Theme:**

Protect forests from harm

Enhance public benefits from trees and forests.

**Strategic Objective:**

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

Assist communities in planning for and reducing wildfire risks.

**National Direction:**

Assessments should identify areas where management can significantly reduce the risk of catastrophic wildfire while enhancing multiple associated forest values and risks.

Assessments should identify areas where the effects of fire exclusion can feasibly be mitigated or countered through sound management, particularly where there are opportunities for federal, state, and community partnerships.

# Nevada Natural Resource Assessment

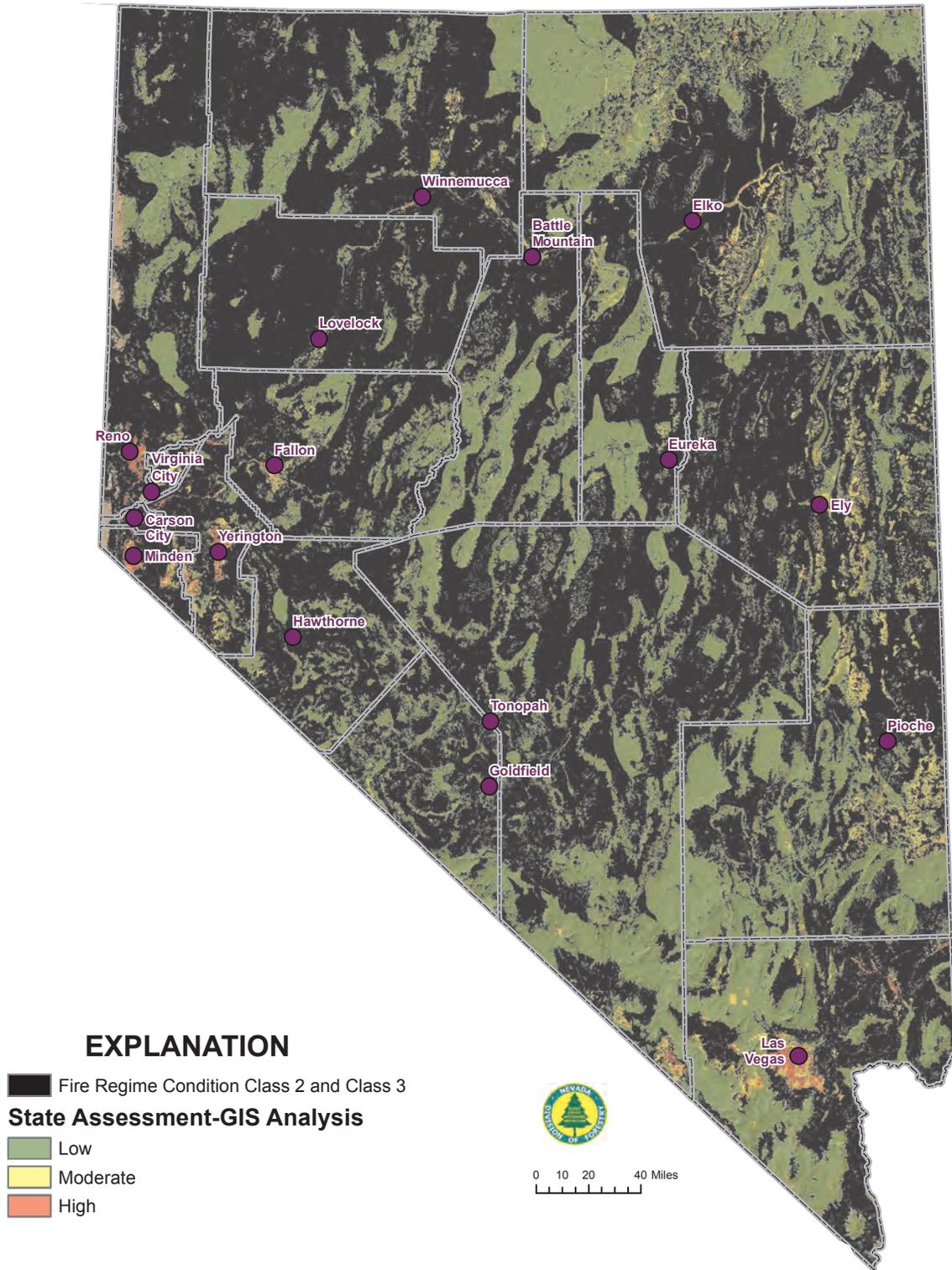


Figure 9. Forest Condition Class data overlaid on the final GIS analysis

## Forest Health Risk

The data source for this layer is the National Insect and Disease Risk Map (NIDRM) (FHTET). This is the 2006 all RISK layer data. The same data layer was used in NDF's SAP analysis.

**National Theme:**

Protect forests from harm.

**Strategic Objective:**

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

**National Direction:**

Assessments should identify high value forest landscape areas that are especially vulnerable to existing or potential forest health risk factors where management practices are most likely to prevent and mitigate impacts.

Assessments should also identify areas where management could successfully restore impacted forests.

Utilizing the NIDRM to locate the most vulnerable forests in Nevada is a first step. Many damaging agents are not included in this risk map but are impacting Nevada's forests, whether traditional, riparian, or community. Main environmental factors such as high stand densities and multiple contiguous drought years will continue to occur in Nevada and exacerbate the insect and disease outbreaks as well as defoliations over time. Proper forest stand management over time is key to creating health forests in Nevada. Managing insect epidemic outbreaks after they have occurred is usually not successful or expeditious. Brief descriptions of the current situation follow:

- Pinyon ips has taken out large numbers of pinyon in the western, central and southern portion of the state during the drought periods of 2003-2006 (over 4 million trees on 728,000 acres in 2004 alone when it peaked). With the moderate to severe sawfly/scale defoliation of many of the States pinyon stands in 2009, pinyon ips had increased to above endemic levels taking the opportunity to attack the weakened defoliated trees. This is especially evident in the western, central and southeastern portions of the State's pinyon forests. When these defoliations occur in long periods of drought much of the lower elevation pinyon will continue to die off. Large scale management of pinyon-juniper woodlands in eastern Nevada should take into account that natural influences such as insect outbreaks combined with drought will reduce the amount and densities of lower elevation pinyon.
- Mountain pine beetle populations are increasing statewide in the higher elevation white pines and in the western portion of Nevada on the large diameter lodge-pole pine forests. Much of the mortality in lodgepole pine forests is being attributed to mountain pine beetle populations in northern California migrating into Nevada.
- For the last three years large acreages of mountain mahogany (*Cercocarpus ledifolius*) have been defoliated by predominantly drought conditions. In 2009, many of the centers of these defoliated forests had died out. As drought years continue in successive years, this pattern can be expected to continue.
- Dwarf mistletoe is one of the most present and destructive disease in Nevada in pinyon pine, lodgepole, Jeffrey, ponderosa pine, and white fir forest is present in the forested lands and throughout Nevada. There is no mapped layer of this infection available for the State, but it has affected many acres significantly. In many of the heavily affected areas, bark

# Nevada Natural Resource Assessment

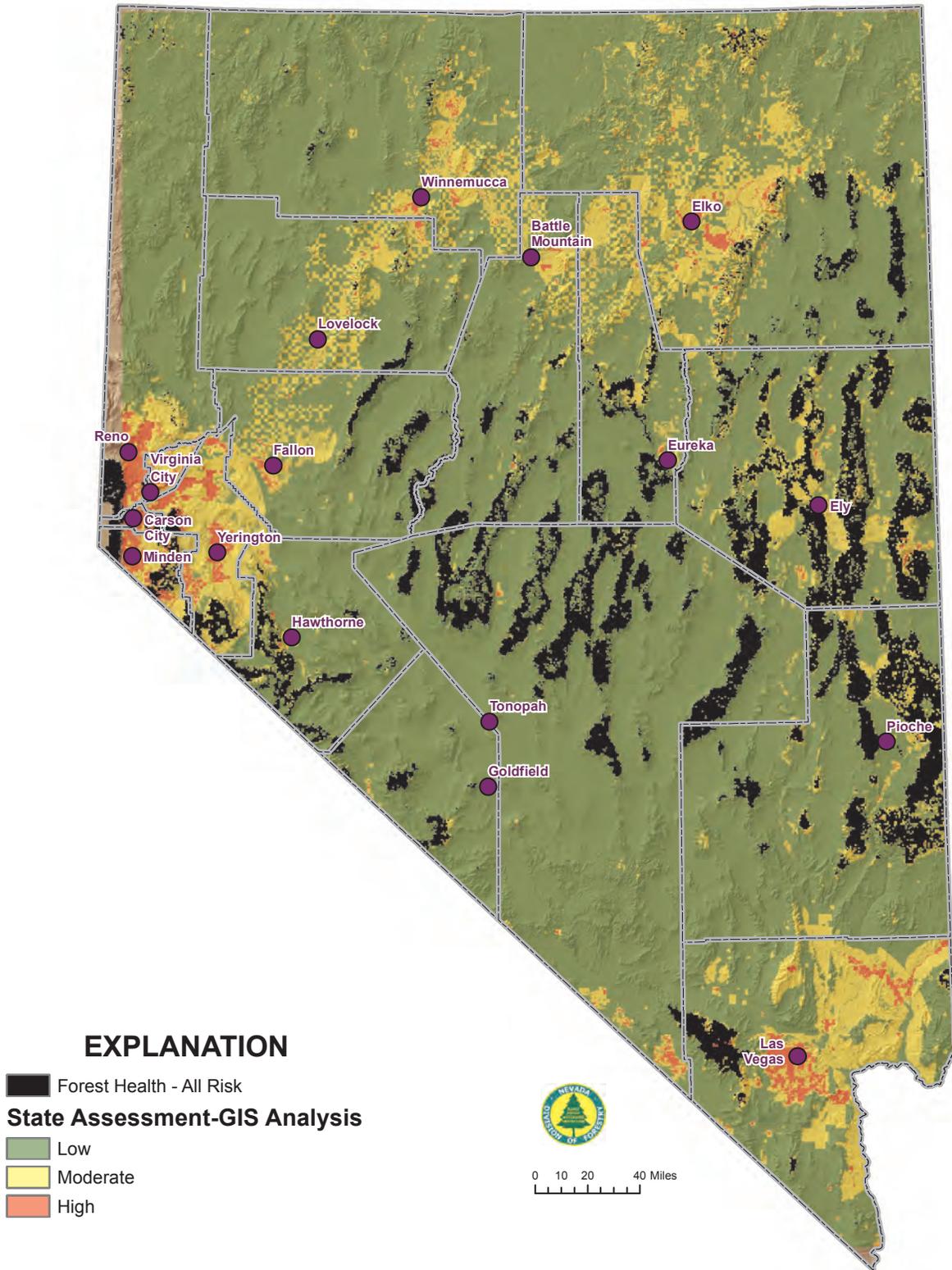


Figure 10. Forest Health-All Risk data overlaid on the final GIS analysis

## Nevada Natural Resource Assessment

beetles are often increasing significantly when drought years occur.

- Salt cedar (tamarisk) are exotic plants that are replacing native willow and cottonwood forests. In northern Nevada, where the tamarisk defoliating beetle (*Diorhabda elongate*) has been released and introduced, it has helped keep the tamarisk spread and infestation to reasonable levels. In the south, agencies are working on treating the tamarisk to eradicate it and re-introduce native vegetation into the riparian areas. The tamarisk beetle has moved into the southern Utah area and may move into southern Nevada tamarisk stands over time.
- While the drought has eased somewhat in 2007 and 2008, forests will be impacted until a number of years of average to above-average precipitation occur, fires and other management reduce competition between trees for scarce resources.
- Exotic pests pose a continuing threat to native forests in the state.

Most communities in Nevada were developed on valleys or near mining claims. The early source of plant materials was generally confined to riparian forests of willow and cottonwoods growing naturally along rivers and streams or PJ or mixed conifer stands. Cottonwoods are not long lived and these over-mature trees are rapidly declining in many communities. Many were planted as street trees and are not being replaced with more diverse species or are not being replaced at all. The national risk assessment layer used in this analysis does not evaluate all of the important forest insect and disease agents. Therefore, Figure 10 shows the state assessment final map with forest health risk as an overlay. Forest health risk is a significant contributor to many of the priority areas. Efforts to address the forest health risk would be beneficial to the priority areas. On many of the areas shown under high risk based on pinyon pine engraver beetle, the stands also have a high risk for pinyon needle defoliation that will periodically affect Nevada's pinyon forests.

