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Environment and Sustainability in Nevada

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UNLV Center for Democratic Culture
Edited by Dmitri N. Shalin

The Social Health of Nevada

Leading Indicators and Quality of Life in the Silver State

Environment and Sustainability in Nevada

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Introduction

When the inaugural Earth Day launched the first environmental decade in the U.S. more than forty years ago, protecting our air, water, land and other natural resources seemed a relatively straightforward task. Environmental polluters and exploiters would be brought to heel by tough laws. The U.S. and other industrialized nations responded to quality of life concerns associated with environmental degradation by adopting dozens of major environmental and resource policies and creating new institutions such as the U.S. Environmental Protection Agency to manage environmental programs. Following these national developments, states and local communities began systematic efforts to address environmental problems.

What appeared to be a relatively straightforward job of controlling a few key pollutants and other development trends has become a far larger and more complicated task involving major changes in human behavior. Public opinion favoring greater environmental

Highlights

- In the last four decades, Nevada has been among the country's fastest growing states, increasing at nearly twice the national average from 2006 to 2018.
- The Las Vegas metropolitan area is located in a valley with one of the world's harshest climates.
- Hydrologists estimate that there is a 50% chance Lake Mead will be dry by 2021 if drought conditions persist.
- Vehicle exhaust accounts for some 85% of carbon monoxide air pollution in Clark County.

How to Cite this Report

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protection has continued to grow as social values change and mounting scientific evidence reveals threats to our local, regional, and global life support systems. People perceive the environment as more endangered now than it was 40 years ago. Yet, despite some successes, we remain a long way away from comprehensive solutions.

In 1987, the United Nation's Report of the Brundtland Commission, *Our Common Future*, highlighted "sustainability" as the primary challenge of the 21st century. The report's well-known and oft-cited minimalist definition says: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations World Commission on Environment and Development (WCED), 1987). Sustainability requires communities to evaluate how they can most efficiently use resources and create infrastructures that protect and enhance life for human and biotic systems now and in the future. Sustainability requires comprehensive, long-term thinking and planning to account for environmental impacts, emphasizing ways to mitigate impacts that damage environmental resources on which we rely. This report offers an overview of key environmental sustainability issues we face in Nevada, identifies steps to improve the situation, and lists community resources available to those interested in helping with the Silver State's environmental concerns associated with four key sustainability issues – air, water, land, and energy.

Historical Overview

Nevada is an enormous state whose inhabitants are mainly clustered in just a few urban areas. Environmental health and safety are central to the Silver State's environmental sustainability and its residents' quality of life. Environmental problems facing Nevadans are closely linked to the extraordinary population growth and urban development. Consider the following statistics:

- Since World War II, Nevada's population has climbed from less than 100,000 to just over 3 million (World Population Review 2018).

- From 1950 to 1990 the state's population increased 650%.

- During the past four decades, Nevada has been among the country's fastest-growing state, with its population climbing 66.3% during the 1990s alone.

- According to the U.S. Census Bureau's first post-2000 population count, the state continued to outpace the nation by growing at a rate five times the national average.

- Between 2000 and 2007, roughly half a million people arrived in Las Vegas.

- According to 2017 U.S. Census estimates, more than 2.2 million Nevada citizens are clustered in Clark County, mostly in the Las Vegas metropolitan area, while more than 600,000 live in the Reno-Carson City-Fernley region.

- In Clark County alone, population has grown by more than 120% since 1990 – an increase of more than 1 million people.

- Nevada's State Demographer estimates that Nevada's population will grow to 3.3 million by 2032, with most immigrants to the state settling in a few major population centers (Hardcastle 2014). Others project that Nevada's population nearly doubling to 4.3 million by 2040 (Lang et. al, 2008).

Not surprisingly, the most prominent environmental issues facing the state are also centered in these urban areas and are directly related to the rapid urban population growth.

Both Las Vegas and the Reno-Sparks-Tahoe area are home to unique geographic and climatological conditions. The Las Vegas metropolitan area is located in a valley with one of the world's harshest climates. Summer temperatures average well over 100 degrees Fahrenheit and the average annual rainfall barely tops 4 inches. The Las Vegas Valley is situated within the eastern Mojave Desert, an extremely rich area in terms of biological diversity. The Reno/Tahoe region, located on the interface of the eastern Sierra Nevada and western Great Basin, enjoys a more temperate climate, and it hosts one the world's most unique natural ecosystems, notably in the Lake Tahoe area, as well as sensitive mountainous and meadowland regions. The glacially-formed Lake Tahoe area is famous for its astonishingly clear waters, and the unique plant, and microbiotic and animal species inhabiting the Tahoe basin. The serious ecological stresses plaguing these areas can be traced to the human causes that challenge future sustainability.

Nevada's Key Environmental Concerns

Four areas central to understanding environmental quality of life issues in Nevada include: (a) air, (b) water, (c) land, and (d) energy.

Air Quality

Air quality is perhaps the most acute problem in the Las Vegas Valley. Stemming from motor vehicles, construction, and commercial and industrial enterprises, air pollution challenges ebb and flow in proportion to the population and economic development in the valley. The rapid influx of people and businesses into Southern Nevada during the 1990s and early 2000s exacerbated already severe air quality problems. Like many urban areas throughout the U.S., Las Vegas faces air quality problems from several pollutants:

- Carbon Monoxide (CO)
- Nitrogen Dioxide (NO2)

- Ozone (O3)
- Particulate matter (PM)
- Sulfur Dioxide (SO2)

Efforts to control CO emissions in Las Vegas have been largely successful. The U.S. Environmental Protection Agency, designated Las Vegas as a CO nonattainment area in 1978. In response, Clark County and the State of Nevada adopted and implemented new air quality plans and control measures, including state and local wintertime gasoline fuel requirements. These measures helped reduce the number of exceedances of the CO standard from more than 40 each year in the mid-1980s to less than 5 by the mid-1990s. The last recorded exceedance of the CO air quality standard occurred in 1998. On September 16, 2010, the U.S. Environmental Protection Agency finalized a rule to redesignate the Las Vegas Valley to attainment for the National Ambient Air Quality Standard (NAAQS) for Carbon Monoxide (CO) and approved the plan showing maintenance of the CO standard though 2020 (U.S. Environmental Protection Agency, 2011).

Carbon Monoxide and Nitrogen Dioxide

Auto emissions constitute the major source of both carbon monoxide and nitrogen dioxide pollutants that aggravate asthmatic conditions and, after interacting with the oxygen, release ozone into the air. Wildfires are another major source of carbon monoxide.

- According to the Clark County Department of Air Quality Management, vehicle exhaust accounts for approximately 85% of carbon monoxide air pollution in Clark County.

- In the late 1990s, the Las Vegas Valley failed to meet federal standards for carbon monoxide levels and, in November 1997, was designated by the Environmental Protection Agency (EPA) as a major nonattainment area.

- In August 2000, the Clark County Department of Air Quality and Environmental Management submitted a plan to the EPA to control carbon monoxide.

- Between 1999 and 2017, Southern Nevada did not violate national carbon monoxide standards. Due to new, more stringent, attainment standards, passed in 2015 and implemented in 2017, the EPA re-designated Clark County a non-attainment area. Clark County Department of Air Quality Management continues to work toward meeting the new standards, but they are not yet there.

State and county officials continue to take several measures to limit CO, including (a) vehicle inspection and maintenance programs, (b) the state-wide smog reporting system, (c) seasonal oxygenated and cleaner-burning gasoline programs, (d) increased mass transit options, and (e) an alternative fuel vehicle program and

voluntary rideshare programs. Numerous pollution reduction measures are also in place for industrial and commercial sources.

