

Ecosystem Stressors in Southern Nevada

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Executive Summary

Southern Nevada ecosystems are subject to a number of stressors that range in scope from local to regional to global. At the regional scale, human population growth and related activities constitute a major stressor. Nevada has undergone significant change due to unprecedented population growth and ongoing global change processes. Nevada's growth rate has been the highest in the nation for the last five decades. Clark County has experienced particularly rapid growth with a population increase of more than 40 percent since the 2000 census. Other regional or local stressors, many of which are related to human population growth, include invasive species, changes in land use, and altered fire regimes. Global stressors affecting southern Nevada ecosystems include elevated carbon dioxide (CO₂) concentrations, nitrogen (N) deposition, and changes in temperature and precipitation patterns. This chapter provides background information on the stressors affecting southern Nevada's ecosystems that is needed to address Goal 1.0 in the SNAP Science Research Strategy, which is "Restore, sustain, and enhance southern Nevada's ecosystems."

Global Stressors

Atmospheric CO₂ increased approximately 32 percent during the last century and is expected to double by the end of this century. Concentrations of CO₂ are closely linked to global warming and climate change. Over the last 150 years, global temperatures have risen in tandem with increasing CO₂. Data for Nevada show that temperatures have risen 2.0 °C since 1908, with a projected increase of 2-6 °C by 2100. Increases in nighttime temperatures will likely lead to an expansion of desert species northward. Precipitation patterns also are influenced by rising levels of atmospheric CO₂ through changes in ocean temperatures and global circulation patterns. In addition to expected changes in the amount and timing of precipitation, rising temperatures will likely decrease snow pack levels and increase the rate of snow-melt, resulting in lower mid-summer stream flows. Longer and more intense droughts are expected to occur throughout the west. Drought and reduced runoff will result in increased competition for the limited water resources of southern Nevada.

Local and Regional Stressors

Population Growth and Urbanization

Until the recent economic downturn, Nevada was the fastest growing state in the country for five straight decades. The vast majority of urban development has taken place in the Mojave Desert scrub ecosystem. Associated issues include dust generation,

dumping, off-road travel and unauthorized roads, destruction of cultural resources, creation of dispersal corridors for exotic species, and land degradation caused by uncontrolled recreation and ORV use. Vegetation communities at higher elevations are impacted by recreational activities of the large urban population. Pollution and dust from energy development, housing development, and recreation affect air quality through increases in airborne particulate matter. Of particular concern are particles smaller than 10 micrometers in diameter (PM-10), which can cause serious health effects. Windblown dust accounts for 89-90 percent of the PM-10 occurring in Clark County.

Control measures currently being implemented are expected to offset increases in vehicular emissions that accompany population growth.

Nitrogen Deposition

Industrial and urban pollution have led to increased levels of atmospheric nitrogen deposition. Nitrogen deposition generally occurs as dust. Increased levels of nitrogen may result in higher biomass production if accompanied by sufficient moisture; however, potential gains in productivity will likely be mitigated by changes in climate. Unfortunately, exotic annual grasses are particularly responsive to increased levels of nitrogen, potentially causing a community shift from shrubland to one dominated by invasive grasses. Increased levels of soil N are also expected to alter nutrient cycling.

Energy Development

In southern Nevada, renewable energy is in the form of solar and wind energy development. The BLM has identified five solar energy zones in southern Nevada. These areas have high solar radiation and limited environmental concerns. Solar energy facilities are planned, under construction, or in operation in Boulder City and Amargosa Valley. Limited experience with large-scale solar facilities means that there is little on-the-ground capacity to mitigate potential impacts. Attention during the planning, construction and operation phases could help to minimize potential environmental impacts.

The technology to develop energy from wind on a large scale is more mature than that for large-scale solar development, but our understanding of potential impacts of proposed large-scale wind farms in southern Nevada is severely lacking. Potential effects of wind turbines on wildlife include avoidance behavior, and bird and bat mortality.

Recreation

As the population in southern Nevada continues to grow, so too will the use of public lands for recreation. Meeting recreational needs of both citizens and visitors to the area must be balanced with maintaining natural resources and conserving the unique biodiversity of southern Nevada's ecosystems.

Water Development

Water is a very critical issue throughout the Southwest. The Southern Nevada Water Authority (SNWA) was formed in 1991 with the goal of managing existing water resources, developing new ones, and promoting conservation. Ninety percent of the water provided by the Las Vegas Valley Water District is from Colorado River water impounded in Lake Mead. Ten percent of the water budget comes from approximately 100 municipal groundwater wells. Based on current and projected demands, a long-term water supply other than the Colorado River is needed. The Water Resource Plan projects the need for additional groundwater resources to be brought on-line by 2020.

Springs are home for many rare species and the presence of non-native species, both animal and plant, constitute a major stressor. Stressors on springs include animal and human trampling, water diversion and groundwater pumping, seasonal freezing and drying, contamination, and scouring by flooding.