**Nevada Natural Resource Assessment**



**Top Photo: Mountain Pine Beetle caused mortality  
Bottom Photo: Pinyon Ips caused mortality**

## ***Threatened and Endangered/Sensitive Species***

This data layer includes sensitive species data from the Nevada Natural Heritage Program and Critical Habitat Areas from USFWS. The information ranged from a precise area in which a field observation was made to a general area in which they believe the species may inhabit the area. This data was used to maintain consistency with SAP. Nevada Department of Wildlife completed a Wildlife Action Plan in 2006. The plan targets the species of greatest conservation need and the key habitats on which they depend, with strategies for on the ground actions for conserving wildlife in each key habitat. Data from this plan is overlain on the priority landscapes to determine appropriate management strategies for conservation of species located with these areas.

Nevada's tremendous diversity of wildlife is derived from its climate and complex geography; the many mountain ranges are effectively isolated from one another by arid and treeless basin. The varied habitats and landscapes of the Great Basin, Mojave Desert, Sierra Nevada, and Columbia Basin all contribute to the biological complexity of our great state. Among the 50 states, Nevada ranks eleventh in overall biological diversity. This rich diversity of wildlife and habitats helped form Nevada's wildlife heritage and provides the setting important to many of our family traditions. Our children and future generations deserve the chance to enjoy this valuable wildlife legacy.

**National Theme:**

Enhance public benefits from trees and forests.

**Strategic Objective:**

Protect, conserve, and enhance wildlife and fish habitat.

**National Direction:**

Assessments should identify forest landscapes that represent or contribute to viable wildlife habitats, contain high species richness, and/or represent core habitat for focal conservation species.

Assessments should incorporate comments from state wildlife organization and state wildlife action plans

# Nevada Natural Resource Assessment

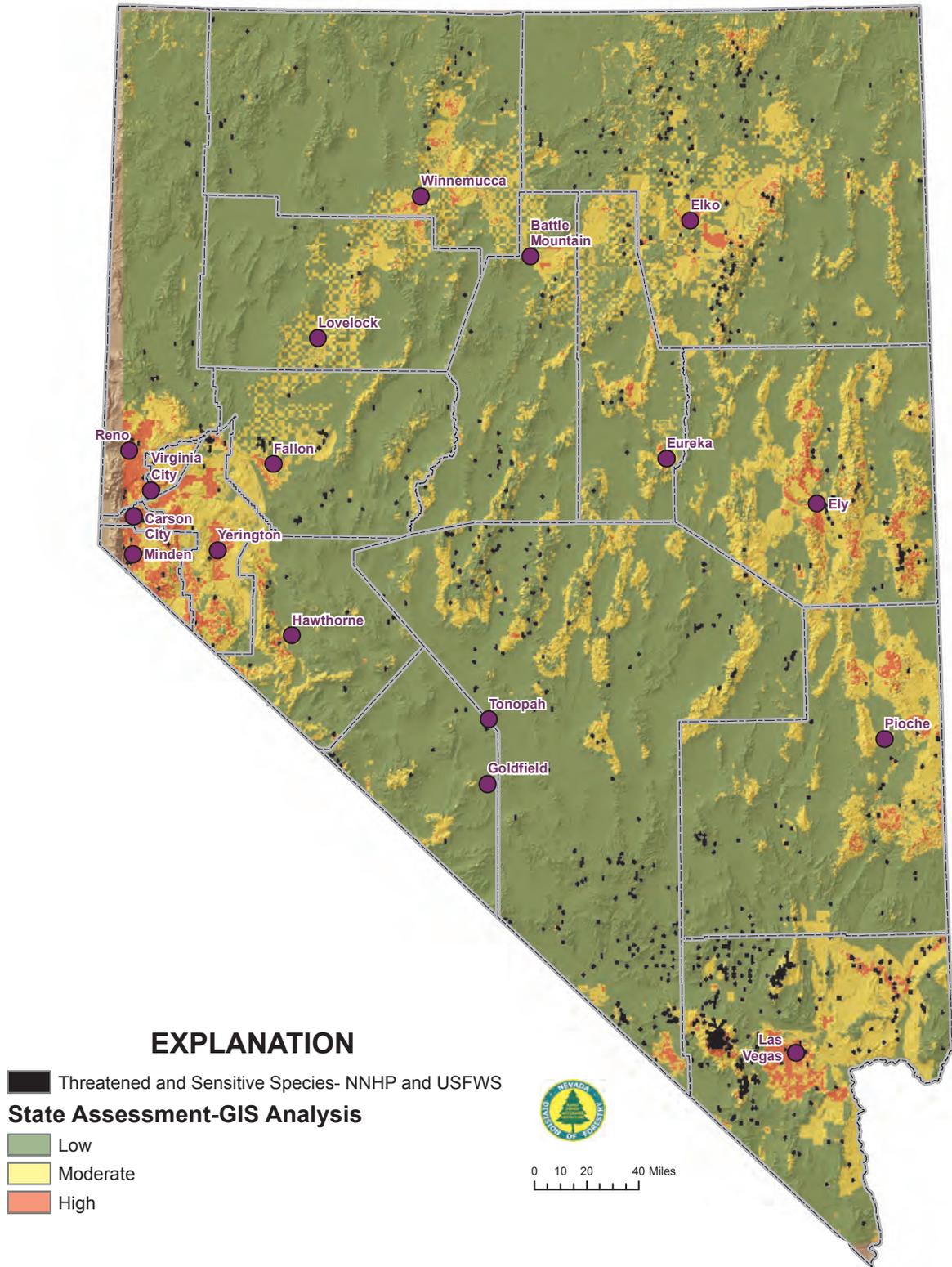


Figure 11. Threatened, Endangered and Sensitive Species data overlaid on the final GIS analysis

## ***Water Supply***

This layer represents Nevada's sphere of influence of a well among the public water supply. A majority of Nevada's drinking water comes from ground water. This data set is from Nevada Division of Environmental Protection. NDF worked with the Bureau of Water Pollution Control and used their well protection guidelines that call for a 6,000 foot buffer (protection zone) around each well.

In the arid West, water quality and supply has always been a critical issue for people, wildlife, industry, and agriculture. Long term drought, like Nevada is recently experiencing, increases the focus on the issue. Pressure on the available water supply can be intense due to competing demands.

Nevada's water supply from both surface and ground water. Forest management activities that protect watersheds used for drinking water supplies and that protect well heads are critical to maintaining this invaluable resource.

Water quality and supply is a significant contributor to many of the priority areas and watershed management efforts to address water quality and supply would be beneficial to the priority areas. Studies have shown the positive effects that trees or other desirable vegetation cover can have on the water quality in a watershed.

**National Theme:**

Enhance public benefits from trees and forests.

**Strategic Objective:**

Protect and enhance water quality and quantity.

**National Direction:**

Assessments should identify watersheds where continued forest conservation and management is important to the future supply of clean municipal drinking water, or where restoration or protection activities will improve or restore a critical water source.

# Nevada Natural Resource Assessment

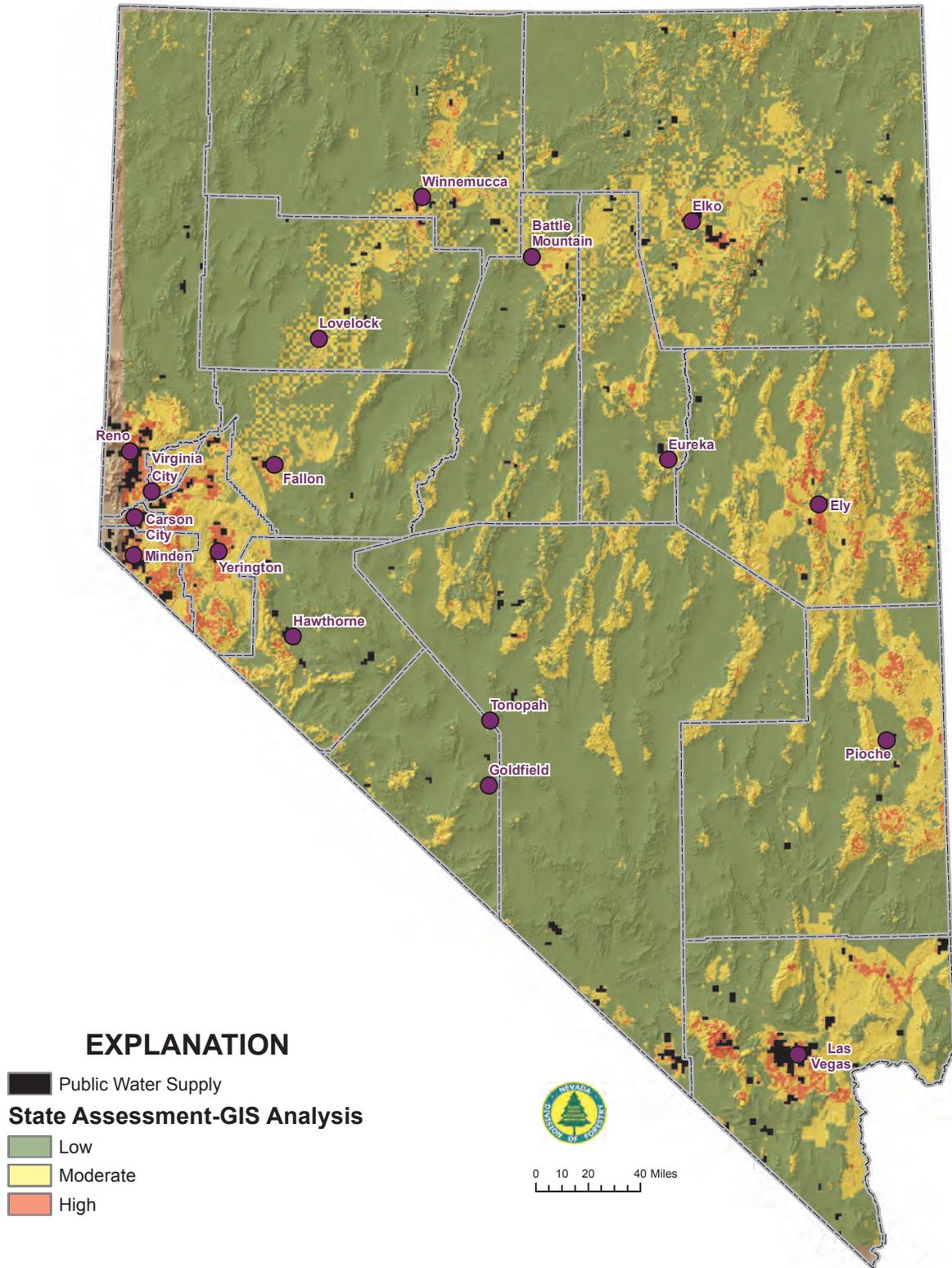


Figure 12. Public Water Supply data overlaid on the final GIS analysis

## ***Water Quality***

This data layer was created from the EPA 303d classification on streams and water bodies with impaired water quality. Watersheds containing streams and water bodies classified as impaired were included in areas of concern. The major watersheds are designated by the U.S. Geological Survey's Hydrologic Unit Codes (HUCS). Certain changes in forest conditions can help mitigate water quality degradation and in turn slowly help improve water quality.

In the arid West, water quality and supply has always been a critical issue for people, wildlife, industry, and agriculture. Pressure on the available water supply is intense as a result of the competing demands. Droughts common in Nevada increase the focus on the issue.

Water quality and supply is a significant contributor to many of the priority areas and efforts to address water quality and supply would be beneficial to the priority areas. Nevada's water comes from mountain snowmelt stored in reservoirs and from ground water. Forest management actions maintain water yield and protect water quality are vital. Studies have shown the positive effects that trees and other desirable vegetative cover can have on the water quality in a watershed.

**National Theme:**

Enhance public benefits from trees and forests.

**Strategic Objective:**

Protect and enhance water quality and quantity.

**National Direction:**

Assessments should identify watersheds where continued forest conservation and management is important to the future supply of clean municipal drinking water, or where restoration or protection activities will improve or restore a critical water source.

