Southern California Alluvial Scrub Habitats

Climate Change Vulnerability Assessment Summary

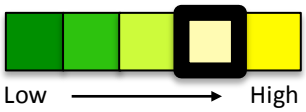
An Important Note About this Document: *This document represents an initial evaluation of vulnerability for alluvial scrub habitats based on expert input and existing information. Specifically, the information presented below comprises habitat expert vulnerability assessment survey results and comments, peer-review comments and revisions, and relevant references from the literature. The aim of this document is to expand understanding of habitat vulnerability to changing climate conditions, and to provide a foundation for developing appropriate adaptation responses.*

Habitat Description

In southern California, alluvial scrub habitats occur along outwash fans and riverine deposits at canyon mouths toward the base of mountain ranges, including the San Gabriel, San Bernardino, San Jacinto, and Santa Ana ranges.[1,2] Alluvial scrub habitats can also be found on wash deposits of regional rivers,[1] including the Santa Ana River and its tributaries. Alluvial scrub consists mainly of flood-adapted drought-deciduous subshrubs and evergreen woody shrubs.[1]

Habitat Vulnerability

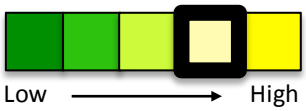
Moderate-High Vulnerability



The relative vulnerability of alluvial scrub habitats in southern California was evaluated to be moderate-high by habitat experts due to moderate-high sensitivity to climate and non-climate stressors, high exposure to projected future climate changes, and low-moderate adaptive capacity. Alluvial scrub habitats are critically sensitive to climate drivers and disturbance regimes that alter hydrologic, flooding, and scouring regimes and/or that alter moisture availability, as these factors affect habitat distribution, composition, and survival. Other factors (e.g., temperature, wildfire) are also likely to affect vegetation and associated wildlife communities. Alluvial scrub habitats are also very sensitive to non-climatic drivers that exacerbate climate-driven changes. For example, dams and water diversions compound hydrological shifts, and invasive species can directly compete with alluvial scrub vegetation for increasingly limited resources. Large portions of alluvial scrub habitat have been lost as a result of human activity, resulting in isolated contemporary habitat along unaltered streams and alluvial outwashes. A variety of landscape barriers, in addition to the soil requirements of component vegetation, may limit dispersal opportunities in response to climatic stressors. However, alluvial scrub communities are disturbance-adapted and feature moderate diversity, which may enhance their resilience in the face of climate change. Alluvial scrub habitats provide several ecosystem services including biodiversity and flood and erosion protection.

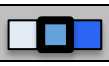
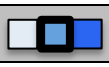
Sensitivity

Moderate-High Sensitivity

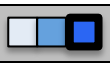


Alluvial scrub habitats are sensitive to several climate drivers, including precipitation, soil moisture, altered stream flows (high and low flows), drought, and air temperature. Spatial diversity in alluvial scrub communities is driven by periodic flooding,[1] erosion, and sedimentation,[6] as well as wildfire.[7,8] Species composition and distribution is also determined by sub-surface moisture[1] and air temperature. Non-climate stressors may destroy or alter habitat and enhance climate vulnerability by exacerbating hydrological changes and shifts in wildfire regimes.[1,2,8,15,16]

Habitat sensitivity factors and impacts*

CLIMATIC DRIVERS Moderate-High Sensitivity  Moderate Confidence 	
Hydrology	Precipitation frequency and intensity, as well as snowpack and snowmelt timing, affect soil moisture, flow volumes, and scouring and sedimentation regimes, which control alluvial scrub composition, succession, and persistence.[1,9] Hydrological shifts may result in: • Altered distribution,[2,9] species composition, and productivity;[1,9] precipitation declines may reduce annual species' germination, abundance, and seed production[8,10] • Altered invasive species pressure • Altered succession patterns; drier conditions may prevent succession to mature stands[1] • Potential conversion to more xeric communities if moisture declines[6]
Air temperature	Minimum winter temperatures may affect alluvial scrub landscape distribution and local and species composition. Warmer temperatures drive shifts in rain/snow partitioning and may affect establishment and survival. Increased air temperature may cause: • Altered habitat distribution due to shifts in hydrology and moisture availability • Altered species composition; freeze-sensitive vegetation may have more growth opportunities, but hot conditions may reduce annual plant establishment and survival[6]
DISTURBANCE REGIMES Low-Moderate Sensitivity  Moderate Confidence 	
Flooding	Flooding delivers new nutrients and organic matter, redistributes sediments, and facilitates alluvial scrub succession and spatial diversity.[1-3,11,12] Shifts in flooding regimes may cause: • Shifts in habitat distribution as alluvial fan and axial wash formation processes and substrate composition changes[1,6,9] • Altered seasons for colonization and species composition[11,15] • Altered succession patterns;[1,6] increased flooding may promote habitat

* Factors presented are those ranked highest by habitat experts. A full list of evaluated factors can be found in the Alluvial Scrub Habitats Climate Change Vulnerability Assessment Synthesis.

