Desert Habitats

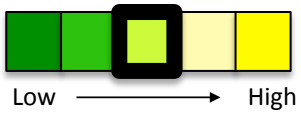
Climate Change Vulnerability, Adaptation Strategies, and Management Implications in Southern California National Forests

Habitat Description

There are three deserts in southern California: the Mojave Desert, the Colorado Desert (a subdivision of the larger Sonoran Desert), and the less well-known San Joaquin Desert, which historically and included much of the San Joaquin Valley, Carrizo Plain, and Cuyama Valley. These desert ecosystems contain the highest temperature extremes in the United States; topographical relief in these desert ecosystems ranges from 86 m below sea level in Death Valley up to 3300 m above sea level in the Panamint Range.

Habitat Vulnerability

Moderate Vulnerability



Sensitivity & Exposure

Desert habitats are sensitive to climate drivers that exacerbate the already hot and dry conditions, enhancing vulnerability for many species that already exist close to their physiological limits. Climate drivers and disturbances (e.g., changes in precipitation, flooding, wildfire) have the potential to significantly alter species survival and composition. Slow-growing vegetation makes deserts particularly vulnerable to invasive grasses, which provide fine fuels for wildfire; ultimately, the cycle of invasive species and wildfire can cause type conversion to grasslands . Non-climate stressors have already disturbed and/or fragmented many desert habitats.

Drivers of Desert Habitats

- Climate sensitivities: Precipitation, soil moisture, low stream flows, drought, extreme heat events
- Disturbance regimes: Wildfire, flooding
- Non-climate sensitivities: Invasive species

Projected Climate and Climate-Driven Changes	Potential Impacts on Desert Habitats
Changes in precipitation, decreased soil moisture, and increased drought *Changes in timing and amounts of seasonal precipitation; longer, more severe droughts with droughts years twice as likely to occur*	• Loss of critical water sources and associated microclimate refugia (e.g., palm oases) • Changes in plant phenology (e.g., germination, blooming) • Increase in drought-adapted vegetation, including succulents • Reduced seedling establishment, leading to older age classes
Increasing temperatures & extreme heat events *+2.5 to +9°C by 2100; heat waves will occur more frequently, last longer, and feature hotter temperatures*	• Increased evapotranspiration and loss of soil moisture • Increased dependence of wildlife on underground thermal refugia, reducing opportunities to forage • Damaged ability of plants to photosynthesize
Altered fire regimes *Increased fire size, frequency, and severity*	• Altered species composition and population structure • Increased invasive annual grasses and associated increases in availability of fine fuels, leading to more fire • Direct mortality, reduced survival, and reduced reproductive success in wildlife (e.g., desert tortoises, western yellow bats)

Adaptive Capacity

Factors that enhance adaptive capacity:

+ High levels of biodiversity, including many rare, endemic, and threatened/endangered species
+ Species specifically adapted to drought and heat may be able to expand range
+ Limited habitat fragmentation compared to other habitat types
+ Valued for research potential

Factors that undermine adaptive capacity:

- Plant species are slow to recover from disturbance and exist close to physiological limits
- Habitat migration limited by anthropogenic and geological barriers
- Habitat may not be valued by the public, except for recreation opportunities and land use conversion (e.g., to agriculture, energy development).

Adaptation Strategies for Desert Habitats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What kinds of adaptation options are there?

Enhance Resistance ➔ Prevent climate change from affecting a resource

Promote Resilience ➔ Help resources weather climate change impacts by avoiding the effects of or recovering from changes

Facilitate Transition ➔ Accommodate change and/or enable resources to adaptively respond to variable conditions

Increase Knowledge ➔ Gather information about climate impacts and/or management effectiveness in addressing climate change challenges

Engage Collaboration ➔ Coordinate efforts and capacity across landscapes and agencies

Adaptation Category	Adaptation Strategy	Specific Management Actions
Enhance Resistance	Design educational programs to address potential safety issues and limit non-climate stressors	• Communicate with the public about access to roads and recreation areas through signage, visitor centers, and brochures
	Manage invasive species, including non-native grasses	• Remove non-native grasses around possible ignition sites • Identify the species that may colonize sprayed areas and develop a plan
	Reduce possibility of severe wildfire	• Close access to roads and campgrounds during high fire hazard years or when site needs to recover; direct visitors to more resilient sites
Promote Resilience	Protect and enhance seeps and springs, as well as the source aquifer(s) that supply them[1]	• Discourage visitor use of springs in sensitive spring areas[1] • Protect a buffer zone for natural vegetation around spring sites to minimize effects of storm runoff[1]
Facilitate Transition	Identify and protect desert refugia	• Prioritize land acquisition to target areas with potential refugia, such as seeps and springs, foothills, and dunes • Protect desert refugia through varied strategies such as land acquisition, land use planning, and land transfers
Increase Knowledge	Establish monitoring programs to detect changes over time	• Monitor desert biodiversity, including invertebrates and soil microbial communities
Engage Collaboration	Collaborate with decision-makers to create policies that support healthy ecosystems	• Identify current policies that could offer funding or logistical support for desert research and restoration projects

*Actions presented are those evaluated as having higher effectiveness and/or feasibility.

Management Implications

This information can be used in a variety of ways:

✔ Forest Plan Revisions

✔ U.S. Forest Service Climate Change Performance Scorecard: Element 6 - "Assessing Vulnerability" and Element 7 - "Adaptation Actions"

✔ Bureau of Land Management Resource Management Plan Revisions

Resilient management requires implementing a variety of adaptation options

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Further information and citations can be found in source reports, *Climate Change Vulnerability Assessment for Focal Resources of Southern California* and *Climate Change Adaptation Strategies for Focal Resources of Southern California*, available online at the EcoAdapt Library: http://ecoadapt.org/library.

[1] Comer, P. J., Young, B., Schulz, K., Kittel, G., Unnasch, B., Braun, D., … Hak, J. (2012). *Climate change vulnerability and adaptation strategies for natural communities: piloting methods in the Mojave and Sonoran deserts*. Arlington, VA: Report to the U.S. Fish and Wildlife Service. NatureServe.