# Nevada Natural Resource Assessment

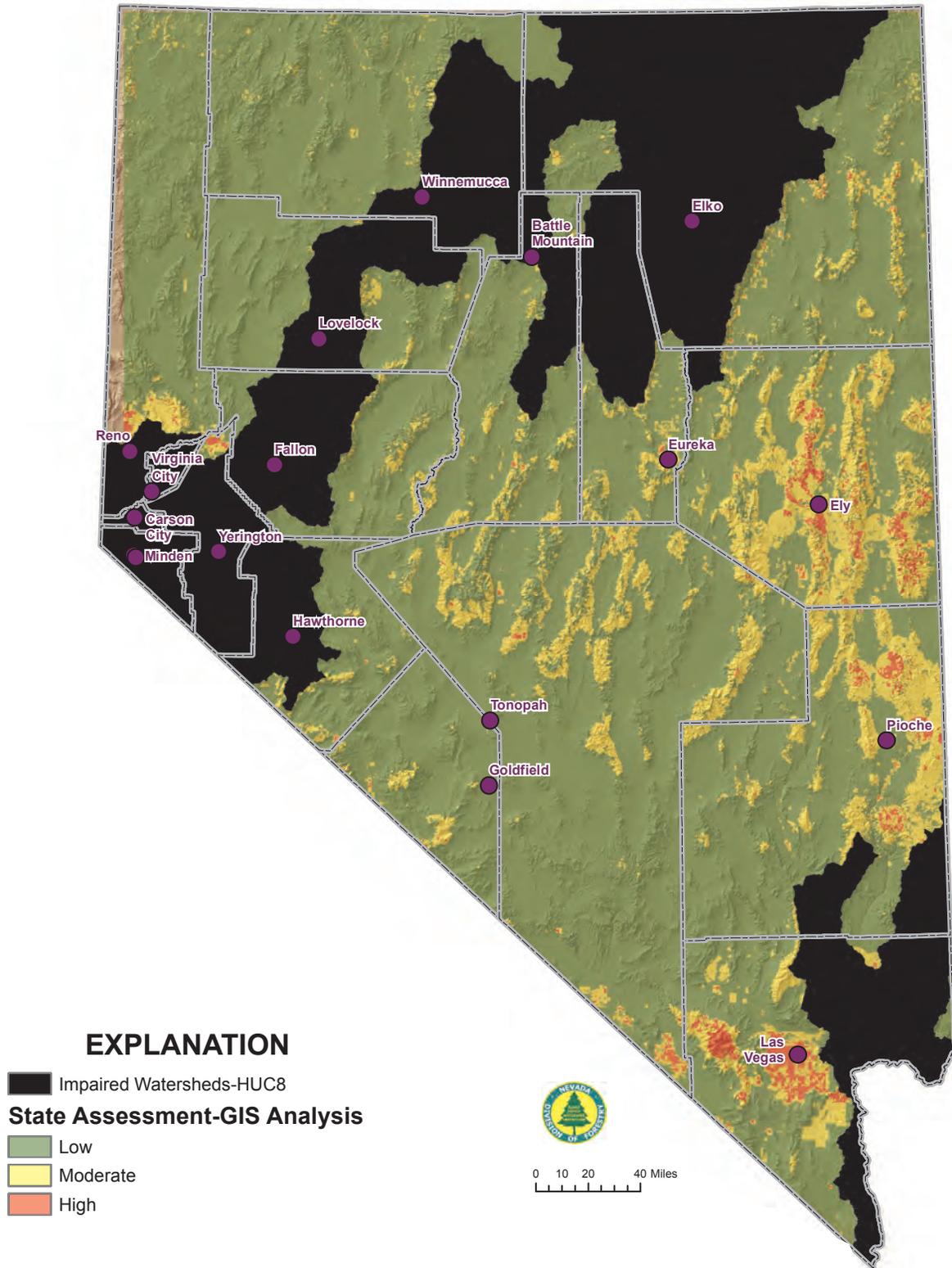


Figure 13. Impaired Watersheds data overlaid on the final GIS analysis

## ***Economic Potential – Biomass***

This data set was created using a 50 mile buffer around current biomass utilization facilities to show where the potential fuel sources could be located and would be economically feasible to transport to and operate the facilities. The intent is to represent all potential biomass sources, rural and urban.

Harvesting activity is typically associated with fuel management, timber stand improvement, salvage or conversion for development. Increasing efforts to utilize residues from harvesting activities are important to sustaining the growing biomass industry in the state.

Using biomass to heat schools, produce wood pellets, and generate electricity have all been explored. Federal and state governments have provided technical assistance and funding to promote new markets. Economic factors, such as the cost to transport materials to processing facilities, have made establishment of these new markets difficult. Current economic factors dictate that new markets would be most successful if located near a reliable sources of raw material to minimize the transportation costs for the biomass. Additionally, federal agencies will need to ensure a long-term supply of feed stock to invite investors interested in construction of biomass utilization facilities.

**National Theme:**

Enhance public benefits from trees and forests  
Conserve working forest lands.

**Strategic Objective:**

Maintain and enhance the economic benefits and values of trees and forests.  
Actively and sustainably manage forests.

**National Direction:**

Assessments should identify forest landscape areas where there is a real, near term potential to access and supply traditional, non-timber, and/or emerging markets such as those for biomass or ecosystem services.

Assessments and strategies can identify viable and high potential working forest landscapes where landowner assistance program can be targeted to yield the most benefit in terms of economic opportunities and ecosystem services.

Assessments and strategies can also identify opportunities for multi-landowner landscape scale planning and landowner aggregation for access to emerging ecosystem service markets.

# Nevada Natural Resource Assessment

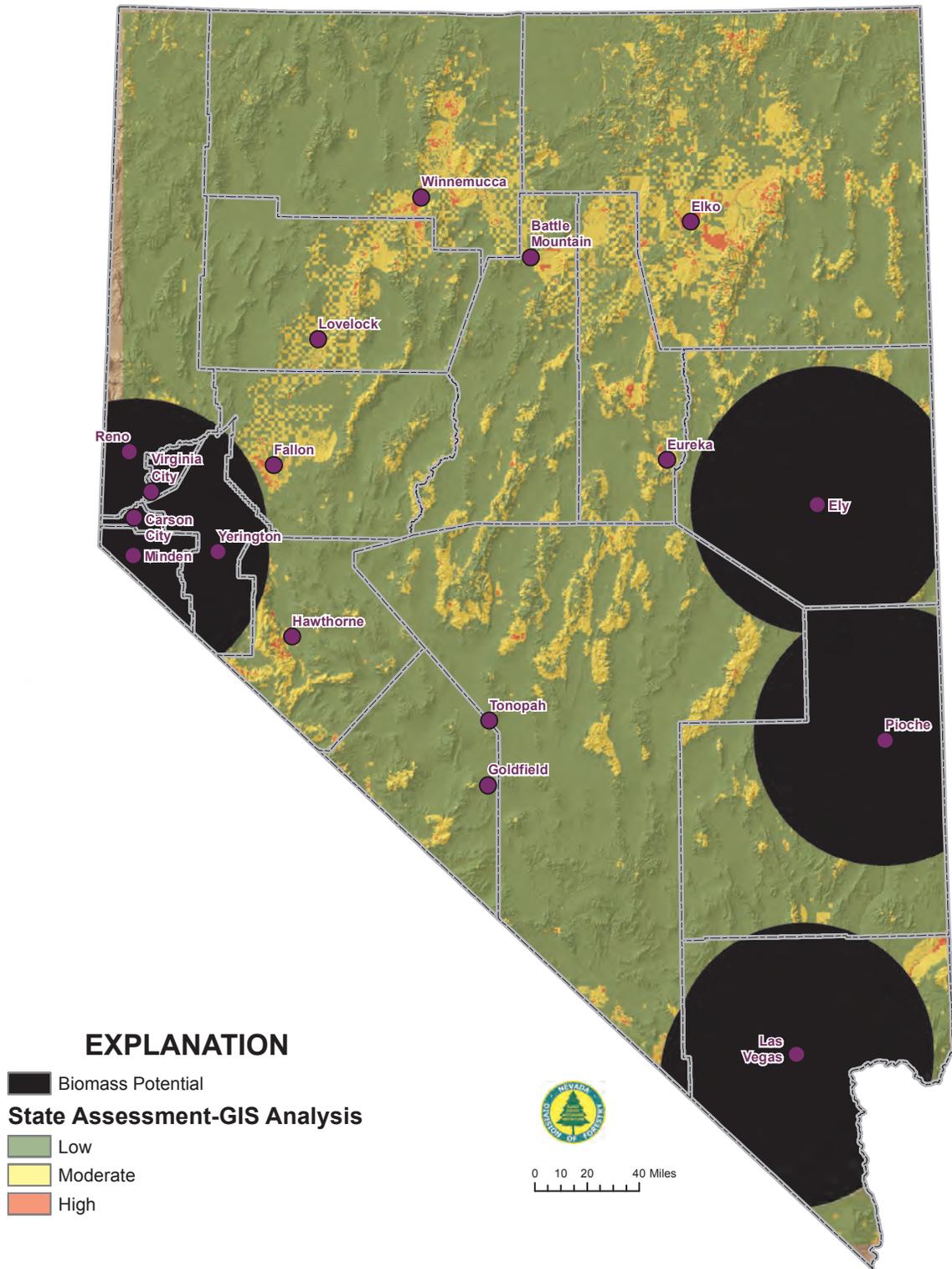


Figure 14. Economical Potential Areas for Biomass data overlaid on the final GIS analysis

## ***Green Infrastructure/Community Forestry***

Urban Boundaries were selected as the layer to depict “green infrastructure” in Nevada. This layer then would include all the open spaces like parks, golf courses, common areas, etc. located within communities, as well as the urban forest itself. As shown on the following map, most of the “green infrastructure layer is in priority areas as identified by the assessment.

**National Theme:**

Conserve working forest lands

Enhance public benefits from trees and forests.

**Strategic Objective:**

Identify and conserve high priority forest ecosystems and landscapes.

Actively and sustainably manage forests.

Improve air quality and conserve energy.

**National Direction:**

Assessments should attempt to identify, protect, and connect ecologically important forest landscapes and open space, thus maintaining a green infrastructure, particularly around and within areas of population growth and development.

Identify areas where management of the urban or suburban forest will have a positive and measurable impact on air quality and produce substantial energy savings.

In urban and suburban areas, forest agencies can assist communities to develop sustainable forest management and green infrastructure programs.

