

# COASTAL DUNES, WET MEADOWS, & PRAIRIES

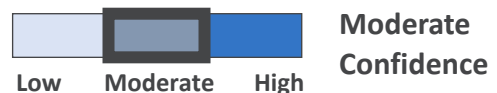
Climate Change Vulnerability and Adaptation Strategies for the Santa Cruz Mountain Region

## Habitat Description

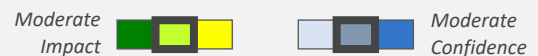
Coastal dunes range from mobile foredunes to semi- or fully-stabilized dunes dominated by dune grasses and, eventually, coastal scrub vegetation. Dune morphology and ecology are strongly impacted by wind and inland sand movement from the beach, as well as land-use change and management activities. Vegetation communities are characterized by species tolerant of low nutrient availability, high water drainage, salt spray, and wind desiccation.

Coastal prairies occur on coastal terraces influenced by summer fog, and are generally dominated by perennial grasses and annual forbs. Seasonal freshwater meadows are scattered within the prairie, and these are characterized by wetland vegetation such as *Juncus* spp. and *Carex* spp.

## Habitat Vulnerability



## Sensitivity & Exposure



Projected Changes	Trend	Potential impacts:
Precipitation	▲ ▼	<ul style="list-style-type: none"> <li>Altered amount and timing of water availability for coastal vegetation, affecting plant growth/recruitment and successional dynamics (e.g., coyote brush encroachment)</li> </ul>
Sea level rise	▲	<ul style="list-style-type: none"> <li>Likely expansion of invasive dune plants in response to wetter winter and drier summer conditions</li> </ul>
Storms/flooding	▲	<ul style="list-style-type: none"> <li>Increased coastal erosion and inundation of low-elevation dunes due to sea level rise and storm surge</li> <li>Increased gullying in shallow soils during heavy precipitation</li> </ul>

**Non-climate stressors** may interact with climate stressors and disturbance regimes:

- Invasive grasses* alter habitat structure and function by outcompeting native plants and, in dunes, reducing foredune mobility as sand is anchored by deeper root systems
- Land-use conversion* and *roads* eliminate, fragment, and/or degrade coastal habitats, reducing habitat extent and limiting the ability of dunes to migrate in response to sea level rise
- Recreational activity* contributes to vegetation loss and destabilization of coastal dunes, as well as disturbs nesting shorebirds and increases populations of nest predators (e.g., corvids)
- Inappropriately-managed grazing* can negatively impact perennial grasses and has been associated with increased cover of non-native forbs and species richness of invasive grasses

Altered amount and timing of precipitation is likely to stress native vegetation, while also driving invasive beach grasses into dune systems and possibly accelerating coyote brush encroachment into coastal prairies. The combination of sea level rise and storm surge is also expected to reduce habitat extent in coastal dunes, particularly where inland movement is constrained by human development.

# Adaptive Capacity



## ***Intrinsic factors (i.e., inherent characteristics) that enhance or undermine adaptive capacity:***

- |   |  |
|---|--|
| ▲ High physical and topographical diversity                             | ▼ Very significant loss, fragmentation, and degradation of all coastal habitat types |
| ▲ Very high species richness and supports many rare/endemic species     | ▼ Reduced resistance to sea level rise where geomorphic processes are altered        |
| ▲ Dynamic habitats adapted to harsh conditions and natural disturbances | ▼ Many native species at high risk of extirpation                                    |

## ***Extrinsic factors (i.e., management potential) that enhance or undermine adaptive capacity:***

- |  |  |
|--|--|
| ▲ High public and cultural value   | ▼ Many constraints (e.g., staff training, air quality regulations, burn windows) limit more extensive use of prescribed fire |
| ▲ High societal support for dune protection to limit flooding in developed areas |  |

Although coastal dune and prairie vegetation are well-adapted to natural disturbances, habitat degradation and altered natural geomorphic processes likely reduce the resilience of these habitats to climate change.

## Adaptation Strategies for Coastal Dunes

Management activities that may increase habitat resilience to climate change include protection of transition zones and removal of barriers to inland dune migration as well as removal of invasive species.