Ozone

Ozone is a gas that occurs naturally in the Earth's upper atmosphere and provides protection from the sun's harmful ultraviolet rays. However, ground-level ozone is a pollutant which, inhaled by a human, irritates the lungs and causes coughing, burning sensations, and shortness of breath. Ozone is particularly problematic for elderly, children, and people with heart and respiratory problems like asthma and bronchitis.

Ground-level ozone is a component of smog generated largely by motor vehicle emissions and industrial operations. It forms during hot, summer days from a chemical reaction between sunlight, heat, and nitrogen oxides (NOx) and volatile organic compounds (VOCs) produced from the burning of fossil fuels, gasoline vapors, dry cleaning products, chemical solvents, and other products. Seasonal weather and traffic congestions during the hottest months of the year (May to October in Clark County) are principle factors in ground-level ozone concentration.

- In April 2004, the EPA designated Clark County as a nonattainment area for failing to meet the federal eight-hour standards which designate levels (85 parts per billion of ground-level ozone) that cannot be exceeded over an eight hour period.

This development prompted the **Clark County Department of Air Quality**, and Environmental Management to design plans for reducing emissions that cause ground-level ozone.

- In March 2011, the U.S. EPA determined that Clark County had met the federal eight-hour standards for ground-level ozone and suspended the county's non-attainment status (U.S. Environmental Protection Agency, 2011).

- In May 2017, the U.S. EPA cited Clark County for non-attainment of the newly implemented ozone pollution standards. The new standard dropped acceptable levels from 75 parts per billion (ppb) to 70 ppb. Despite Clark County's overall downward trend in ground level ozone there is still work to do to reach the new EPA-required acceptable levels. The Clark County Department of Air Quality estimates they will meet the new standards by 2025.

Particulate Matter

Particulate matter (PM) refers to a complex mixture of very tiny solid or liquid particles, composed of chemicals, soot, and dust. PM increases when tiny particles of dust or matter become airborne. This dust is not a natural phenomenon of desert

living. Native desert soils around Las Vegas are crusted by years of wind, sun, and rain. Sustained winds of 25 mph are required to disturb this soil. Dust is raised when the soil's crust is broken and the winds fan it throughout the valley. Under those conditions, the airborne dust contributes to the valley's particulate matter pollution.

Particulate matter is typically grouped into two sizes:

- PM10 refers to particulate matter measuring 10 microns or less – thinner than the width of a human hair.

- PM2.5 refers to particulates smaller than 2.5 micrometers. These particles can stay airborne several days and make up as much as half the haze visible around the Las Vegas Valley.

- Research suggests that PM2.5 particles may be more hazardous to human health than PM10 particles because they can travel deeper into your lungs.

- Clark County's Department of Air Quality Management has collected data on PM2.5 since 1996, and it shows that the valley meets the federal EPA standards with the PM2.5 national air pollution mark.

- Though less hazardous, PM10 is of immediate concern in the Las Vegas Valley, which was designated by the EPA as a serious nonattainment area for PM10 on Jan. 8, 1993.

- Since then, air quality officials in Nevada have been working to reduce PM10 levels by creating awareness about the health problems associated with dust in the valley, better regulating construction activities, and limiting other sources of PM10 (e.g., off-highway driving).

- In 2014 the Environmental Protection Agency approved Nevada's request to redesignate Clark County to attainment for the PM10 standard, and also approved Clark County's plan to maintain compliance with the standard through 2023.

Air pollution affects everyone's health. Symptoms include watery eyes, coughing, and wheezing. Small children breathe at a faster rate than adults do, and their developing lungs make them more susceptible to pollutants. People with emphysema or asthma – a sizable population group in the area – are facing the greatest risks.

- In 2014, the Center for Disease Control and Prevention (CDC 2014) reported that more than eight percent of Nevada adults suffer from asthma. Nationally, the percentage of adults who report having asthma has remain steady, decreasing only one-tenth of one percent between 2010

(8.4%) to 8.3% in 2016 (CDC 2016). Nevada is currently not funded under CDC's National Asthma Control Program.

- Between 2015-2016, the Kids Count Data Center also found that 7% of children (children under age 18) in Nevada suffer from asthma (National Kids Count Center, 2017).

Valley Fever

Coccidioidomycosis, more commonly known as Valley Fever, is a fungal infection most commonly seen in the desert regions of the Southwestern United States, arid regions in Mexico, and in Central and South America (Center for Disease Control and Prevention 2013). Coccidioides immitis, the fungus that causes valley fever, lies dormant in dry, alkaline soil (especially during long droughts); but when it rains, it blooms, and becomes airborne when soil is disturbed by wind, construction, farming, etc. A person gets valley fever by breathing in fungal particles from soil. Valley fever is spread through the air. People can breathe in the spores and get valley fever developing symptoms similar to the common cold or flu and asthma. The disease is not spread from person to person. In 2013, the Center for Disease Control and Prevention reported that the incidence of reported coccidioidomycosis increased substantially from 5.3 per 100,000 population in 1998 across Arizona, California, Nevada, New Mexico, and Utah to 42.6 per 100,000 in 2011.

Water

Water scarcity tops the list of environmental, economic, and political problems facing the U.S. Southwest. Water supply and water quality are both at risk in Southern Nevada and the Reno-Sparks-Tahoe area. Water scarcity is particularly critical in Southern Nevada. Due to the numerous compacts, federal laws, court decrees and regulatory guidelines known collectively as "The Law of the River," Nevada receives, by far the smallest allotment of Colorado River water among all lower basin states that rely on the river for their water needs.[1]

Anticipated population growth in Southern Nevada and other Southwest states will mean even more demands on the water infrastructure in an arid region already pressed to its limits under present drought conditions and climate change. Although the river is replenished to some extent each year through rain and snowfall in the Colorado Rockies watershed, river flow varies greatly due to unpredictable precipitation patterns in the Colorado Plateau. Since 2000, the lower basin states have been facing the effects of the worst drought on record in the Colorado Plateau. After years of drought, the Bureau of Reclamation estimates that Lake Mead water levels may fall below 1075 feet in late-2019, reaching the critical threshold for triggering the Colorado River's first ever critical shortfall (Bureau of Reclamation. 2018. Operation Plan for Colorado River System

[1] Lower Basin states defined by the Colorado River Compact include: Nevada, Arizona, and California. Nevada receives only four percent of the total Lower Basin allotment of Colorado River water, while Arizona receives 37.30% and California receives 58.70%. Las Vegas, Nevada's two million residents receive 90% of their water from the Colorado River.

Reservoirs: June 2018 24-month study).

Concerned about changing flow rates and use levels, water managers continue to raise concerns water demand and underscore the need for conservation. In this context, conflicts may emerge among states over water allocations and water management. In 2018, officials from Colorado, Wyoming, Utah, and New Mexico accused Arizona water managers of attempting to manipulate the complex system that governs Lake Mead to draw more water than the state's allotment.[2] Arizona officials admitted poor communication about their plans and pledged more cooperative efforts with the other states. But, this threat to long term cooperation among Colorado River water users raises question about how fragile the multi-state agreement for water allotments may be as water flow decreases and demands rise.

Aggressive water conservation in the Las Vegas metropolitan area has reduced per capita water demands by 36 percent between 2002 and 2017. But, persistent drought across the Colorado River watershed means that shortages persist. In May 2018, the reservoir stood at just 39 percent capacity with further decline imminent. Water managers in the Las Vegas metropolitan area estimate that more aggressive conservation outreach and education, incentive programs, and rate increases, are needed to meet sustainable water consumption goals.