# Nevada Natural Resource Assessment

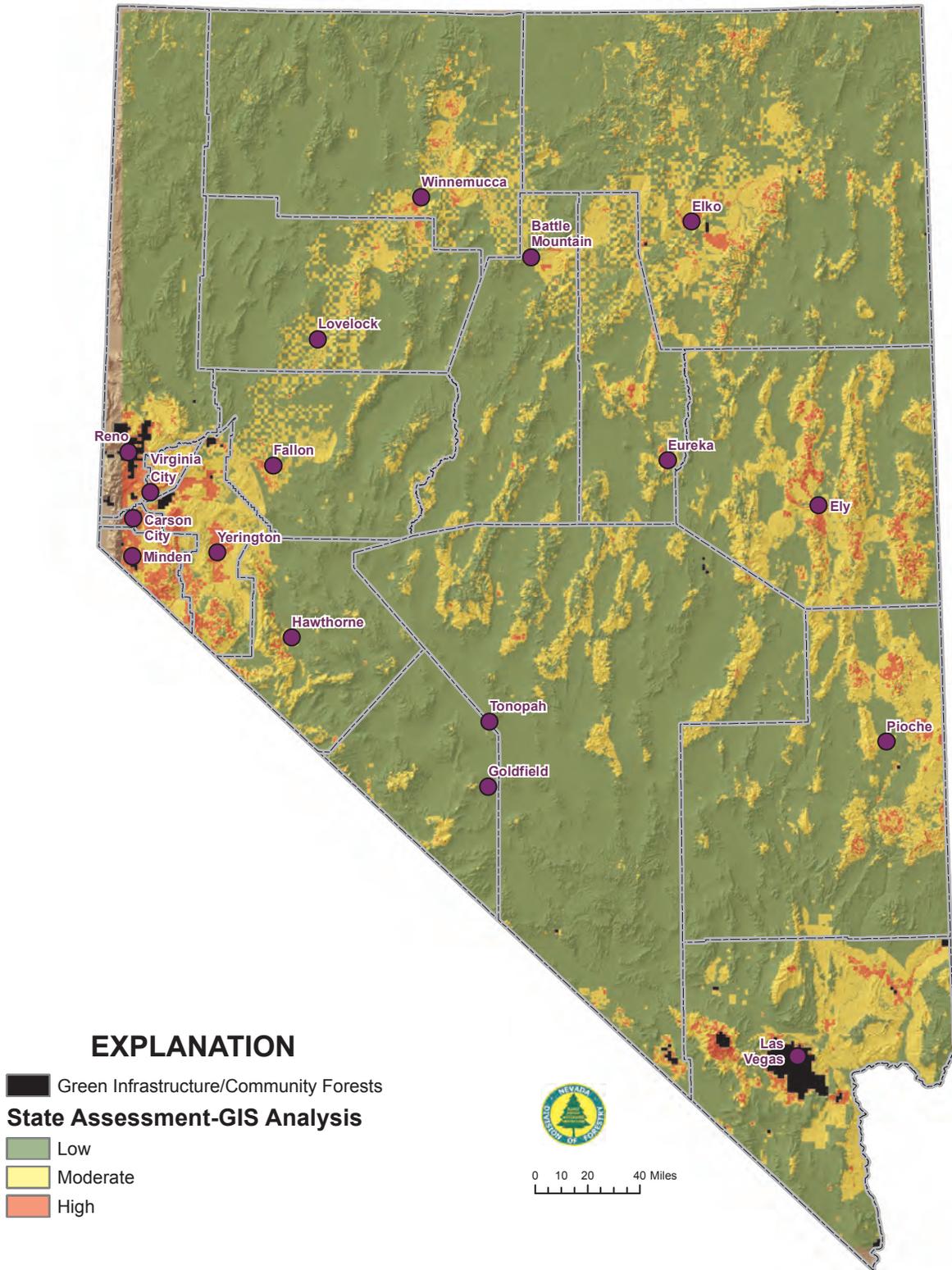


Figure 15. Green Infrastructure/Community Forests data overlaid on the final GIS analysis

## ***BLM/USFS Projects***

This layer was specified in the national guidance from the USFS and S&PF to identify potential partners and work in cooperation with them. NDF decided to develop this layer due the importance of identifying projects and practices by different agencies within the state. This data set was created using a five mile buffer placed around each point to assist in creating the raster data set and to make sure the projects were represented in the analysis. This layer identifies opportunities for coordination between NDF and adjacent USFS/BLM projects for the next 5 to 10 years, and that these areas have been prioritized for resource management or improvement projects.

**National Theme:**

Conserve working forest lands.

**Strategic Objective:**

Identify and conserve high priority forest ecosystems and landscapes.

Actively and sustainably manage forests.

**National Direction:**

Assessments should identify forest landscape areas where there is a real, near term potential to access and supply traditional, non-timber, and/or emerging markets such as those for biomass or ecosystem services.

Assessments can identify viable and high potential working forest landscapes where land-owner assistance programs can be targeted and working relationships and partnerships with USFS and BLM can be identified.

# Nevada Natural Resource Assessment

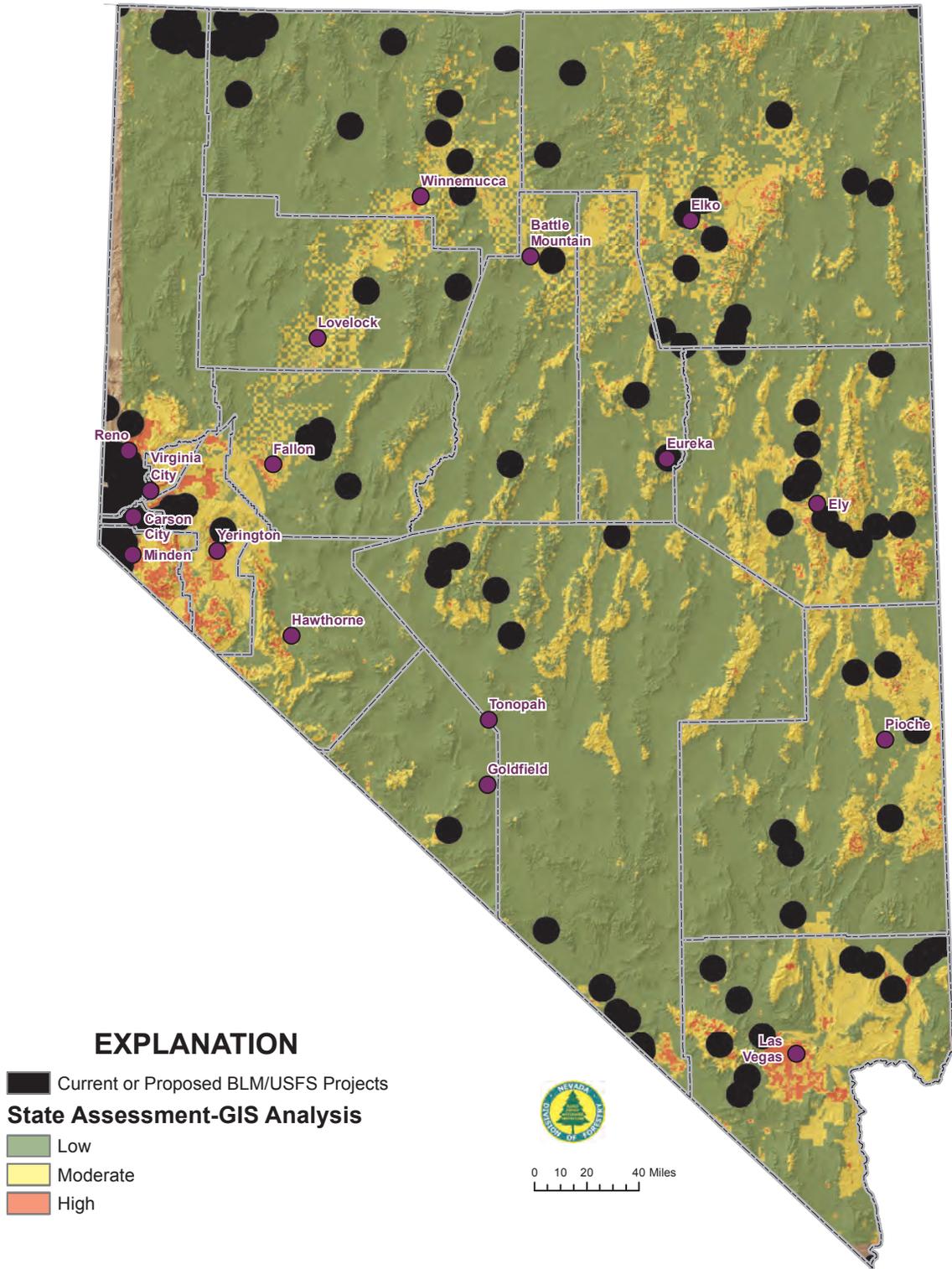


Figure 16. Current or Proposed BLM/USFS project data overlaid on the final GIS analysis

## ***Community Wildfire Protection Plans***

Nevada's Community Wildfire Protection Plans (CWPP) were used to address wildfire hazards facing communities in the state. CWPPs are an important tool for county governments, county fire organizations, communities, and land management charged with providing wildfire protection. A CWPP identifies communities at risk and recommends measures to mitigate the risk across ownership boundaries. Land management agencies have begun to pay close attention to CWPP's and in many cases projects recommended by a CWPP have become high priorities for land managers. This data layer came from the Nevada State office of the Bureau of Land Management.

**National Theme:**

Enhance public benefits from trees and forests.

**Strategic Objective:**

Assist communities in planning for and reducing wildfire risks.

**National Direction:**

Assessment should incorporate existing CWPPs and identify communities in especially vulnerable areas that need a CWPP.

# Nevada Natural Resource Assessment

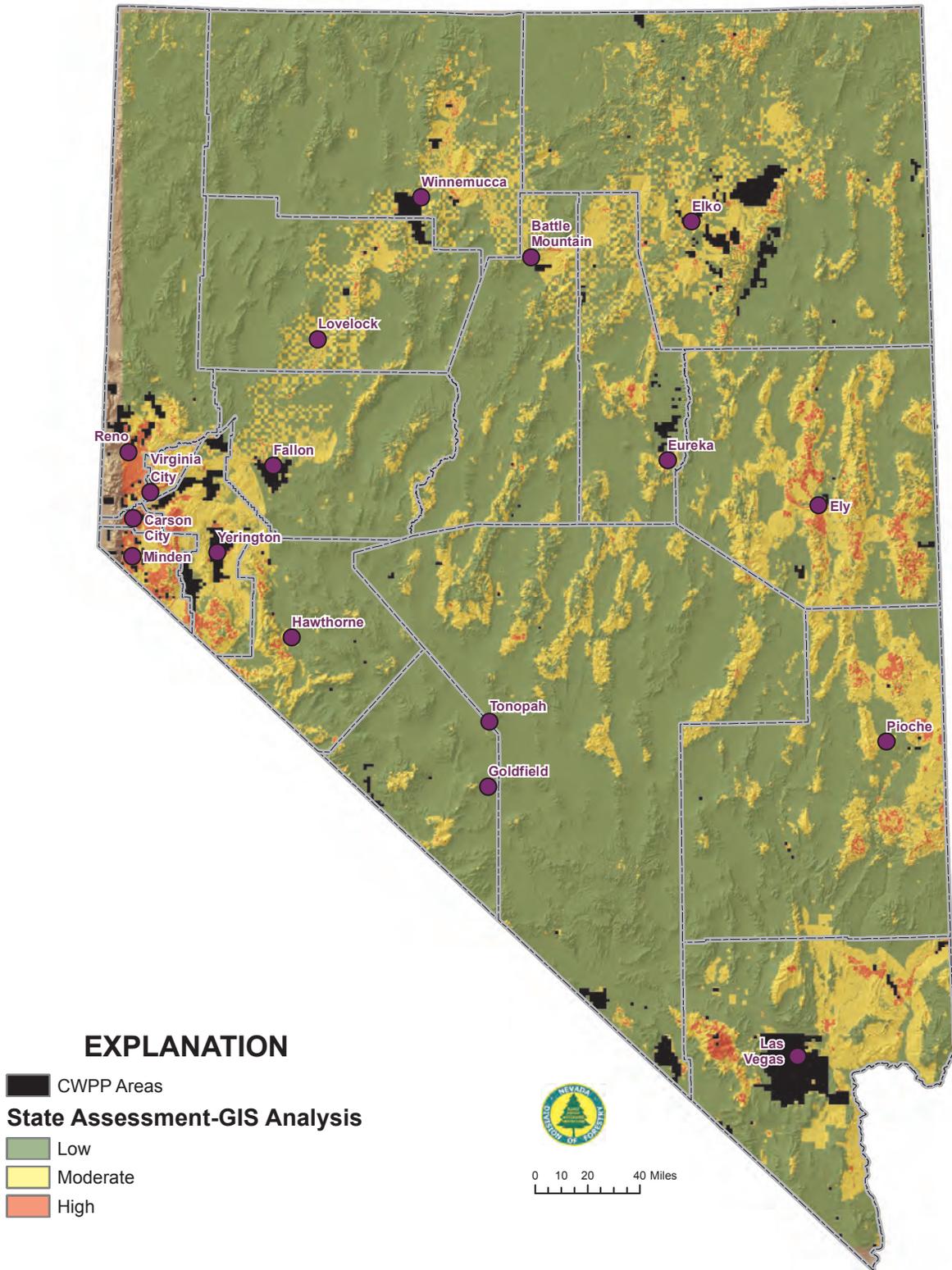


Figure 17. CWPP data overlaid on the final GIS analysis

## ***Forest Stewardship Potential***

This layer identifies lands with high priority for forest stewardship as defined by the SAP. For more information on how this data set was created, please see [NDF's Spatial Assessment Project's assessment and methodology paper ([http://www.fs.fed.us/na/sap/products/NV/nv\\_methodology.pdf](http://www.fs.fed.us/na/sap/products/NV/nv_methodology.pdf)).]

This layer was included to emphasize areas where the Spatial Analysis Project (SAP) identified lands as high priority for stewardship planning. These are private lands where planned management would be the most beneficial to benefit the resources and address the threats identified by the SAP analysis.

Priority forest stewardship areas correspond with priority areas identified by the state forest resource assessment on private lands. Investment of resources to ensure appropriate management of private lands will benefit the priority areas.