ADAPTATION APPROACH	ADAPTATION STRATEGIES
<b>Resistance strategies:</b> Maintain current conditions by limiting change <i>Near-term approach</i>	<ul style="list-style-type: none"> <li>Protect sensitive dune habitats still dominated by native vegetation from human disturbance (e.g., recreation)</li> <li>Remove invasive plants from remnant dune habitats to allow for the recovery of native vegetation and natural processes</li> </ul>
<b>Resilience strategies:</b> Accommodate some change while enabling a return to prior conditions <i>Near- to mid-term approach</i>	<ul style="list-style-type: none"> <li>Restore natural sediment transport processes to ensure continued renourishment of beaches and dunes*</li> <li>Use “soft-engineering” techniques, living shorelines, and/or natural infrastructure to enhance or mimic natural buffers*</li> </ul>
<b>Response strategies:</b> Intentionally facilitate or direct adaptive change <i>Long-term approach</i>	<ul style="list-style-type: none"> <li>Modify planting pallet to include species/genotypes tolerant of projected future conditions*</li> <li>Anticipate and facilitate inland/upland migration through site assessment, acquisition, and management*</li> </ul>
<b>Knowledge strategies:</b> Gather information about climate impacts, and/or management effectiveness <i>Near- to long-term approach</i>	<ul style="list-style-type: none"> <li>Conduct a feasibility study and pilot land acquisition in priority areas to evaluate a variety of creative alternatives (e.g., rolling easements, flood easements, life estates)*</li> </ul>
<b>Collaboration strategies:</b> Coordinate management efforts and/or capacity across boundaries <i>Near- to long-term approach</i>	<ul style="list-style-type: none"> <li>Increase public awareness of invasive species removal efforts in dune habitats and their role in reducing climate vulnerability*</li> <li>Identify/develop cooperative management and land acquisition opportunities to address habitat loss due to sea level rise*</li> </ul>

\* Future management strategies (not currently occurring)

## Adaptation Strategies for Coastal Prairies

Both the scientific literature and traditional knowledge document the importance of fire in maintaining coastal prairie habitats and associated native species. Tools that are often used to enhance native vegetation in coastal prairie habitats include prescribed fire, conservation grazing, and planting. In general, these tools are most successful in areas where a substantial component of native species remain, while restoration efforts are generally less successful in degraded prairies.

ADAPTATION APPROACH	ADAPTATION STRATEGIES
<p><b>Resistance strategies:</b> Maintain current conditions by limiting change <i>Near-term approach</i></p>	<ul style="list-style-type: none"> <li>• Re-route roads and trails and limit introduction of new trails</li> <li>• Implement conservation grazing for managing coyote brush encroachment</li> <li>• Evaluate current and potential new invasive species vulnerability/resilience to different climate scenarios to inform Integrated Pest Management (IPM)*</li> <li>• Manage recreation impacts on grasslands, including trail planning to reduce impacts*</li> <li>• Remove barriers to connectivity*</li> </ul>
<p><b>Resilience strategies:</b> Accommodate some change while enabling a return to prior conditions <i>Near- to mid-term approach</i></p>	<ul style="list-style-type: none"> <li>• Implement low-intensity prescribed burning, including finding ways to increase the pace and scale and/or frequency</li> <li>• Restore native plants, including planting tarweed (a native, fire-resistant plant)</li> <li>• Test out intermittent disturbance regimes in grasslands to maintain desired species and maximize system heterogeneity*</li> <li>• Increase seed banking efforts, looking at the right composition of species based on projected changes*</li> </ul>
<p><b>Response strategies:</b> Intentionally facilitate or direct change that adaptively responds to new conditions <i>Long-term approach</i></p>	<ul style="list-style-type: none"> <li>• Consider assisted migration of serpentine species to new locations that are expected to remain or become suitable under future climate conditions*</li> </ul>
<p><b>Knowledge strategies:</b> Gather information about climate impacts, and/or management effectiveness <i>Near- to long-term approach</i></p>	<ul style="list-style-type: none"> <li>• Identify opportunities to integrate monitoring of groundwater fluctuations over time</li> <li>• Identify and monitor places of high and moderate quality habitat and prioritize for invasive species management*</li> <li>• Increase monitoring efforts to study impacts of recreation on coastal grasslands*</li> <li>• Develop post-disturbance event monitoring plan*</li> </ul>
<p><b>Collaboration strategies:</b> Coordinate management efforts and/or capacity across boundaries <i>Near- to long-term approach</i></p>	<ul style="list-style-type: none"> <li>• Improve regional collaboration and coordination with regard to data sharing and monitoring</li> <li>• Improve efforts to coordinate and streamline burn permits and timing*</li> <li>• Increase education and outreach to enhance appreciation of grasslands and public support for management activities*</li> </ul>

\* Future management strategies (not currently occurring)