Drought has also affected water supplies in the Reno-Sparks-Tahoe area. The Truckee River system, which flows out of the Sierra Nevada in California, provides most of the water for Reno-Sparks-Tahoe residents. The Truckee River system is sensitive to the precipitation patterns and snow pack thawing in the surrounding mountains. Drought, in conjunction with rising water consumption from development along the complex **Truckee River System**, makes for less dependable water supply. The problem is further exacerbated by the inadequate management of the Lake Tahoe basin that has plagued the area since about 1960 and drastically affected the lake's water clarity. More than one quarter of a mile deep, the lake is world-renowned for its blue color and transparent waters. Yet, the lake's clarity has been decreasing at an alarming rate of nearly one foot per year. According to UC Davis scientists who have monitored the lake for almost 50 years, Lake Tahoe clarity dropped in 2010, but the rate of decline in clarity over the past decade remains slower compared with previous decades (UC Davis Tahoe Environmental Research Center, 2011). Historic drought followed by record-breaking precipitation and warm lake temperatures converged to produce the lowest annual average clarity levels recorded at Lake Tahoe in 2017 (UC Davis Tahoe Environmental Research Center, 2018). Several factors continue to contribute to Lake Tahoe's declining water clarity in recent years: (a) storm water runoff, (b) urban development, (c) air quality, and (d) erosion. Officials, environmentalists, and business leaders are now tackling questions about growth

[2] For many reasons, Arizona is last in line for the Colorado River's water, and the state is already preparing for the mandatory restrictions.

limits to stave off further deleterious effects on the lake and surrounding. The same trends have underscored the importance of enforcing present laws and passing new pollution regulations.

Southern Nevada

Southern Nevada's water situation is complicated by the lack of diversity in its supply sources. Southern Nevada currently receives nearly 90% of its water from the Colorado River, with the other 10% being drawn from groundwater pumped out through wells in Clark County. Water allotments from the river are governed by the 1922 Colorado River Compact and a series of subsequent compacts, laws, and court-mandated ordinances collectively known as the Law of the River. When Nevada received its allotment of 300,000 acre feet in 1922, it seemed like a lot of water. In fact, the Las Vegas Valley did not begin using its allocation until 1955. As population grew, this allotment has had to be supplemented with large groundwater draws. To supplement the Colorado River supply, the Southern Nevada Water Authority (SNWA) holds applications or groundwater grants for six in-state water resource areas – Garnet and Hidden Valleys, Three Lakes Valley and Tikaboo Valley, Indian Springs, Delamar, Dry Lake, Cave, and Spring Valleys, Snake Valley, and Railroad Valley Groundwater (SNWA 2017). SNWA also retains rights to a significant water allocation from the Virgin and Muddy Rivers. Additionally, the SNWA is also exploring desalination opportunities and water transfers and exchanges as parts of a long-term water supply solution (SNWA 2017).

While development of in-state water resources would supplement southern Nevada's municipal water supplies, and reduce its dependence upon the Colorado River, there are many environmental and socio-political concerns associated with these projects. Unlikely alliances of environmentalists, ranchers, tribes, and other rural citizens formed to resist the potential large-scale impacts to surface water resources in southern and eastern Nevada that may result from both surface flow diversions and groundwater pumping and exportation of these resources through pipelines to the Las Vegas Valley. These water resources, including the Virgin, Muddy river systems in Clark County, the Amargosa River system in Nye County, and the Pahranagat and White river systems in Lincoln and White Pine counties, are critical sources for rural domestic water supply, agriculture, wildlife, riparian and wetland habitats, and endangered species.

The SNWA's plans to convey millions of gallons of groundwater from central and eastern Nevada to Las Vegas generated myriad state and federal-level legal challenges. As it presently stands, SNWA must demonstrate that their proposed groundwater mining and export operation will be sustainable and not cause impermissible impacts on the environment and existing water rights holders, such as ranchers, farmers and local businesses. In 2017, a federal judge upheld the SNWA's plan to deliver water from the Pahranagat and White river systems to Las Vegas, but also indicated that federal regulators would have to specify how they will address environmental damages from the proposed pipeline needed for the project.

The push to increase access to water resources stretches the limits of water availability. Water is a limited natural resource in Southern Nevada. While renewable, it is also finite. Since the water cycle makes available only so much each year in any given location, supplies per person drop as population grows. Sooner or later water demand approaches the natural limits of the water supply, and when it hits those limits, trouble signs begin to multiply – falling water tables, dried up rivers, shrinking lakes and wetlands. Some of those signs are already visible in Southern Nevada. The area's artesian wells have long overextended groundwater supplies found in the large aquifer beneath Las Vegas. Water managers responded by increasing our draws from Lake Mead, which threatens to turn the Colorado River into what hydrologists call a "deficit river" where more water is allotted for its users and is used each year than is annually replenished through the natural cycle. Moreover, drought conditions in the Colorado Plateau, which serves as the watershed for the Colorado River, threaten future supplies if climatological trends continue and future water usage is not further limited.

Water quality in Lake Mead and the valley's groundwater is also vitally important. Potential sources of contamination include urban chemicals such as fertilizers, pesticides, and industry. Presently, all Southern Nevada water districts stand in compliance with federal safe drinking water standards. Health standards are monitored and maintained in the Lake Mead area, but water clarity and water odor are deteriorating. These negative factors are likely to multiply in the future as lake use continues to increase and water levels drop.

Water Conservation

The main challenge facing the Silver State is how to manage effectively water conservation efforts to support existing and future water supply needs. A water resource plan created for Southern Nevada in 1996 by the Southern Nevada Water Authority (SNWA) identified several successful preliminary management strategies that gradually reduced water consumption by more than 5% between 1996 and 2000. But between 2000 and 2003, consumption rates grew and conservation measures began to falter. The SNWA updated their plan in 2002, and once again, in 2004, when the SNWA released a Five-Year Conservation Plan: 2004-2009, which established a number of rebate incentive programs that focus on xeric landscapes, irrigation clocks, and water efficient technologies. The Authority also put forward regulatory programs like water use ordinances, development codes, and drought watering policies aimed at curbing water misuse, as well as several public education and outreach programs designed to teach the public the virtues of watersmart desert culture.

The key to conservation is reducing demand. Some of the SNWA's conservation approaches have been used to good effect as the severe drought became apparent. In 2003, the community achieved an almost 7% increase in water conservation. Between 2002 and 2017, the SNWA calculated that per capita water use declined by 36%, while the population that the SNWA serves increased by nearly 660, 000 (SNWA 2018).

The SNWA has established their goal to achieve a per-capita conservation goal of 199 gallons per capita per day (GPCD) by 2035. SNWA indicates that Southern Nevadans' reduced their GPCD demand from 314 GPCD in 2002 to 219 GPCD in 2012; a much faster rate than originally anticipated. With outdoor water use related to landscaping accounting for 60-90% of water used in the valley, the Authority places a lot of their focus on conserving outdoor water use, such as converting turf lawns to xeriscape and more efficient water use in new construction projects. The economic recession beginning in 2008, along with stabilized population, may also be a factor in the rapid GPCD reduction.

Reno-Sparks-Tahoe

The Reno-Sparks-Tahoe region also faces long-term drought risks that may affect water supplies. However, regional water plans predict that sufficient water supplies exist to serve more than half a million people projected to live in the area within the next two decades.

- According to the Regional Water Planning Commission, a surplus of water will continue until 2036 when the population of the Reno-Sparks metropolitan area is expected to reach about 550,000.

The Truckee Meadows Water Authority (TMWA) reported that the 2010-2011 winter months brought the seventh largest snowpack in more than 100 years to the Sierra Nevada range, which serves as the Truckee River watershed. All reservoirs and Lake Tahoe filled almost to capacity during summer 2011. However, in 2015 the Sierra Nevada range hit a 500-year low snowpack. Persistent "snow droughts" in the northern Sierra Nevada may continue and some environmental experts express concern about long-term water availability economic and population growth continues apace.