	heterogeneity[5] • Altered pollination and dispersal due to flooding impacts on native ground-dwelling insects[13,14]
Wildfire	Wildfire resets succession and releases nitrogen needed for plant fertilization.[2] Impacts of shifting wildfire regimes are largely unknown[3], but could include: • Altered species composition and population structure,[2] and impeded vegetation recovery due to more frequent fires • Altered pollination and dispersal due to fire impacts on native ground-dwelling insects[13,14]
NON-CLIMATE STRESSORS High Sensitivity  High Confidence 	
Dams, water diversions, & flood control structures	These stressors alter water availability and stream function, habitat connectivity, and flooding/scouring regimes, threatening the integrity, persistence, and composition of alluvial scrub habitats.[1,2,8,15,16] Exposure to dam and water diversion impacts is consistent across the landscape.
Invasive & problematic species	Invasive species may reduce fitness or abundance of native vegetation, particularly annual species, by competing for limited resources.[2,10] Invasives are commonly introduced via agriculture, development, and transportation corridors.[2,8] Exposure to invasive species is localized on the landscape.

Exposure†

High Exposure

Under future climate conditions, alluvial scrub habitats are likely to be exposed to precipitation changes, decreased soil moisture, altered stream flows, increased drought, increased air temperature, and increased wildfire. These factors are likely to influence alluvial scrub distribution and species composition.[2,9] Experts believe that refugia from changing climate conditions are less likely to exist for alluvial scrub habitats relative to other vegetation types because terrain exerts a strong influence on the location and formation of alluvial deposits.

Projected climate and climate-driven changes for Southern California

Climate Drivers	Projected Change
Precipitation & soil moisture	Variable annual precipitation volume and timing, with wetter winters and drier summers; reduced snowpack (-42%) and earlier snowmelt by mid-century; increased climatic water deficit
Drought	Longer, more severe droughts with drought years twice as likely to occur
Stream flows & flooding	Increased winter flow and flood volume; earlier and shorter spring runoff with reduced spring flood volume; decreased summer flow
Air temperature	+2.5 to +9°C by 2100
Wildfire	Increased fire size, frequency, and severity

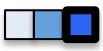
† Relevant references for regional climate projections can be found in the Southern California Climate Overview (http://ecoadapt.org/programs/adaptation-consultations/socal).

Adaptive Capacity‡

Moderate Adaptive Capacity

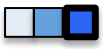
Alluvial scrub habitats occupy only a small portion of their former range, [1-4] and habitat extent is limited by the availability of suitable substrate (e.g., outwashes, alluvial floodplains) and human activity.[1,2,8,10] As a disturbance-adapted community[2] with decent reproductive and floristic diversity,[3,12] this habitat is fairly resilient if given time and space to recover.[2] However, annual and short-lived perennial species may be more vulnerable to climate change impacts due to short life span, while endemic species (e.g., Santa Ana River woolly-star, slender-horned spineflower) may be more vulnerable to climate and non-climate stressors due to limited distribution.

Habitat adaptive capacity factors and characteristics§

FACTORS	HABITAT CHARACTERISTICS
Habitat extent, integrity, & continuity Low-Moderate  Moderate Confidence 	- A variety of human activities (agriculture, development, mining, dams & water diversions) have eliminated 90-95% of historical habitat[1-4] - Current alluvial scrub habitats are fairly isolated, restricted only to unaltered streams and alluvial fan outwashes[1-3] - Connectivity between different drainages is low, and within drainages, alluvial scrub exists in patches with moderate connectivity
Landscape permeability Low-Moderate  High Confidence 	- There are significant barriers to habitat/species dispersal, including geologic features, energy production & mining, and dams & water diversions - Dispersal is also limited by current habitat fragmentation, specific soil requirements of component vegetation, and various dispersal capabilities of different species[1,2,8,10]
Resistance & recovery Moderate  Moderate Confidence 	+ This disturbance-adapted community is able to recover from flooding and fire if given time and space[2] + Diverse reproductive capabilities amongst different species[7]

‡ Please note that the color scheme for adaptive capacity has been inverted, as those factors receiving a rank of "High" enhance adaptive capacity while those factors receiving a rank of "Low" undermine adaptive capacity.

§ Characteristics with a green plus sign contribute positively to habitat adaptive capacity, while characteristics with a red minus sign contribute negatively to habitat adaptive capacity.

FACTORS	HABITAT CHARACTERISTICS
Habitat diversity Low-Moderate  High Confidence 	+ Moderate species diversity: floristically diverse with many rare animal species;[3,12] contains more mesic species than other scrub habitats[17] - Low-moderate physical/topographic and functional group diversity
Management potential Moderate-High  Moderate Confidence 	+ Moderate-high societal value: valued for aesthetics, recreational opportunities, rare species, and as tribal cultural and archaeological sites + Alluvial scrub habitats provide a variety of ecosystem services: biodiversity, water supply/quality/sediment transport, recreation, carbon sequestration, and flood and erosion protection

Recommended Citation

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This document is available online at the EcoAdapt website (http://ecoadapt.org/programs/adaptation-consultations/socal).

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