**National Theme:**

Conserve working forest lands.

**Strategic Objective:**

Identify and conserve high priority forest ecosystems and landscapes.

Actively and sustainably manage forests.

**National Direction:**

Assessments should identify forest landscape areas where there is a real, near term potential to access and supply traditional, non-timber, and/or emerging markets such as those for biomass or ecosystem services.

Assessments can identify viable and high potential working forest landscapes where land-owner assistance programs can be targeted.

# Nevada Natural Resource Assessment

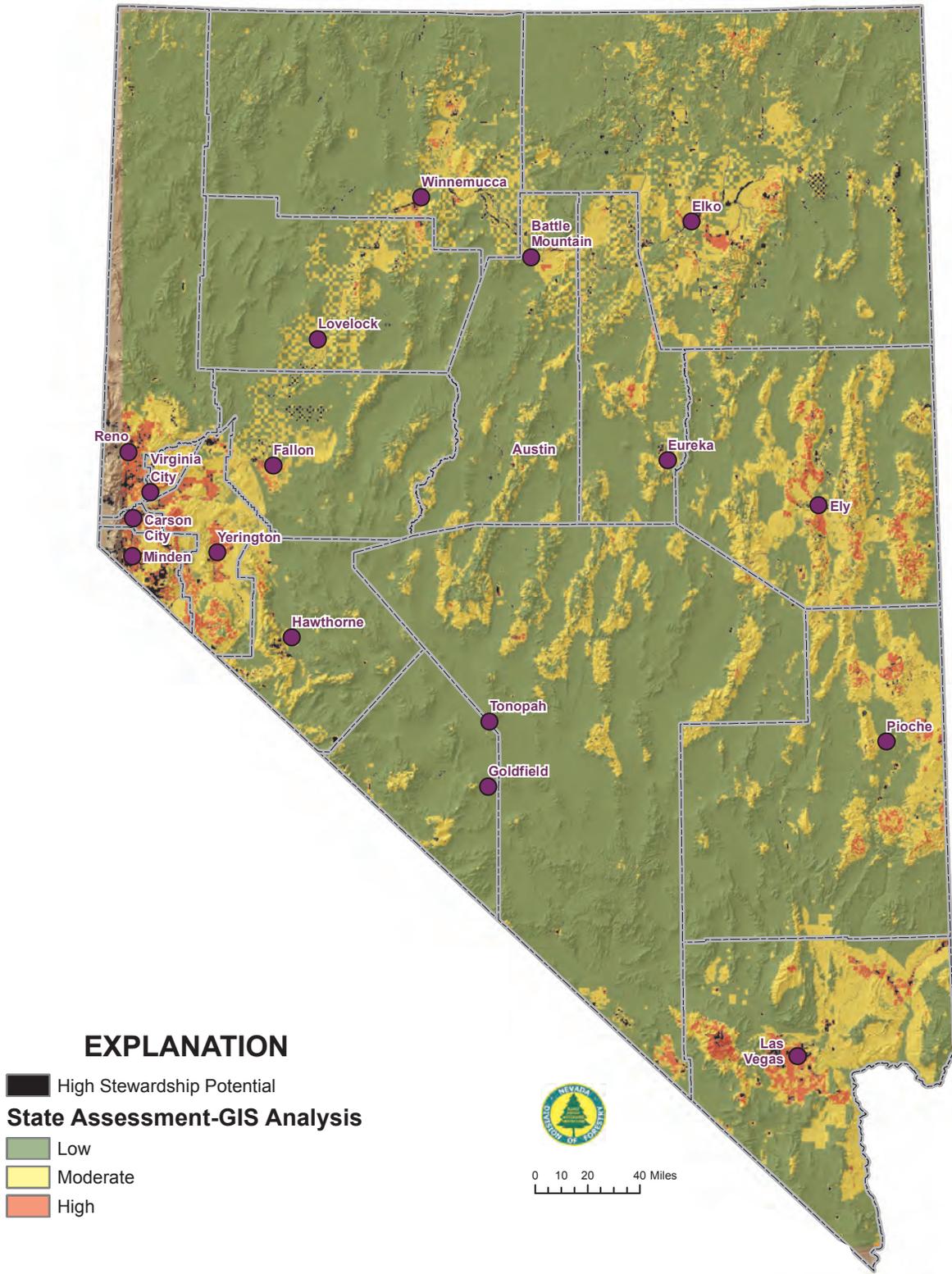


Figure 18. High Forest Stewardship Potential data overlaid on the final GIS analysis

## GIS Analysis & Priority Landscapes

NDF conducted the GIS analysis for this assessment using the 17 layers previously identified and explained. All the layers are tied to one of the three national themes identified by the USFS and S&PF in their direction for state assessments. Most of the strategic objectives associated with national themes were directly addressed by one or more of the data layers used in the analysis. One strategic objective, “Connect people to trees and forests, and engage them in environmental stewardship activities” did not lend itself to any data layer NDF considered using for the assessment. However, NDF feel it addresses this objective on regular basis through its conservation education program and collaborative efforts with environmental education groups in the state.

NDF chose to use equal weighting of layers because the national direction gives states the opportunity to complete a separate analysis for individual resource management concerns. The initial assessment used all 17 layers to help define priority landscapes across the state. The initial GIS analysis did not provide the discriminatory power to discern which of the layers were combining to create high priority landscapes.

Figure 19 shows the results of the preliminary priority landscape analysis. The areas shown in red are the highest priority areas, and represent geographic areas where 4 or more data layers used in the GIS analysis overlap. Individual layers are shown in relationship to the final GIS composite to help the reader understand the extent of each layer

An additional shortcoming of the initial analysis was that the large percentage of federally managed land in Nevada logically led to a significant amount of federal ownership within the priority landscapes. High priority areas resulting from the initial analysis contained 64% federal lands. Management of these lands is critical to the state in terms of water supply, recreation opportunities, wildlife habitat and other natural resources. However, these lands are not the focus of NDF, nor does the agency have the ability to direct the management activities on federally owned lands. Therefore, the subsequent evaluation was performed that produced a smaller, more focused group of priority landscapes that will be the primary focus of NDF in its future efforts. That is not to say that where opportunities arise for our participation in geographic areas outside of the identified areas of focus we will not participate. It’s simply an explicit acknowledgment of our agency’s statutory mission of working on state and local government and privately owned land. In addition, it is recognition of practical realities imposed by federal laws on process for management on federal lands.

The secondary GIS analysis was conducted with 11 data layers using the same ArcGIS process as the initial analysis. The eleven data layers selected for this analysis reflect the state’s highest priorities, or to provide the functional equivalent of greatest number of layers used initially. Where five or more layers were overlapped, they were used to define a priority landscape. The layers most frequently overlapped and leading to priority landscape definition were:

- Annual grasses
- Forest health
- Forest fragmentation
- Impaired watershed

# Nevada Natural Resource Assessment

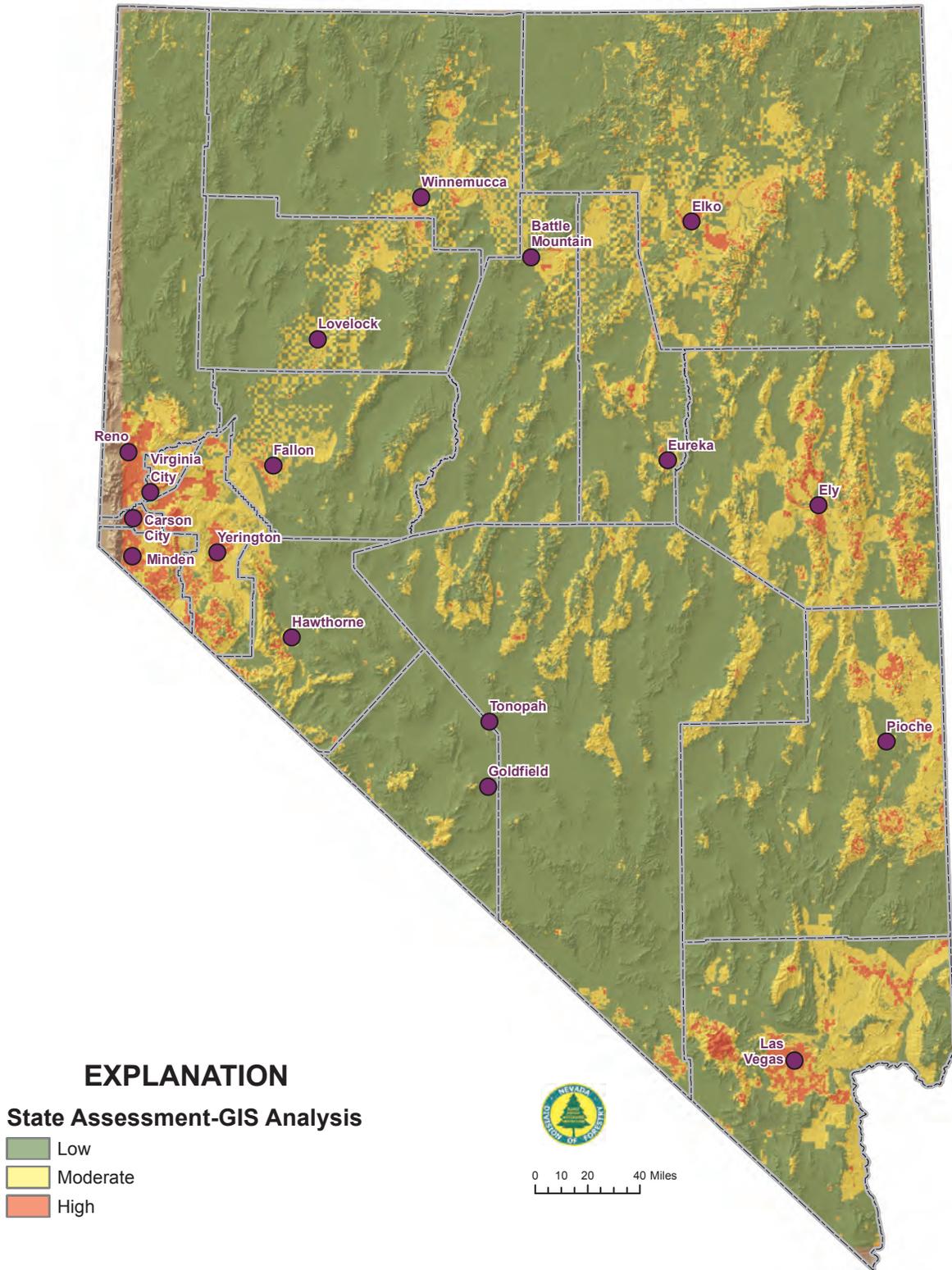


Figure 19. Preliminary GIS analysis for the state wide assessment

## Nevada Natural Resource Assessment

- Sensitive/Threatened species
- Population change

All the data layers used in the secondary GIS analysis are:

- Private forest lands—this layer is a combination of GAP and SWreGAP vegetation mapping layers.
- Forest health and risk—an all risk data set used in the SAP analysis.
- Annual grasses with 25% or greater coverage.
- T & E species—from NNHP and USFWS.
- CWPP-WUI-Urban Areas—these were combined into one data set.
- Biomass locations with a buffer showing sources of fuels.
- Proposed BLM and USFS projects.
- Greatest change in population between 2000 and 2030.
- Impaired watershed boundaries—using EPA 303d designation based on 8 digit Hydrologic Unit codes.
- Forest fragmentation—this came from the SAP analysis and in guidance documentation.
- Forest stewardship high potential.

The results of this GIS analysis and assessment are the identification of “priority landscapes” and threats/issues that both will help focus the outreach and management efforts of NDF over the next several years. One result of the both GIS analyses was the most urban areas had high values in them. It was therefore decided that all urban areas would be a priority landscape.

Figure 20 shows the result of the second analysis utilizing a screen of privately owned lands overlaid on the red, priority landscapes identified in the preliminary analysis.

USFS direction encourages regional and multi-state analyses to delineate multi-state priority landscape areas. In the West, states are independently developing state assessments that are appropriate for their unique circumstances. Because there is no West-wide assessment, states will need to work together to identify priority landscapes across state boundaries after the individual state analyses are completed. The Lake Tahoe Basin lies within both Nevada and California and is regulated by a bi-state agency, The Tahoe Regional Planning Agency (TRPA). The TRPA has a regional plan, currently being revised, that will be used to specific proposals for potential bi-state collaboration.