The Truckee Meadows Water Authority does not foresee water shortage problems as a result of growth in the *near* future. In the greater Reno-Sparks area, water rights are allocated differently than in Southern Nevada because developers in the Reno-Sparks region must purchase water rights before they can build. The water rights are akin to real property and are sold on the open market. Historically, a set number of water rights were dedicated to the Truckee River – a number that can't change. The result is that when housing developers buy the rights, they turn them over to TMWA once the houses are sold. Since there are a finite number of water rights, they can't be resold. So, if ten people are to cut their water use in half, their rights cannot be sold to develop five new homes. The time is coming when water rights will be sold on the open market, and then a new supply will have to be found.

Lake Tahoe

In 2000, a consortium of universities and federal agencies completed a major study known as the Lake Tahoe Watershed Assessment. Researchers identified several factors that spurred the adverse environmental changes in the Lake area: (a) urbanization, (b) habitat loss, (c) air pollution, and (d) soil erosion.

- The assessment estimates that Lake Tahoe will lose about 30 feet of water clarity by 2030 at current rates of change. Lake color would transform from cobalt blue to green because of estimated five percent algae growth per year.

This projected rate of change is based on phosphorous and nitrogen runoff, which along with other pollutants, contribute to algae blooms. Unless the trend is stopped in time, the damage may become irreversible. This would be a hard blow for Reno-Tahoe residents and the tourism trade.

These problems defy easy solutions, as the loss of water clarity is traceable to an array of sources, including:

- Water that runs off the roads each spring carrying road salt and other fine materials into streams that empty into the lake.

- Building in the Tahoe watershed that disturbs soils and adds to the natural clay runoff.

- Fire suppression that prevents natural small-scale fires from clearing brush and downed timber, which ignites more damaging catastrophic fires and breeds sick forests.

Several multiagency plans are in place to stem the tide of environmental pressures on Lake Tahoe's waters. Still, lake managers fear that the efforts will not be enough and that the lake waters will succumb to human intrusion. The UC Davis Tahoe Environmental Research Center notes that water clarity has been decreasing at an alarming rate of nearly one foot per year. In 2017, historic drought followed by record-breaking precipitation and warm lake temperatures converged to produce the lowest annual average clarity levels recorded at Lake Tahoe.

Water Conservation

The **Truckee Meadows Water Authority** and **Tahoe Carson Irrigation District**, which oversee water management for the Reno-Tahoe area, also have water conservation plans in place. However, the plans appear much less comprehensive than the SNWA's. There are fewer enforceable ordinances covering water misuse and no rebate programs for converting high-intensity water use landscapes. The area does have a tiered conservation plan based on flows of the Truckee River during drought periods. Similar to Southern Nevada, water use is managed by a system that designates various drought condition levels, starting with "no drought," moving to "drought watch," and as the situation worsens, to "drought alert" and "drought emergency." Each step introduces water restrictions for residents to follow. Enforcement mechanisms remain unclear, however.

In 2015, the Truckee Meadows Water Authority converted its remaining flat-rate residential users to metered rates to encourage more responsible water use. Water metering has played an important role in decreasing residential water use.

Between 2003 and 2014, residential water use declined 11.6 percent, while the customer base nearly doubled.

Groundwater Contamination

Many Nevadans draw water from artesian wells that tap underground aquifers. The urban development boom has created contamination problems for some groundwater sources. A substantial number of wells in urban areas contain low levels of nitrates and volatile organic compounds. Some urban shallow wells show nitrate levels exceeding the safe drinking water standard.

The incidence of elevated nitrate levels in aquifers underlying suburban and rural subdivisions has increased. New homes and businesses built outside urban areas often use individual septic systems, which at the time of construction appear to be a cost-effective alternative to community wastewater treatment systems. In some valleys, septic systems have become concentrated, especially where piecemeal housing development is allowed. Housing developments using septic systems that rely on local groundwater sources for domestic or community drinking water supply are of special concern. Septic system seepage appears to be a major source of groundwater recharge and contributes to elevated nitrate levels.

Forty-one years of nuclear weapons testing at the Nevada Test Site (now named the Nevada National Security Site), located 60 miles northwest of Las Vegas, contaminated underground aquifers at the 1,375 square mile site. Nevada hydrogeologists estimate that nuclear testing polluted 1.6 trillion gallons of water. Although the contaminated water is gradually migrating southwest from test site, the U.S. Department of Energy has no cleanup plans, but will continue to monitor the water's movement. State and federal official worry that if too much clean water is pumped out of the ground from nearby area, the contaminated water migration may accelerate.

Land and its Inhabitants

Nevada has the driest climate, the most mountain ranges, and the largest percentage of federal public lands of all lower 48 states.

- The federal government owns almost eighty-four percent of all Nevada land.

The immense recreational opportunities found on the state's public and private lands draw many people to Nevada. These include: hiking, camping, climbing, biking, motorized off-road vehicle use, skiing, golf, boating, and hunting. The activities are enhanced by and must coexist with Nevada's unique natural environment.

From the standpoint of biological diversity (the number and type of species occurring in a given area), the State of Nevada, with 3,800 plant and animal species, ranks fourth in the nation, after California, Florida, and Hawaii. Nevada is also home to a large number of species (309) found nowhere else in the world. The

considerable species diversity in Nevada is attributable to the large variety of habitat types, ranging from arid shrublands to riparian and wetland communities, from low elevation desert playas to alpine habitats at the highest elevations in the many mountain ranges of this basin and range-dominated landscape.

Wildlife Habitats and Conservation

Wildlife habitats are found across 4 distinct eco-regions. According to the Nevada Department of Wildlife's "Action Plan," ecoregions are "relatively large areas of land and water that contain geographically distinct assemblages of natural communities." Nevada's ecoregions include:

- The Columbia Plateau consisting of broad volcanic plains and valleys of the Intermountain West which comprises north central Nevada.

- The Great Basin, a semidesert area extending from the east slope of the Sierra Nevada range across much of Nevada to the Wasatch range in central Utah. It consists of salt desert scrub and sagebrush, conifer forests, and alpine areas near the mountains with isolated aquatic habitats in each area.

- The Sierra Nevada ecoregion is located on the western edge of the Great Basin and is characterized by conifer forests mixed with sagebrush, pinion-juniper stands and alpine areas at high elevations.

- The Mojave Desert eco-region is located in Southern Nevada and is inhabited by creosote scrub, succulents, and yucca-blackbrush species. There are also upper elevation habitats atypical for desert ecoregions.

Nevada's tremendous wildlife diversity derives from its varied geography and climatological conditions. For instance, the myriad mountain ranges are relatively isolated from one another by the arid, treeless basins that divide them. As the Nevada Department of Wildlife explains, this has created isolated islands of habitat, called sky islands. These isolated islands produce the evolution of new species and subspecies of flora and fauna.

Food and water to sustain wildlife exist in abundance in only a relatively few places. Across much of Nevada, these resources are widely scattered at relatively low density. The distribution of wildlife closely reflects this pattern of resource distribution and, so, wildlife is generally not found in high densities across Nevada's ranges. The pattern of isolation and divergence has been even more extreme for Nevada's aquatic species. The state is home to 67 aquatic species found nowhere else in the world. Many of these species are traceable to the Pleistocene period with large lakes covered much of the state. As the climate changed, the lakes dried up, leaving isolated pockets of wetlands and springs. Many organisms that thrived in the lakes, now persist in these isolated areas, evolving and adapting to ongoing ecological change.

Wildlife conservation on Nevada lands is a unique challenge. The generally arid

climate, geography, and water scarcity means that wildlife is easily subject to ecological stressors such as droughts. Also, human factors such as ecologically damaging land uses that alter or destroy habitats are critical. Some of the most influential include:

- Urban Sprawl (discussed below)
- Agricultural impacts leading to water and soil pollution, soil erosion, and chemical buildup of pesticides and herbicides
- Hydrologic changes produced by damming waterways or excessive groundwater pumping
- Mining operations, particularly open-pit techniques
- Characteristics and extent of recreational activities, particularly motorized forms such as off-road vehicles, snowmobiles, watercraft, and other devices that produce noise pollution, erosion, habitat fragmentation, wildlife displacement, vegetation loss, and soil compaction.
- Invasive plant and animal species

Urban Development and Sprawl

Population growth and urban development is transforming Nevada lands. While urban and rural population centers remain widely distributed despite a more than doubling of the state's population in last 30 years, the exuberant pace of urban development in the Las Vegas and Reno-Tahoe areas has raised the awareness of resource issues associated with urban sprawl.