Insects and Disease

Insect and disease issues in southern Nevada are limited at present. Chronic wasting disease in deer, white nose syndrome in bats, and respiratory infections in desert bighorn sheep have the potential to occur in southern Nevada, but are not currently found within the state. In 2009, the Humboldt-Toiyabe National Forest conducted an aerial survey of bark beetle damage. Over 200,000 acres were surveyed, with only minimal damage observed. Drought, warmer winter temperatures, and changes in precipitation amount and timing will certainly affect the type and extent of insect and disease outbreaks, but what these might be is currently unknown.

Grazing

Permitted grazing by domestic livestock in southern Nevada is minimal, although trespass grazing is an issue in some areas. There is a legacy of effects from grazing of large numbers of cattle and sheep in previous decades. Very few records of past use are available and that makes determining the amount of disturbance and recovery rates difficult. Currently, the major grazing impacts in southern Nevada come from wild horses and burros. The annual population increase since 2006 is estimated to be 17 to 20 percent for wild horses and 20 percent for burros, a fact that makes maintenance of appropriate population size difficult. Wild horses and burros consume herbaceous vegetation and some parts of woody vegetation in a wide variety of vegetation types, with use concentrating at springs/seeps. Ground disturbance caused by trampling, particularly in areas surrounding sensitive springs and seeps, creates conditions favorable for invasive non-native species and may harm rare species. Large scale fires, which are a fairly recent phenomenon, and the projected increases in temperature and drought frequency will reduce available water and forage.

Invasive Species

Invasive species present a number of management issues. In the Mojave Desert, management of invasive plants and management of fire must be integrated due to the linkage between the two issues. Invasive plants produce biomass and fine fuels that will carry fire in the interspaces between shrubs, resulting in large, relatively frequent wildfires in desert shrub ecosystems that are not fire adapted. Wetland and aquatic invasives are also on the rise. Riparian weeds reduce the biodiversity of critical wetland communities. Also, the release of nonnative fish into springs, quagga mussels into lakes, and nonnative bullfrogs and crayfish into lakes and rivers are impacting the native and endemic fish, amphibians, and snail species.

Altered Fire Regimes

Wildfire is a growing concern to managers in southern Nevada. The shrub communities of the Mojave Desert are not adapted to large-scale fire. Shrub seedbanks of many species are not sufficient for natural regeneration to occur after fire. The post-fire shrub community is less diverse, and has increased fine fuel loads that are prone to more frequent fire. Thus, the fire cycle is reset outside of the timeframe under which these

communities developed. Restoration of the post-fire landscape is problematic due to lack of predictable moisture, unavailability of native seed, and other issues. Suppression of naturally occurring fires at upper-elevation ecosystems that are fire-adapted has also created a problem for land managers.

Knowledge Gaps and Management Implications

Southern Nevada is experiencing both a novel suite of stressors and an unprecedented rate of climate change. With the introduction of new stressors, rapid climate change, and increased and larger disturbances, ecosystems will change in new and difficult to predict directions. Managers are faced with situations for which we have no current answers. What can be done to control the influx of invasive species? How can we manage the increasing frequency and intensity of wildfires? Of particular concern are endemic species that exhibit specific habitat requirements. Are they resilient enough, genetically variable enough, or are their specialized habitats protected enough for them to persist in place? These questions constitute some of the big issues facing managers and provide a general overview of knowledge gaps, which are discussed in more detail in subsequent chapters. Additional information needs are:

- Species-specific climate profiles and projected ranges under different climate change scenarios; methods to detect geographic shifts in plant communities and individual species.
- Effects of drought, warmer winter temperatures, and changes in precipitation amount and timing on the type and extent of insect and disease outbreaks.
- Interactive effects of naturally occurring disturbances with global change drivers such as rising levels of CO₂ and N deposition.
- Effects of N deposition and increased CO₂ levels on biogeochemical cycles including biological soil crust function.
- Appropriate plant materials and planting techniques for use in reclamation and restoration of disturbed sites under expected climate change scenarios.
- Criteria for selecting the most appropriate and least deleterious sites for energy development.
- Information on the environmental impacts of large-scale power development, including wind and solar, on animal mortality, migration corridors, seed movement, and potential off-site effects of dust and chemical dust control agents.
- Improved techniques for tracking available forage given the increase in the biomass of exotic annual grasses and the accompanying changes in the size and frequency of wildfires.

Human caused stressors can be mitigated through educational programs. Dust control and reduction, energy savings to reduce energy sprawl, reduction of soil surface disturbance, and reduction of the impact of recreational activities are among many areas in which existing and new educational programs could reduce human impacts. All educational programs should stress how these steps increase ecosystem integrity. For a complete discussion of topics in this executive summary, see *Chapter 2, Southern Nevada Ecosystem Stressors* in “The Southern Nevada Agency Partnership Science and Research Synthesis – Science to Support Land Management in Southern Nevada” (RMRS GTR-303).

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