The GIS analysis was conducted at a maximum 30 meter pixel size. Whenever possible, data layers from previous analyses were utilized. For this assessment considerable information was obtained from the Nevada Division of Forestry- Spatial Analysis Project [NDF’s Spatial Assessment Project’s assessment and methodology paper ([http://www.fs.fed.us/na/sap/products/NV/nv\\_methodology.pdf](http://www.fs.fed.us/na/sap/products/NV/nv_methodology.pdf)).]

Nevada’s priority forest landscapes can generally be found on federal lands, on the surrounding state and private lands, in areas defined as important for water quality and supply and/or terrestrial habitat, and in and around communities.

# Nevada Natural Resource Assessment

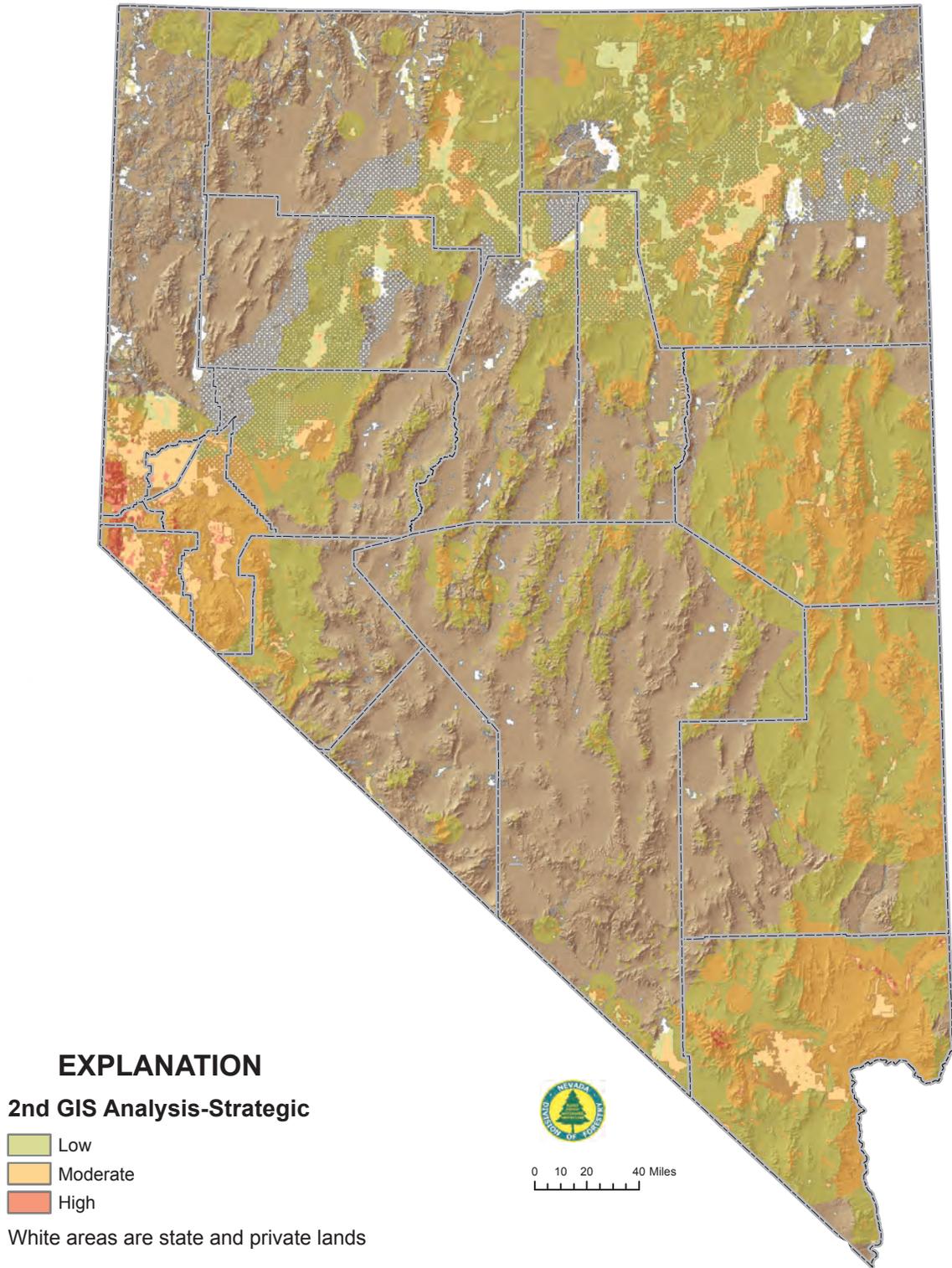


Figure 20. Secondary GIS analysis using only 11 layers. This analysis will assist in defining NDF's priority landscapes and strategies

## **Nevada Natural Resource Assessment**

The colors are assigned based on statistics by the GIS software. There is a range of analysis values within the various colors on the map. For example, within the brightest red color on the figure, values range from 4 to 13 on the primary state wide assessment.

The display scale of the map also affects the appearance. When looking at the full map within this document, the areas of bright red may appear more widespread and contiguous than they actually are. When zoomed in on a portion of the state, the color pattern becomes more complex than it appears on the full map in this document.

The red areas are the priority landscapes for investment of NDF and S&PF other resources as defined by this analysis. However, an area that is not red on the map could still be a high priority for management for any number of reasons.

NDF has a Forest Legacy Program to help preserve lands in priority landscape areas. This assessment takes into account the original Assessment of Need (AON) that was developed for NDF. The only change to the original AON for legacy is it change the boundary for the Jarbidge priority area. The boundary drops south of Interstate 80 to encompass the Ruby Mountain area, as shown below

Forest Legacy Areas for the program are the Tahoe/Sierra Front, Mt. Charleston, Schell Creek, Muddy River and Jarbidge. NDF's long-term strategy for the Forest Legacy Program is to help private landowners and counties to preserve Nevada's forested lands.

NDF uses the same basic guidelines to evaluate submitted projects as the regional and national ranking. The projects are evaluated during the spring Forest Stewardship meeting, and the rankings are made available during the fall Forest Stewardship Committee meeting. For a legacy project that requires a conservation easement, the State of Nevada is willing to hold the easement provided no state funds or bonds are used to complete the project.

# Nevada Natural Resource Assessment

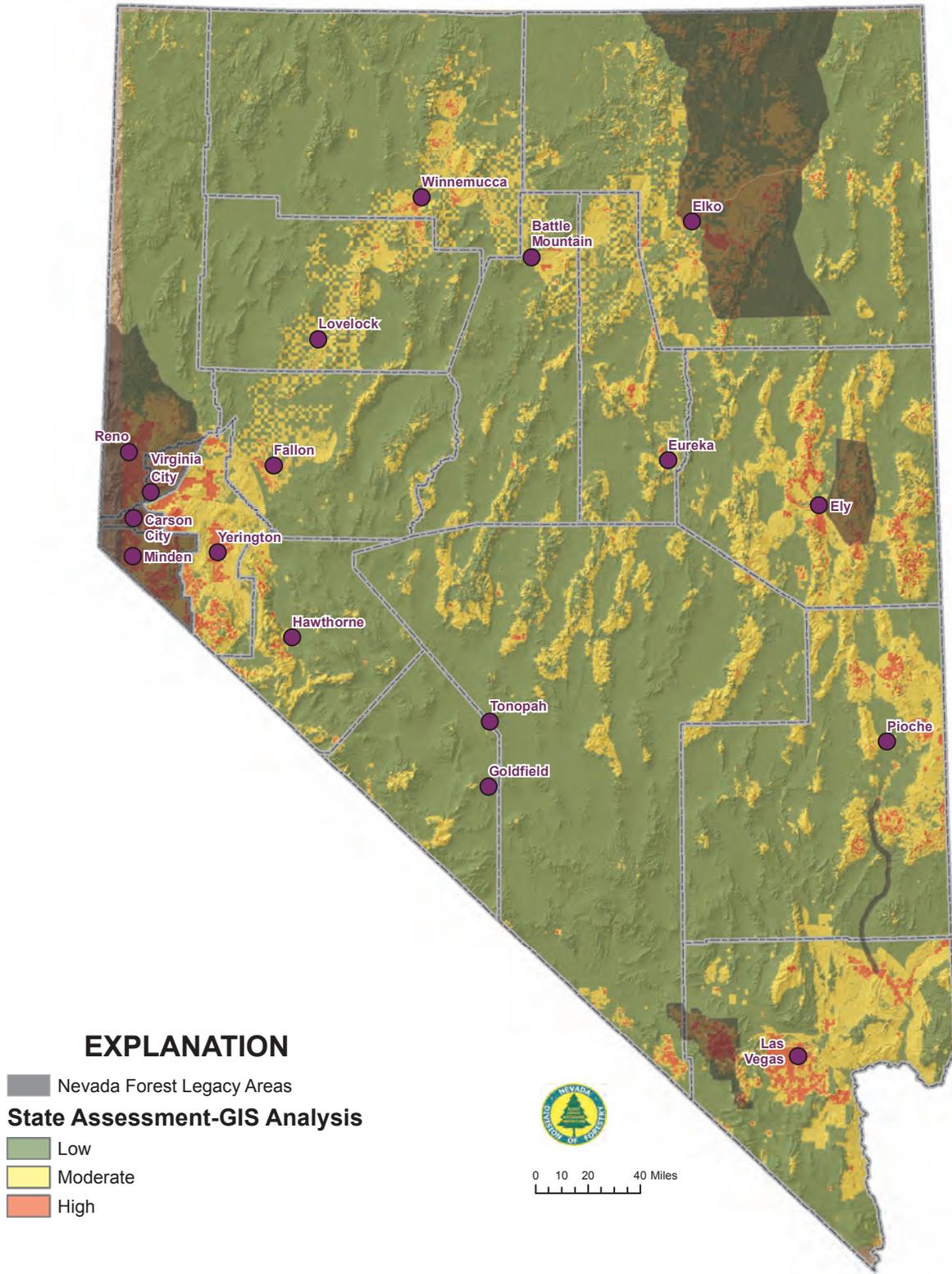


Figure 21. Forest Legacy Areas (FLA) to included the change to the Jarbidge FLA overlaid on the final GIS analysis

## Threats to Statewide Forest Landscapes

The assessment of Nevada’s natural resources, together with the GIS analysis, lead to the identification of 11 general threats and 17 priority landscapes where NDF will focus its natural resource program efforts. The 11 threats are presented below. The priority landscapes are presented in greater detail in the Natural Resource Strategy document.

### *Forest Health, Pests and Pathogens*

Nevada is facing forest health issues that are unprecedented from a historical perspective. The forest insect and diseases issues are described in more detail in the “Forest Health Risk” section of this assessment. Entomologists state that it is an anomaly for all of the major bark beetles to be at epidemic levels at the same time. In some areas, mortality in mature trees of specific species can approach 100 percent. There are a number of factors involved, including dense forest stand conditions, too little active forest management plus effective fire suppression, and climatic factors such as drought and possible climate change. In many areas, age class diversity is lacking, leaving large parts of forests susceptible to a particular damaging agent at the same time. Increased age class and species diversity would result in a more resilient, sustainable forest. Selective thinning of Nevada’s forests is imperative to develop this resiliency. Large diameter conifers are generally the targeted tree by the major forest bark beetles. If the stands are always thinned from below, the remaining forest becomes susceptible to complete mortality from one agent. Leaving multiple age classes and species will provide some insurance against this. The dominant



Aerial Photo showing damage in the Schell Creek Range from sawfly

## Nevada Natural Resource Assessment

forest/woodland type in Nevada is the pinyon juniper (PJ) type. Currently, large scale treatment of pinyon and juniper being done in eastern Nevada are oftentimes leaving a single age and species class stand (young juniper or mid age pinyon) and miss leaving other age/species classes. Although it requires more time for the marking and implementation of this type of silviculture, it makes the forest more insect and disease resistant and healthier. One of the newest publications for management of PJ is the 2009 USGS publication “Pinon and Juniper Field Guide: Asking the Right Questions to Select Appropriate Management Actions” available at: <http://pubs.usgs.gov/circ/1335/circ1335.pdf>. There is little to no discussion in this publication for managing for insect and disease concerns. The publication focuses on the large scale treatment of PJ based on ecological site, landscape considerations and the current successional stage of the site. The pinyon juniper stands that have reached near complete canopy closure with very little to no understory vegetation (Phase III successional stage according to Dr. Tausch’s classification) dominate many of the mid to upper ranges of the species and it is estimated that approximately 100,000 acres/year are being converted from Phase II (more open woodlands with still-intact understory vegetation). Dr. Tausch advises treating the more recoverable Phase I and II woodlands that still have significant understory vegetation for natural recovery instead of wasting time treating Phase III woodlands that will require significant rehabilitation. Treating the Phase II sites will keep them from converting into Phase III closed canopy woodlands. When doing these landscape scale treatments, be aware that the more large diameter trees left on site, the more significant bark beetle habitat left on site. This may cause significant build up of populations of bark beetles in these areas to infest adjacent PJ woodlands. This is especially true in stands that have significant dwarf mistletoe, are dense and/or are experiencing drought conditions. The publication “Pinyon Pine Management Guidelines for Common Pests” located at <http://www.unce.unr.edu/publications/files/nr/2003/EB0302.pdf> discusses the biology of pinyon insect and diseases and how to manage stands to avoid attracting or increasing the level of these pests.