Sprawl is a development cycle that begins with housing developments outside urban boundaries and ends up with a blanket of residential and commercial buildings. Conserving open space for important ecological functions, aesthetic considerations, and socioeconomic values may be only an afterthought for planners in rapidly growing areas. While floodplain, wildlife habitat, and forest areas are sometimes retained as parks or other recreation areas, piecemeal land management does not bode well for maximizing the natural appeal of open environmental spaces. Sprawl is also an inefficient consumption of land that raises costs of municipal and utility services. Sprawling development is known to leave in its wake a host of problems. In particular, it

- Extends road and utility corridor construction
- Expands disturbance in native plant communities and fragments wildlife habitat
- Spurs soil disturbance and erosion

- Compromises water quality
- Increases noxious weed invasions

Subdivisions built outside urban boundaries often resort to using individual septic systems that diminish groundwater quality, as seen presently in several areas throughout the state with high densities of septic systems.

Uncontrolled sprawl development increases pressures on state and local governments to tackle problems with air and water quality, deterioration of plant and animal habitat, over development of floodplains, and loss of public land. Regional air quality deterioration is due, in part, to increasing amounts of pollution produced by the growth in vehicle miles traveled and traffic congestion that accompanies sprawl.

Las Vegas development reveals some of the ways that rapid growth patterns are transforming the Southern Nevada lands, especially regarding use of natural resources and destruction of natural habitats. The Las Vegas Valley was once an area with abundant springs fed by three major aquifer zones generally located from 300 to 1,500 feet below the land surface. These springs provided life-sustaining water for wildlife, plants, and the Pueblo Peoples, Patayan (ancestors of the Yuma groups), and Numa (Paiute) before Anglo-Europeans arrived. As Las Vegas developed from a small Mormon outpost into the sprawling metropolis of today, through well-drilling tapped the aquifer and began to deplete the groundwater. Geologists have "estimated that about 25,000 to 35,000 acre-feet of water naturally recharge the aquifer every year (one acre-foot, about 325,000 gallons, can sustain a family of four for one year). By 1968, Las Vegas residents pumped about 88,000 acre-feet every year. Surveyors also began to notice that the city was sinking" (Bartlett, 2002). Subsidence (i.e., collapse of land) is an outcome of over-pumping groundwater and can be seen in a number of fissures in the land across the valley. Today, the aquifer is "recharged" with water pumped from Lake Mead for use by residents and businesses who own water rights through artesian wells on their land. Thus, while these springs were the life-blood of the valley for humans, wildlife, and plants, today they are taxed past sustainable levels.

Uncontrolled sprawl increases pressures on state and local governments. Regional air quality deterioration is due, in part, to increasing amounts of pollution produced by the growth in vehicle miles traveled and traffic congestion that accompanies sprawl. In the 1990's, local residents responded with calls for the conservation of open space for both human and wildlife use. In Southern Nevada, community efforts are focused on protecting natural stream courses, floodplains and wetlands, improving access to outdoor recreation resources, sensitive species habitats, agricultural greenbelts, cultural sites, scenic views, and wildfire prone forest and shrub lands. In the Reno-Sparks-Tahoe area, communities are assessing open space conservation programs and weighing the merits of bond and tax initiatives for the purchase and conservation of open space.

In October 1998, the **Southern Nevada Public Land Management Act** was passed. The purpose of the act is to direct the BLM to auction approximately 27,000 acres of federally-owned land in Clark County, mostly principally in and around the Las Vegas valley, which in turn provides funding for projects in Southern Nevada that enhance outdoor recreation opportunities and contribute to development of the Clark County **Multiple Species Habitat Conservation Plan**. This plan permits urban development of Las Vegas Valley that currently provide habitat for the desert tortoise, a species listed as threatened under the Endangered Species Act, as well as other sensitive species of plants and wildlife, in return for funding of mitigation measures that conserve these species and their habitats on public lands elsewhere in Clark County. Because the federal government owns nearly 84% of the lands in Clark County, the Act effectively drew a tight ring around the Las Vegas valley. While the BLM lands inside the ring will be sold to private parties, the land outside the ring will remain under Federal management, limiting the extent to which development can spread. However, in 2018, the Clark County Commission approved a resolution calling for federal legislation to open more than 44,000 acres of public land for new development south of Las Vegas, while simultaneously setting aside more than 300,000 acres for conservation.

Urban Green Space and Environmental Amenities

Urban green spaces serve important ecological and social functions. Urban green space refers to attractive parks, urban squares, green corridors, and recreational areas that make an essential contribution to the quality of life of urban residents. Green spaces provide a recreational resource, places for reflection and relaxation, a space for public gathering and social interaction, safe and exciting play areas for children, habitat for animals and plants, attractive backdrops to the built environment, and microclimate buffer zones that moderate the heat of dense urban development.

The "heat island effect" is a crucial concern, especially in the desert. This phenomenon describes urban and suburban temperatures that are 2 to 10°F hotter during the day and in the evening can be as high as 22°F hotter than nearby non-urbanized areas. The Las Vegas metropolitan area is heated by concrete, asphalt, brick, and other materials that absorb the sun's energy. As the valley floor heats up, it then re-radiates the heat to the ambient air, creating an urban heat island. Elevated temperatures can impact communities by increasing peak energy demand, air conditioning costs, air pollution levels, and heat-related illness and mortality (U.S. Environmental Protection Agency, 2011).

Green spaces are critical for mitigating the heat island effect. Increasing the cover of trees and vegetation in cities decreases overall temperatures as well as making homes and buildings significantly more energy efficient. Scientists estimate that strategically planting trees and vegetation reduces cooling energy consumption by up to 40%.

Rooftops can also be converted to green space. On a hot, sunny, summer day, traditional roofing materials may reach summertime peak temperatures of up to 190°F (88°C). By comparison, green "cool roofs" only reach peak temperatures of 120°F (49°C). When installed widely in a city, green cool roofs contribute to heat island reduction by replacing heat-absorbing surfaces with plants, shrubs, and small trees that cool the air through evapotranspiration (or evaporation of water from leaves). Planted rooftops remain significantly cooler than a rooftop constructed from traditional heat-absorbing materials. Further, green roofs reduce summertime air conditioning demand by lowering heat gain to the building. It is presently unclear whether green roofs are appropriate for the intense desert climate of Las Vegas. Phoenix, Arizona developers are beginning to test green roofs adapted to arid environments and Arizona State University researchers are incorporating green roofs into a multidisciplinary study of the urban heat island in the Phoenix metro area. The City of Las Vegas began exploring the idea with a special symposium in spring 2008 by facilitated by Green Roofs for Healthy Cities with the aim of educating city politicians, planners, businesses, and building and design professionals on the sustainable potentials of green roofs and green walls in Las Vegas (see Green Roofs for Healthy Cities, 2008).

Installation of solar panels on and around homes and businesses could also better mitigate the heat island effect by absorbing the heat and light to help prevent rising temperatures while simultaneously putting the solar energy to use.

Resident Health and Community Well-Being

Green spaces in urban communities also serve crucial social functions that enhance individual and social well-being. A key social function is mitigating the psychological demands of urban living. City life appears to stimulate a desire for contact with nature (van den Berg, Hartig, and Staats, 2007), a feeling that stems from what Richard Louv (2008) and other social scientists call "nature deficit." The urban experience is replete with stressors such as noise from traffic, fear of crime, overcrowding, and the like. Several studies have shown that residents highly appreciate urban green space, considering it an important factor in their residential satisfaction (Bonaiuto et al., 1999). Contact with nature serves an important adaptive function environmental psychologists call "psychological restoration" (van den Berg, Hartig, and Staats, 2007). Green spaces enhance psychological restoration by providing an experience of "being away" from daily routines, offer aesthetically pleasing stimuli, encourage processes of exploration and mindfulness of stimuli that attract and hold attention with little effort. Moreover, there are some indications that urban residents who live in neighborhoods with abundant green space report fewer health problems.

Green space may be especially crucial in Las Vegas, where more than two-thirds of Nevada's population resides. Between 1985 and 2014, greenspace in the Las Vegas metropolitan area decreased by about two and one-half percent (McLean, Daniel D., Rayn R. Jensen, and Elizabeth Barrie 2016). Green spaces are urban amenities that encourage active behavior good for physical and mental well-being, such as walking or resting. Green spaces also act as community gathering spaces for the

Las Vegas community. However, deciding on who benefits from these public areas can be controversial as common trends in growing cities show that parks and public space are developed more in newer areas. As a result, older areas of urban cities are neglected of new landscaping and green spaces.

One of the major issues that the City of Las Vegas Planning and Development Department expects to address is the unequal distribution of environmental amenities in the City. One of their goals is to create a needs-based model to environmentally improve lower income areas first and then move to middle and higher income areas. They plan to plant more trees in areas in need of green space and provide other environmental amenities.

Military Lands

Nevada is sometimes called a "wasteland" because of its stark high desert landscape that seems so inhospitable to life. This common misperception is used to rationalize the use of Nevada lands for military operations and nuclear research. It has also helped to justify the location of Yucca Mountain, the nation's proposed repository for spent nuclear fuel and high-level radioactive waste.

Activities on the large federal facilities in Nevada have caused significant environmental damage. A large portion of the former-Nevada Test Site (now named the Nevada National Security Site) will remain restricted "in perpetuity" due to radiological and toxic contamination stemming from 40 years of above and below ground nuclear tests. Underground testing has contaminated groundwater over vast areas.

- State officials now estimate that a more than 300 square mile area is contaminated beneath the site.

- Surface soils at the former-NTS are also contaminated with various radionuclide. At least 30,000 acres will remain permanently restricted for all uses at the site.

Environmental damage at the Hawthorne Army Depot, Nellis Air Force Base, and Fallon Naval Air Station stems from industrial contamination, such as solvents and aviation fuels in shallow aquifers. It is unlikely that contamination of bombing and testing ranges will ever be remediated, the chief reason being the high costs of cleanup. Contamination in such areas resulting from live ordnance use is a significant safety hazard and potential long-term environmental risk.

The federal government has funded groundwater and surface contamination studies at some of the military facilities, but such programs are inevitably limited, as the facilities remain active. The federal government allocates federal funds to military bases to address site-specific cleanup and closure activities. Groundwater contamination at the former Nevada Test Site is perhaps the most troublesome because certain contaminants remain mobile in water (e.g., tritium). Radionuclide

also pose a tangible threat, as they have decay periods measured in thousands of years. Most radioactive remnants remain in the Test Site's underground detonation sites (Rogers 2014).

Energy

Relative to other states, Nevada does not have a very energy intensive economy. Per capita energy consumption is among the lowest one-fifth of states. Presently, Nevada imports about 88% of all the energy consumed in the state. More than two-thirds of the state's electricity comes from natural gas-fired power plants (State of Nevada. 2017 Status of Energy Report. Governor's Office of Energy.) But, Nevada has vast under-developed renewable energy resources, including solar, geothermal, and wind energy, that could greatly reduce dependency on out-of-state sources. In 2016, Nevada ranked second in the nation in utility-scale net electricity generation from geothermal energy and fourth in utility-scale net generation from solar energy in 2016.

Renewable Energy in Nevada

Nevada's Energy Portfolio Standard requires that 25% of electricity sales come from renewable energy resources by 2025. Presently, more than one-fifth of Nevada's electricity generation is fueled by 51 renewable energy sources including geothermal, solar, wind, biomass, and hydroelectric power sources. Of these, geothermal and solar sources account for the vast majority of Nevada's renewable energy generation.

Geothermal: Geothermal technology uses the heat from the earth's surface or deep hot water or steam reservoirs. Nevada has some of the richest geothermal resources in the world and is one of the few states with utility-scale electricity generation from geothermal resources. Presently, geothermal resources account for almost half of the state's renewable generation. With 550 megawatts of geothermal power under development and another 1,000 of untapped potential, Nevada ranks first in geothermal energy use per capita in the nation. Nevada sits second in the nation, after California, in geothermal power production and has the country's largest geothermal energy potential. Nevada and the surrounding region have the potential to become one of the world's most productive resource areas for geothermal energy development.

Solar: Solar power generation uses the sun as a source to convert sunlight directly into electricity via photovoltaic panels or to concentrate sunlight then use the resulting heat to generate electricity from conventional steam driven turbines. Nevada ranks first in total solar electricity generated per capita and holds great potential for much more solar energy production. Nevada has the highest solar energy potential in the nation.

During 2015, Nevada saw the completion of three of the highest-capacity solar plants in the world: the 110-megawatt Crescent Dunes Solar Energy Project, the 150 megawatt Copper Mountain Solar 2 plant, and the 250 megawatt Copper Mountain solar 3. By 2016, utility-scale solar generation exceeded the amount

from hydroelectric power for the first time. In mid-2018, NV Energy contracted for more than 1,000 megawatts of new renewable energy sources, including six new solar energy projects and three related battery-energy storage sites. Three projects will be developed in Southern Nevada, while the other three are distributed across Northern Nevada sites.

Controversy has surrounded residential rooftop solar efforts in Nevada. In late 2015, the Nevada Public Utilities Regulatory Commission tripled the fixed charges solar customers would pay over the next four years and reduced the credit solar customers receive for producing more energy than they use by three-quarters. Regulators argued that the order was designed to make solar customers pay their fair share for use of NV Energy's electrical grid. Solar companies warned that the changes make rooftop solar economics unworkable. The new rate took effect on January 1, 2016 and several major solar companies and local installers cut staff as a result of low demand for rooftop solar installations. After considerable pushback from customers, environmental groups, and solar installation companies, the Nevada legislature signed AB 405 in 2017 to reinstate net metering to reimburse rooftop solar customers at 95 percent of the retail electricity rate for excess generation from a solar system. The law also established several additional consumer protections. AB 405 reinvigorated rooftop solar adoption in Nevada with applications increasing 11-fold shortly after its passage.

Wind: When harvested by **wind turbines,** wind can be used to generate renewable **electricity**. Wind turbines convert the wind's kinetic energy into mechanical power to run electric generators that supply useable electric current. Nevada has vast wind power potential along the state's many mountain ridges. The state's first utility-scale wind energy project, the Spring Valley Wind project, was constructed in 2012. However, Nevada's installed capacity of 152 megawatts, lies far short of the almost 500,000-megawatt potential capacity that Nevada wind power holds. Because the federal government controls much of the land in the state, most large-scale wind projects require need federal rights-of-way. No new large wind projects are currently under construction.

Hydroelectric: Hydroelectric power refers to electricity generated by water flowing through turbines located in reservoir dams. Nevada has two major dams which produce electric power: Hoover Dam and Davis Dam. Hoover Dam generates, on average, about 4 billion kilowatt-hours of hydroelectric power each year for use in Nevada, Arizona, and California –enough to serve 1.3 million people. From 1939 to 1949, Hoover Powerplant was the world's largest hydroelectric installation; today, it is still one of the country's largest (Bureau of Reclamation: Lower Colorado Region – Hoover Dam). About 40% of Nevada's renewable energy comes from hydropower and mostly from the Hoover Dam. Almost 24% of all power generated by Hoover Dam goes to Nevada. NV Energy provides incentives for agriculture and tribal customers to install micro-hydro systems on their land to create additional localized power.