The major pathogen affecting Nevada’s forests, dwarf mistletoe, is infesting many of Nevada’s conifers. When combined with the above factors, this has led to weakened forests that are very susceptible to insect outbreaks especially in drought years. Many of these stands were heavily infested during the 2003-2005 drought years with significant losses. Treatment of these dwarf mistletoe infested stands often requires drastic measures such as complete conifer removal, prescribed burning and buffer creation. Without treatment these dwarf mistletoe infected stand will continue to decline from drought and bark beetle attack and become major wildfire hazards. Other significant pathogens affect Nevada’s fir forests. Those pathogens are a number of root or butt diseases such as Annosus root disease (*Heterobasidion annosum*), Armillaria root disease (*Armillaria ostoyae*), Schweintzii root and butt rot (*Phaeolus Schweinitzii*). These have been found in Nevada’s fir forest pre-disposing them to attack from fir engraver beetles (*Scolytus ventralis*) which have significantly affected the stands throughout Nevada. This has left many of these stands with a lot of standing and down fuel setting them up for high intensity wildfires. Often many of the white fir stands have undergone succession from aspen stands (See discussion below regarding region wide aspen stand deterioration and decline). In Nevada’s Utah juniper stands, juniper pocket rot (*Pyrofomes demidoffii*) has been found in all areas of the State. It generally is found in older stands and when severe leads to death of the trees. This has occurred in some of southern Nevada State Park’s recreational areas.

## ***Riparian System Degradation***

Nevada's low elevation riparian forests are declining or have been completely replaced by exotic, invasive species. Upstream water use has reduced flows necessary for successful regeneration of aging riparian tree populations. Salt cedar (tamarisk) and other invasive weeds have completely taken over large stretches of Nevada's rivers. Not only do these invasive plants replace native species and reduce the quality of wildlife habitat, they present significant wildfire hazards. Reestablishing native riparian plant communities is an expensive effort that typically requires several different approaches involving cutting, burning, herbicides and flooding. A promising biological control method, the tamarisk leaf beetle, is currently being used on a limited research scale.

### ***Region-wide Aspen Stand Deterioration and Decline***

Although aspen is relatively minor forest cover in Nevada, its ecological and social importance overshadows its limited occurrence. Aspen stands are showing significant decline across Nevada. Several factors have been identified as contributors to this decline. They are diminished reproduction, succession to conifers, disease outbreaks, and browsing pressure from ungulate populations and domestic livestock. Aspen is a disturbance dependent species and the policy of fire suppression has contributed significantly to the decline of aspen populations. Most of these stands have become so conifer encroached that the fuel loading has become very high. This is a conversion from a fairly fire resistant timber type (aspen) to a heavy fuel type (white fir). If the fir has completely taken over the aspen, the aspen most likely will not come back after a wildfire



**Photo showing Tamarisk in the Meadow Valley Wash. The pink is Tamarisk in bloom.**

or timber stand treatment. This is because the underground clonal root mass has often degraded to the point where it will no longer initiate re-sprouting especially after a high intensity fire that often results from the heavy fuels that dominate these stands. This type of fire will often burn through the soil to the root mass and permanently damage it. As with PJ treatment, it is often better to focus treatment on recoverable stands using hand or mechanical means and prescribed fire to initiate re-sprouting of aspen clones. Protection from grazing will be necessary in many areas of Nevada

### ***Increased Wildfire Scale and Intensity***

Wildfires in Nevada are increasing in their size and frequency. This is a result of two primary factors:

- Fire suppression actions prevents fires from burning on historical cycles and reducing fuel accumulations
- Exotic vegetation like cheat grass (*Bromus tectorum*) promote increased fire size and frequency

Fires no longer occur with the same frequency, at the same intensities, or of the same size as they historically did in Nevada. There are several fire regimes associated the varied vegetation and land forms across the state. The areas that historically had the most frequent fires have departed further from their historic fire regime, than those with longer fire return intervals. In the absence of fire, live and dead fuel accumulates to levels that make the inevitable fire burn hotter and faster than they have historically, with associated damage to the vegetation community and associated ecological components.

Cheatgrass, an exotic annual grass, has altered the fire regime in shrub/bunchgrass cover types in other ways. The highly prolific grass can fully occupy an area after a couple fire cycles leading to an almost complete loss of the native plant community and new fire regime of frequent, high intensity fires. Areas with lower percent cheatgrass cover are manageable with appropriate seeding strategies. Areas with higher percent cheatgrass cover are difficult and expensive to reclaim.

The development of non-traditional enterprises that can increase biomass utilization are considered to be an important part addressing the wildfire hazard issue. Wood to energy projects like the State's cogen power plant in Carson City provide an important outlet for biomass produced from fuel reduction treatments. Economical treatment of the high density pinyon and juniper stands across the state will require new industry that can utilize the harvested wood/biomass generated. In order to attract investment by private industry in these types of processing facilities, a guaranteed stream of wood coming off the federal lands is required.

### ***Wildland Urban Interface Development***

Development in the wildland/urban interface is growing at a very rapid pace. Starting in 1987, and for all but one of the next 20 years, Nevada was the fastest growing state in the union with population increases of 66.3 percent from 1990 to 2000 and 74.6 percent from 2000 to 2009.

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Much of this growth was located in new subdivisions built adjacent to wildland vegetation as communities expanded. WUI fires pose great challenges to the fire service. This has impacts on fire suppression strategies, tactics, and costs. Access is often inadequate for suppression forces, water supplies may be limited and strategies often allowing wildlands to burn as structure protection receives a higher priority. Fire prevention and fuel management efforts in the WUI are crucial.

### ***Community Forest Maintenance***

Many threats to Nevada's urban forests, which are primarily landscaped and irrigated trees on both public and private lands, are a result of interacting factors starting with 20 years of rapid population growth and building and changing demographics, followed by a declining economy, unemployment, housing foreclosures, vacancies and rentals, increased water costs and water conservation programs.

**Population Growth.** Starting in 1987, and for all but one of the next 20 years, Nevada was the fastest growing state in the union with population increases of 66.3 percent from 1990 to 2000 and 74.6 percent from 2000 to 2009. Las Vegas had population increases of over 6,000 people per month during the height of the growth, with a net population increase of over 4,000 per month. This rapid influx of newcomers to the state and the nature of a transient population make it impossible to provide adequate tree care outreach and education to the population and results in improperly maintained trees. NDF staff is insufficient to outreach to, and educate a majority of Nevada's' citizens on how to grow and care for trees in a rapidly growing population.

**Green Industry Demographics.** The Hispanic population is considered the fastest growing minority group in Nevada and it is estimated that up to 40 percent the green industry workers are Latino. Based on 2000 Census, jobs in the green industry were expected to increase by as many as 800 new jobs every year. Many Hispanics/Latinos are drawn to the green industry (nursery, landscaping and landscape maintenance), because English speaking skills are not essential to do the work. However, according to a green industry survey conducted by University of Nevada Cooperative Extension (UNCE), many Latino's do not possess basic English or horticulture skills to perform their key tasks.

**Water Conservation Programs.** Southern Nevada Water Authority, serving the municipalities in the Las Vegas Valley, started a turf removal program in 2000 in an effort to reduce outdoor water consumption. They pay customers a rebate for every square foot of grass removed and replaced with desert landscaping. Although the final mature landscape must have at least 50% plant cover, trees that only received water from turf irrigation are dying from lack of water.

Another water conservation program in Northern Nevada, from the Truckee Meadows Water Authority (TMWA), requires its customers to convert to water meters by the end of 2010. The TMWA service area includes the cities of Reno and Sparks and the urban areas of Washoe County within and surrounding the cities. As these conversions occur and water bills increase, homeowners, and especially renters, have cut-back on watering and as a result, trees are dying from lack of water or are in poor vigor and susceptible to insects and diseases.

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**Nevada's Economy.** Nevada has been hard hit by the declining economy and was reported to have “hit bottom”, but without “any signs of a turnaround” according to a May 2010 report from the Center for Business and Economic Research, University of Nevada Las Vegas. This is having an effect on the watering and care of both public and private trees. All urban forests, whether in rural communities or large urban areas are affected.

- Landscapes that are no longer watered because of vacancies, rentals or a result of cost-cutting measures that include reduced watering, are evidenced by the number of brown lawns and declining trees throughout residential areas.
- Municipalities and the state government have reduced their budgets for parks, and tree and grounds maintenance. One Nevada community has reduced its parks staff by as much as 25%. Others haven't reduced permanent staff, but have reduced costs by not hiring their normal quota of summer seasonal parks maintenance staff. One city eliminated the City Forester position in 2009 and with the position, eliminated all UF related community outreach and training services. Other municipalities have no budgets for hazard tree removal or new tree planting.

**Lack of expertise, limited funding.** Nevada's small rural towns typically do not have adequate financial resources or the expertise to support municipal forestry programs. Most are under county government and do not have a budget for their own parks or street trees and the tree maintenance department may be located hours away. Improper tree care, planting, pruning, watering and tree selection issues are prevalent throughout Nevada on both public and privately owned properties.

### ***Water Quality and Quantity Maintenance***

The mountain watersheds that are the source of the state's water supply are largely federal lands that are in some form of protected status (wilderness, study areas), or are not identified for types of active management that has the potential to affect water supplies. A concern is the lack of management on areas where increasing fuel accumulation and tree densities predisposes areas to more destructive wildfires which could have significant temporary impacts on municipal supplies and on in-stream flow values.

Although many of the factors leading to the impaired status of many of the state's watersheds are a result of climate and downstream demands placed on the water supplies, are therefore not typically addressed by NDF, there is a role for the state in the area of noxious weed control and streambank stabilization.

### ***Special Status Species Habitat Degradation***

Plant and animal habitats are under pressure in Nevada. Many resource demands have the potential to negatively impact plant and wildlife habitat. Most of the impacts to threatened and endangered plant populations are a result of human activities which can be categorized as agriculture, hydrology, recreation, natural resource extraction, development and military activities. The same

## **Nevada Natural Resource Assessment**

general categories of impact source are applicable to Nevada's wildlife species as well. In addition, natural processes such as bark beetles and wildfires can impact vegetation and wildlife habitat, either positively or negatively. Other forestry issues, such as aspen decline and riparian forest decline, can be detrimental to wildlife habitat.

Declining aspen are an important concern. Some consider aspen to be the most as cover type in the state. Factors contributing to aspen decline include lack of disturbance (primarily fire), and increased browsing from ungulates (primarily elk and cattle). These influences are restricting successful regeneration and promoting successional changes to more shade tolerant conifer species. The majority of the aspen in the state occurs on USFS managed lands. Aspen conservation is a priority in the current forest plan revision.

Another important issue is the potential listing of sage grouse under the Endangered Species Act. A cooperative effort is underway to take action to protect core habitat areas with the goal of preventing a listing. An executive order from the Governor of Nevada directs state agencies to evaluate projects for their potential impacts to sage grouse core habitat and apply certain criteria to projects within core areas.

The state has statutory responsibility for protecting state-listed plant species. Threatened and Endangered species are protected by Nevada Revised Statutes, NRS 501-wildlife, and NRS 527-plants. Protection of wildlife habitat falls to various land managers, including NDF when working with landowners.