Energy on tribal lands

Tribal lands make up two-percent of Nevada, but like most of the state, they have abundant solar resources. Nevada hosts 32 Indian reservations and tribal colonies, including 19 federally recognized Indian tribal entities. Nevada's Moapa River Indian Reservation, located 50 miles northeast of Las Vegas, hosts the nation's first utility-scale solar power plant built on tribal land. However, their leasing agreement designates the power out of states to the Los Angeles Department of Water and Power for the next 25 years.

In 2014, the Department of Interior approved a second utility-scale solar power plant on the Moapa River Indian Reservation. A third solar project on the reservation was approved in 2016.

Other Nevada tribes are evaluating renewable energy projects on their lands. The Pyramid Lake and Walker River reservations are ranked among the top five tribal lands in the nation by potential for geothermal capacity and generation. The Pyramid Lake Paiute Tribe has partnered with Black Rock Solar and NV Energy to create a "Solar City" in Nixon, Nevada. Nixon boasts more solar panels per person than any other U.S., town or tribal community and generates electricity to powering the local high school, tribal museum, health clinic, police station, tribal offices and fish hatchery. Nevada's Washoe Tribe has several solar plants and plans to meet all of the tribe's energy needs with renewable sources by 2025.

Nevada's Renewable Energy Future

State leaders continue to support renewable energy development. In the 2017 Legislative Session, Nevada Governor Brian Sandoval signed several energy bills pertaining to the state's renewable energy growth and improvement, including:

- AB 5, a property assessed clean energy financing bill, to enable more renewable energy and energy efficiency improvements.

- AB 223 ensures that no less than five percent of state energy efficiency spending go toward helping low-income Nevadans.

- SB 405 reinstated 95% retail rate net metering for solar energy production, solving a contentious political situation created when the Public Utilities Commission of Nevada revoked retail rate net metering in 2015. This act also establishes a renewable energy bill of rights for all customers that provides additional transparency, accessibility and accountability in rooftop solar leasing and purchasing.

During the last decade, Nevada's renewable energy development sector has grown, yet much more room remains for additional expansion. Nevadans for a Clean Energy Future call for a ballot measure to increase the state's commitment to a renewable energy portfolio commitment from 25% in 2025, to 50% by 2030. While Nevada has reduced dependence on coal-fired electricity, the primary energy source remains gas-fired generation. Renewables advocates note that "Nevada still

spends $700 million a year to import fossil fuels from out of state to power the grid, and that we can not only get what we need right here, but renewables are getting cheaper...evening the playing field."

Energy Conservation

Energy conservation and efficiency strategies are crucial for energy security and sustainability. The U.S. Environmental Protection agency recommends using energy more efficiently through more efficient products, such as ENERGY STAR qualified appliances or light bulbs. If every American home replaced their 5 most frequently used light fixtures or the bulbs in them with ENERGY STAR qualified lighting, we would save close to $8 billion each year in energy costs and prevent greenhouse gases equivalent to the emissions from nearly 10 million cars. Sealing and insulating homes and offices improves comfort and reduces heating and cooling costs. The EPA recommends Home Sealing to improve your home's "envelope" or the outer walls, ceiling, windows, and floors by adding insulation, sealing air-leaks, and choosing ENERGY STAR labeled windows.

NV Energy offers several incentives for energy conservation and renewable generation through their Renewable Generations incentive program that helps customers offset the installation costs of solar, wind, and hydro energy systems.

The Nevada State Office of Energy also promotes its Direct Energy Assistance Loan (DEAL), H.E.R.O.S Weatherization Program, Green Building Tax Abatements, and Revolving Loans. DEAL Loans provides state employees a zero-interest loan for home energy upgrades. The H.E.R.O.S. weatherization program helps eligible Nevada seniors save energy and money at home. Green Building Tax Abatements are incentives to improve energy efficiency in new and existing buildings. Finally, the Nevada State Office of Energy offers revolving loans to fund systems or projects that develop or expand renewable energy, energy efficiency, or energy conservation measures.

LEED Building Projects

According to the U.S. Green Building Council, Nevada leaders are focused on increasing the state's green building to improve performance in water efficiency, energy saving metrics, CO2 emissions reduction, and indoor environmental design quality. Much of Nevada's success has been in developing several Leadership in Energy and Environmental Design (LEED) projects throughout the state. Between 2015 and 2017, Nevada ranked sixth in the nation in per capita LEED space. Nevada did not make the 2018 top-ten list.

Leadership in Energy and Environmental Design (LEED) is an internationally recognized green building certification system developed by the U.S. Green Building Council (USGBC) in March 2000 (refer to U.S. Green Building Council, 2011). "LEED provides building owners and operators a framework for identifying and implementing practical and measurable green building design, construction, operations, and maintenance solutions." In 2000, USGBC established benchmarks (based on a point system) for the LEED Green Building

Rating System, which are flexible enough to apply to all building types (including commercial and residential buildings). Buildings can qualify for four levels of certification: Certified (40-49 points), Silver (50-59 points), Gold (60-79 points), and Platinum (80 points and above). There are five overarching categories available under the LEED Accredited Professional Program which can qualify for certification: (1) Green Building & Construction; (2) Green Interior Design $ Construction; (3) Green Building Operations & Maintenance; (4) Green Neighborhood Development; (5) Green Home Design and Construction.

Nevada is home to several LEED-certified green building projects with more to come. Nevada's 2016 sixth-place national ranking in per capita LEED buildings, recognized 22 projects that were LEED certified that year. Currently, there are 89 buildings in Nevada that are receiving incentives for energy efficiency and sustainability through the program.

Prospects for the Future and Work Ahead

As the U.S and Nevada economies recover from the Great Recession, pressures on Nevada's environment will continue grow. Several broad measures should be taken to address the environmental issues facing Nevada.

- We need to continue to raise the awareness among Nevada citizens about the causes and consequences of environmental damage and the urgently needed conservation measures, especially our water resources.

- There should be increased advocacy from public officials at state and local levels, community leaders, planning and environmental management professionals, and the media to support ongoing efforts of concerned citizens groups and community organizations in this task.

- Sustained effort should be made by Nevada legislators at federal and state levels to secure federal and state government funding to tackle ongoing issues, such as air quality, water resource management, and environmental damage remediation.

- We need sustained efforts to further advance the vast potential of Nevada's renewable energy sector.

- We need Sorely needed for effective short- and long-term planning is independent research that explores the effects of Nevada's economic and urban development on the local environment.

What Nevada Citizens Can Do

Air Quality can be addressed through strict programs targeting emission sources such as motor vehicles, gasoline stations, and industrial operations. According to the Clark County Department of Environmental Air Quality, the following are the most effective measures for controlling emissions:

- Refuel motor vehicles after sunset to prevent gasoline fumes from interacting with sunlight.

- Keep vehicle engines finely tuned.

- Limit the use of solvents and aerosol sprays for painting and dry cleaning.

- Use electric-powered lawn equipment instead of mowers with gasoline motors.

- Enhance programs to boost ridership on mass transit and increase ride-sharing in private cars and trucks.

Citizens can increase water conservation efforts in the following way:

- Convert grass lawns and other heavy water use landscaping to water efficient xeriscapes. Also install and use an efficient irrigation clock for both sprinkler and drip systems.

- Use commercial car washes that recycle water on-site or send it to a water treatment facility, where it is cleaned and returned to the water cycle.

- Inspect and repairing leaking plumbing and install low-flow shower heads and faucet aerators.