### ***Ecosystem Fragmentation***

Ecosystem fragmentation is occurring in some areas of the state. The phenomenon is largely a result of economic pressures for development on lands formerly used for production of natural resources. Where it occurs, or is likely to occur, there is potential for negative impacts on natural resource production and ecological services from affected lands. Production efficiencies decline with decreasing land parcel size. Additionally, comprehensive treatment of forest health issues becomes more difficult to address and fire management becomes more complex as fragmentation of ecosystems increases.

### ***Climate Change***

Nevada is considered highly sensitive to climate change due to several factors, including a naturally dry climate and dependence on mountain snow for surface water. There may be impacts on the amount and timing of water runoff and on the length and severity of fire seasons. Under a long-term reduced precipitation scenario, shifts in forest cover types is possible along with difficulty in site rehabilitation following large scale disturbances like wildfires. Additionally, increased insect activity would be likely leading to adverse impacts on forest. Nevada will continue to evaluate its land management activities in light of possible long-term climate change, and make appropriate adjustments where necessary.

## *Invasive Weeds*

Although there was no suitable data base for invasive weeds to include in our GIS analysis, invasive weeds are a well documented problem in Nevada. Invasive weeds are highly competitive and aggressive, outcompeting and replacing native vegetation. They cause economic loss, environmental degradation and are often difficult to control. Additionally, they can increase the occurrence, size, frequency, and intensity of wildfires.

Some invasive weeds are listed as “noxious”. This is a legal designation that pertains to “any species of plant which is, or is likely to be, detrimental or destructive and difficult to control or eradicate.” It is the legal obligation and responsibility of the owners or occupiers of land in Nevada to control all weeds designated as noxious by the Department of Agriculture. This applies to private landowners, cities, counties, federal and state agencies, railroads and ditch companies.

The following plants are weed species of concern in Nevada:

### Upland Plant Communities

- red brome
- cheatgrass
- hoary cress
- musk thistle
- diffuse knapweed
- spotted knapweed
- Russian knapweed
- yellow starthistle
- squarrose knapweed
- rush skeletonweed
- common crupina
- leafy spurge
- dyer’s woad
- Dalmation toadflax
- yellow toadflax
- Scotch thistle
- sulfur cinquefoil
- medusahead

### Riparian Areas

- perennial pepperweed
- purple loosestrife
- saltcedar

### Waterways

- Eurasian or spiked watermilfoil
- giant salvinia

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## **Appendix A- GIS Methodology and Data Creation**

## **State Natural Resource Assessment GIS Methodology**

This is a relatively simple analysis because either a layer is represented on a given pixel (30 meter pixel, or a 900 square meter area of the state), resulting in a value of one, or it is not represented, resulting in a value of zero. The 17 layers are stacked on top of one another using a weighted sum analysis with each pixel getting a one or zero from each layer. The resulting total of the layer values on any given pixel is the value of that pixel for the final analysis. The highest total value any pixel could have is 13.

This analysis uses the layers recommended for a standard statewide assessment by national direction or a substitute layer as determined by NDF. The individual layers are overlaid on the final composite map to show the spatial extent.

### **Beginnings of Natural Resource Assessment**

NDF began their Forest Resource Assessment Project (FRAP) by identifying over 60 different Geographic Information System (GIS) data sets that could be important in assessing Nevada's forest resources. NDF used this opportunity to build upon the Spatial Analysis Plan (SAP) created in 2007 for the Forest Stewardship Program. Several data sets used for SAP were considered or used for this assessment. The FRAP working committee identified additional data sets to be created or be acquired for the analysis. The next step was to poll NDF Resource and Fire programs staff (8) to identify the top twenty data sets related to their program and projects. The results of the poll identified 26 data sets that had a value of 4 or more votes. These 26 data sets were included in the first round of analysis following the process used for the SAP program discussed below under data manipulation.

### **Data Layer Creation and Directions**

NDF began the first GIS analysis on the 26 data sets identified by NDF staff as a starting point for the state assessment. Several data sets such as private lands, public water supply, Threatened and Endangered Species, and forest health and risk were used in the SAP project and again for the FRAP analysis.

USFS gave the states additional guidelines on data sets to be included such as; green infrastructure, impervious surfaces, and future population growth. In addition to the SAP and USFS data sets, NDF identified and chose several additional data sets, that were important in assessing Nevada's forest resources.

Data used in the analysis came from the following sources: NDF, BLM, USGS, Colorado State University, Nevada Department of Transportation, Nevada Natural Heritage Program, and Nevada Division of Environmental Protection, Landfire Program.

## **Data Manipulation**

All vector data sets were converted to a raster data set, using the default values in the Convert to Raster tool. The data was resampled to 30 meters for consistency. The values were then reclassified to either one for data or zero for no data. Some layers didn't extend to the edges of the state; to fix this problem, small polygons were added beyond the state boundaries to give a complete data set for the state. All layers are in UTM projection, Zone 11, meters and NAD 83 as the datum. Some of the raster data sets had a cell size different than the 30 meter standard and therefore were resampled to 30 meters for continuity.

## **GIS Analysis and Discussion**

The original 26 data sets identified by NDF were the input layers for the first GIS analysis. For the first analysis, each layer was given an equal weight. The analysis used the weighted sum tool in ArcGIS. The results showed a maximum value of 22, which means 22 data sets of the 26 used overlaid each other.

The results were plotted and discussed by the FRAP Committee who decided to reduce several of the data sets and to split other data sets up into different data sets. For example, in the canopy cover data set, values greater than 60 percent were used to overstocked forests and values less than 30 percent were used to identify understocked urban areas. Another example is the green space/infrastructure data set. This data set was edited to remove any information regarding federal lands, such as National Wildlife Refuges, Wilderness Protection Areas and Wilderness Study Areas.

When the geoprocessing was done, the weighted overlay tool was used to give certain values within the Fire Regime and Wildland Urban Interface layers more importance. This tool didn't work as well as expected. This may have been due to the format of the different layers such as a double precision, floating point, short, or longer integer. Use of this tool is still being researched.

When the weighted overlay tool was unsuccessful, NDF divided the data sets into individual layers based on selection criteria such as the first three fire regime classes for the fire regime layer. NDF did another analysis using the weighted sum tool with 27 data sets. The results favored the urban areas much more than any of the forests in Nevada. It was determined that approximately 5 data sets were urban in nature; these data sets and several others were removed and the total data sets were reduced to 17. An additional analysis was done using the weighted sum tool to obtain the final product. The maximum value of any cell was 15, which means out of 17 layers, 15 of them laid on top of the others.

After review of input from groups and a public web survey, the following changes were made to the GIS data layers.

- Use High Forest Stewardship potential instead of Forest Stewardship sites
- Use a five mile buffer around BLM and USFS project locations
- Use streams as the riparian area; linear features were converted to a raster data set

## Nevada Natural Resource Assessment

- Use an urban boundary polygon to represent green infrastructure to make sure all street trees were included
- Use the Southwest ReGap Data to extract the forest and woodland categories instead of using the National Land Cover Data set

The final weighted sum analysis used the same methodology as the previous attempts, but also used a feature to snap all the raster data sets to one identified layer. This was done to ensure that all the rasters lined up with cells from each layer.

### Layers used-each given equal weight:

Private lands—from SAP analysis  
Forest health and risk—from SAP analysis (FHTHT)  
Annual grasses with 25% or greater coverage  
T & E Species -from Nevada Natural Heritage Program and USFWS Critical Habitat  
Vegetation Type- all forested values-SWReGap and GAP Data Sets  
Community Wildfire Protection Plan boundaries  
Fire Regime Condition Class- Classes 2 and 3  
Biomass locations with a buffer showing sources of fuels  
Stream/riparian areas  
Current/proposed BLM and USFS projects  
Greatest change in population between 2000 and 2030  
NDF Stewardship high potential—SAP analysis  
Public water supplies—from SAP analysis  
Impaired watershed boundaries—HUC 8 using EPA 303d designation  
Wildland Urban Interface—selecting low-middle-high intermix  
Green infrastructure/urban boundaries to include all street trees  
Forest fragmentation-recommended in guidance documents

Given the shortcomings of the initial analysis, a secondary GIS analysis was conducted consisting of 11 data layers to reflect the state's highest priorities, or to provide the functional equivalent of greatest number of the layers that were used initially. Where five or more layers overlapped, they were used to define a priority landscape. The layers that frequently overlapped and lead to priority landscape definition were:

- Annual grasses
- Forest health
- Forest fragmentation
- Impaired watershed
- Sensitive/Threatened species
- Population change

## **Nevada Natural Resource Assessment**

The following data layers were used in the secondary GIS analysis:

- Private forest lands- This layer is a combination of GAP and SWreGAP vegetation mapping layers and clipped to private lands in Nevada
- Forest health and risk—an all risk data set used in the SAP analysis
- Annual grasses with 25% or greater coverage
- T & E Species -from NNHP and USFWS
- CWPP-WUI-Urban Areas—These were combined into one data set
- Biomass locations with a buffer showing sources of fuels
- Proposed BLM and USFS projects
- Greatest change in population between 2000 and 2030
- Impaired watershed boundaries- using EPA 303d designation based on 8 digit Hydrologic Unit codes
- Forest fragmentation-this came from the SAP analysis and was recommended in guidance documentation
- Forest stewardship high potential

**Appendix B- Comments from meeting with Stakeholders  
and a summary of the Public Web Survey**

## **Initial Findings Presentation**

- Nevada Shade Tree Council
- Nevada Forest Stewardship Committee
- Nevada Association of Conservation Districts
- NRCS National Forestry Group
- Nevada Cattleman's Association
- Nevada Inter-Agency Tribal Environmental Managers meeting
- Web Survey from January 21 to February 18, 2009
- Forest Health Monitoring Program Workshop

### **Nevada Shade Tree Council (Urban Forestry) Suggestions**

- Biomass data—discuss with other state agencies about the data that they might have
- Needed clarification on the definition of green infrastructure—the participants thought that using the urban boundary would encompass everything urban—golf courses, athletic fields, parks and street trees
- Consider addressing urban issues—such as recreational use (hiking) vs. ATV's in assessment

### **Forest Stewardship Committee (Service Forestry) Suggestions**

- Look to other agencies for information, such as NDOW, NRCS, USFWS
- Add the noxious weed layer from Nevada Natural Heritage Program,
- Use more current vegetation data such as SWReGAP land cover data

### **Nevada Conservation Districts and Cattleman's Association (Natural Resource and Private Land Owners) Comments-Suggestions**

- The use of a soil data layer—but select soil types that would be the most beneficial for growing
- Question raised about the USFS and their expansion—Response was that we may be influencing them more than the USFS influencing others

### **Nevada Inter-Agency Tribal Environmental Managers (Tribal Input) Comments-Suggestions**

- Meet with NDF to address conservation issues and to open a dialog between the tribes and NDF
- Possibilities about using NDF's nursery and seed bank to help repopulate forests or to help mitigate the expansion of non native vegetation

## **Public Web Survey- Results**

- Top three issues on forested lands in Nevada—fire, fuels reduction and forest health
- In the more detailed questions, conservation of forests, fire, fuels reduction and forest health was rated as extremely important
- Confusion between NDF and the USFS
- Biomass, alternative energy and carbon sequestration were important, but not rated as high as other issues
- Proper forest management to control the outbreak of disease and insects
- Individual Comments
  - Let nature take its course—minimal intervention
  - There is a link between climate change and any outbreak of insects and disease
  - If we don't deal with it, we will lose forests, plants and wildlife
  - Could have higher fire suppression costs if not actively managed
  - Integrate comments as part of a complete forest management plan and forest ecology documents

### **GIS Analysis Poster and Methodology sent to:**

- BLM State office and Ely office
- USFS Carson Ranger District
- Nevada NRCS Office

### **USFS Humboldt Toiyabe Office-comments:**

- Using a fire regime condition class,
- Add noxious weeds
- Wanted to know how will fire history be shown, ignition point, polygon or density/occurrence

### **Nevada Division of Wildlife comments:**

- Identify how strategies will take into consideration of sensitive species such as California spotted owl, American marten and Mono Basin mountain beaver
- Clarification of GIS methodology
- Make sure NDF is using SwReGAP data as a way to connect with the State Wildlife Plan
- Clarify some of the statements in the report regarding strategies and wildlife species status—specifically mentioning state laws and regulations