- Cover and maintain swimming pools

- Purchase electric vehicles, when possible

Citizens should encourage land use planners in Southern and Northern Nevada to focus on:

- Conserving areas for their value as open spaces

- Withdrawing designated areas from development where land use conflicts may arise

- Retaining or acquiring public recreation access to public lands

- Designating areas closed or open to off-highway vehicle use

- Identifying and protecting environmentally sensitive areas

- Controlling urban sprawl

- Developing more green spaces for residential well-being

Citizens can get involved in local, state, and national environmental organizations such as:

- Sierra Club
- The Nature Conservancy
- Friends of Nevada Wilderness
- Lahontan Audubon Society (Reno)
- Red Rock Audubon Society (Las Vegas)
- Nevada Wildlife Federation
- Nevada Wilderness Project
- Clean Energy Project

There are also opportunities to participate in public hearings and evaluation programs organized by local, state, and federal environmental and natural resource management agencies.

Conclusion

A safe, healthy, and sustainable environment is crucial to secure healthy lives for Nevadans. The problems identified in this report are tied primarily to population growth and urbanization. Nevada's two main urban areas – Las Vegas and Reno-Sparks-Tahoe – retain potential as powerful growth engines attracting people and businesses at unprecedented rates during the last decade. The fact that growth has been relatively under-regulated contributes to the environmental woes confronting the regions. In the coming years, Nevadans should continue to focus on ecological stressors in our region and make informed decisions about the environmental policies affecting the Silver State's quality of life.

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Appendix

Community Resources

Federal Resources

U.S. Bureau of Reclamation – Lower Colorado Region manages the last 688 miles of the Colorado River within the United States which includes overseeing water and power delivery, protecting endangered species and native habitat, accounting for water use, and maintaining the river channel and protective levees, http://www.usbr.gov/lc/.

U.S. Bureau of Land Management – In Nevada, the BLM manages approximately 47.5 million acres of public lands for multiple uses including wildlife habitat, grazing, mining, and recreation, http://blm.gov.

U.S. Center for Disease Control and Prevention works to protect public health and safety by providing information to enhance health decisions throughout state health departments, http://www.cdc.gov/.

U.S. Department of Energy is concerned with U.S. policies regarding energy and safety in handling nuclear energy, http://energy.gov/.

U.S. Environmental Protection Agency develops and enforces federal environmental regulations and performs environmental research, http://www.epa.gov/.

U.S. Fish and Wildlife Service conserves, protects and enhances fish, wildlife, and plants and their habitats through management of National Wildlife Refuges and regulation of the Endangered Species Act, the Migratory Bird Treaty Act, and other federal laws and regulations, http://www.fws.gov/.

U.S. Forest Service – The Humboldt-Toiyabe National Forest in Nevada and a small portion of eastern California, at 6.3 million acres, is the largest National Forest is the lower 48 states. The Humboldt-Toiyabe National Forest includes 10 ranger districts primarily in the higher elevation mountain ranges scattered throughout the state, http://www.fs.fed.us/r4/htnf/.

U.S. Green Building Council established the internationally certification system LEED which is a rating of green building, http://www.usgbc.org/DisplayPage.aspx?CategoryID=19

State of Nevada Resources

Colorado River Commission of Nevada (CRC) is responsible for acquiring and managing Nevada's share of water and hydropower resources from the Colorado River, http://crc.nv.gov/.

U.S. Green Building Council, Nevada is the state's resource for LEED building in the Silver State, https://www.usgbc.org/usgbc-nevada.

Southern Nevada Public Land Management Act (SNPLMA) is a law that allows the Bureau of Land Management to sell public land within a specific boundary around Las Vegas, Nevada, http://www.blm.gov/nv/st/en/snplma.html.

State of Nevada Department of Conservation & Natural Resources (DCNR) is responsible for the establishment and administration of goals, objectives and priorities for the preservation of the State's natural resources, http://dcnr.nv.gov/.

State of Nevada Department of Wildlife (NDOW) is the state agency responsible for the restoration and management of fish and wildlife resources, http://ndow.org/.

Nevada State Health Division promotes and protects the health of Nevadans through public health and the enforcement of laws regarding public health, http://health.nv.gov/.

Nevada State Office of Energy is the state office, which ensures the wise development of Nevada's energy resources, http://energy.state.nv.us/.

NV Energy serves the citizens of Nevada with energy in the form of electricity, http://www.nvenergy.com/company/.

Las Vegas/Clark County Resources

Clark County Department of Air Quality and Environmental Management is responsible for monitoring air, developing proper control measures, and educating the citizens of Clark County, Nevada, http://www.clarkcountynv.gov/airquality/Pages/default.aspx.

Clark County Water Reclamation District is responsible for treating, disinfecting, and reclaiming wastewater before returning to the environment, https://www.cleanwaterteam.com/Pages/default.aspx.

City of Las Vegas Sustainability reviews sustainability issues facing the city and strategies to address them, https://www.lasvegasnevada.gov.

Las Vegas Farmers Market provides information on markets in the Las Vegas area, http://www.lasvegasfarmersmarket.com/.

Vegas Root Community Garden is the first public community garden in Las Vegas, http://vegasroots.org/.

Southern Nevada Strong is a collaborate planning effort focused on sustainability in transportation, housing, economy, health, and environment, http://sns.rtcsnv.com/.

Southern Nevada Water Authority is regional agency that manages the Las Vegas Valley's water supply and other water resources, https://www.snwa.com/.

Reno-Sparks-Tahoe Resources

City of Reno Department of Community Development oversees land use through planning and zoning mechanisms, http://www.cityofreno.com/res/comdev/.

Ignite Sparks Initiative stipulates city planning in the areas of growth, economic vitality and quality of life through the year 2030, http://ignitesparksnv.com/.

Lake Tahoe Watershed Assessment provides scientific information in subject areas pertinent to policy development and land and resource management in the Lake Tahoe basin, http://www.fs.fed.us/psw/publications/documents/gtr-175/.

Northern Nevada Water Planning Commission ensures quality of life for Northern Nevadans through efficient total water management, http://www.nnwpc.us/.

Truckee Carson Irrigation District (TCID) acquires, constructs, operates, and controlf facilities and structures relating to the distribution of irrigation waters, http://www.tcid.org/index.htm.

Truckee Meadows Water Authority is a collaborative unit of the Cities of Reno and Sparks and Washoe County that manages water resources for the region, https://tmwa.com/.

USDA Forest Service – Lake Tahoe Basin Management Unit protects Lake Tahoe and its water quality by managing a diverse range of resources,

particularly the complex watershed systems that form the basin surrounding the lake, http://www.fs.fed.us/r5/ltbmu/.

Environmental and Conservation Organizations

The Nature Conservancy (Nevada Chapter) is a leading international, nonprofit environmental conservation organization. Their mission in Nevada is to preserve the plants, animals and natural communities in Nevada by protecting the lands and waters they need to survive, http://nature.org/wherewework/northamerica/states/nevada/.

Sierra Club of Nevada is a chapter of the national organization dedicated to wilderness preservation, http://nevada.sierraclub.org/.

The Wilderness Society is a national conservation group with the goal of protecting America's Wilderness through the combination of science, advocacy and education, http://www.wilderness.org/WhereWeWork/Nevada/index.cfm.

Clean Energy Project is is a nonprofit, non-partisan organization that promotes renewable energy development through education and engagement with policy makers, business and community leaders, and citizens, https://cleanenergyprojectnv.org/.

Friends of Nevada Wilderness is a wilderness education and advocacy group that strives to keep Nevada's wild places wild, http://www.nevadawilderness.org/.

Lahontan Audubon Society is a Reno-based group dedicated preserving wildlife habitat in Northern Nevada, http://www.nevadaaudubon.org/.

Red Rock Audubon Society educates the public and protects and restores delicate Southern Nevada ecosystems, https://www.redrockaudubon.com/.

Nevada Wildlife Federation is state's oldest nonprofit, conservation organization, http://www.nvwf.org/.