Southern California Endemic Habitats

Climate Change Adaptation Actions Summary

An Important Note About this Document: *This document represents an initial effort to identify adaptation actions for endemic habitats in southern California based on stakeholder input and existing information. Specifically, the information presented below comprises stakeholder input during a two-day adaptation workshop, peer-review comments and revisions, and relevant examples from the literature or other similar efforts. The aim of this document is to expand understanding of possible adaptation actions for southern California endemic habitats in response to climate change.*

Endemic Habitat Vulnerability

Moderate Vulnerability

Endemic habitats considered in this assessment include: serpentine, gabbro, carbonate, pebble plains, and clay lens communities. The relative vulnerability of endemic habitats in southern California was evaluated to be moderate by habitat experts due to moderate sensitivity to climate and non-climate stressors, moderate exposure to projected future climate changes, and moderate adaptive capacity. Shifts in precipitation, moisture availability, and temperature may affect endemic habitat composition, survival, and vulnerability to non-climatic stressors. Endemic communities have variable responses to fire, but increasing fire frequencies are unlikely to benefit even the most fire-adapted communities due to slow recovery following disturbance. Endemic habitats face a variety of non-climatic stressors that reduce habitat resilience by increasing fragmentation and/or by exacerbating climate-driven changes; human population growth may increase the severity and/or extent of these stressors in the future. Soil properties largely moderate endemic habitat distribution, composition, and vulnerability to climate and non-climate stressors. Small, isolated populations, specific soil requirements, limited dispersal capacity, and several landscape barriers limit endemic habitat dispersal and recovery potential in the face of climate change, but unique and adapted vegetation enhances habitat resistance. Endemic systems provide a variety of ecosystem services including biodiversity and recreation.

Adaptation Strategies and Actions

Table 1 presents a summary of possible adaptation strategies and actions for endemic habitats, and consists of stakeholder input during an adaptation workshop as well as additional options from the literature or other similar efforts. Stakeholders identified ways in which current management actions could be modified to reduce habitat vulnerabilities as well as future management actions that are not currently implemented but could be considered for future implementation.

Adaptation strategies and actions are grouped according to one of five categories:

1. **Enhance Resistance**. These strategies can help to prevent the effects of climate change from reaching or affecting a resource.
2. **Promote Resilience**. These strategies can help a resource withstand the impacts of climate change by avoiding the effects of or recovering from changes.

3. **Facilitate Transition (or Response)**. These strategies intentionally accommodate change and/or enable resources to adaptively respond to changing and new conditions.
4. **Increase Knowledge**. These strategies are aimed at gathering more information about climatic changes, impacts, or the effectiveness of management actions in addressing climate change.
5. **Engage Coordination**. These strategies may help coordinate efforts and/or capacity across landscapes and agencies.

Table 1. Summary of possible adaptation options for endemic habitats.

Adaptation Category	Adaptation Strategy	Specific Adaptation Action
Enhance resistance	Promote the recovery of threatened or endangered plant and animal species	• Increase habitat suitability through habitat enhancement[1] • Restore habitats[1] • Minimize non-climate stressors (e.g., manage road, trail and recreation impacts)[2]
	Promote the conservation of Forest Service sensitive species and/or California State listed species of special concern	
	Improve biological diversity	
	Prevent loss of relict populations	• Increase seed collection and seed banks (*ex situ*)[2]
	Limit and change urban development patterns to reduce habitat fragmentation	• Rezone, change, or supplement land management plans or zoning plans[2] • Create a moratorium on developing in undisturbed areas, focusing development in previously developed and/or abandoned areas[2]
	Increase invasive species control efforts and prevent invasive species establishment	• Implement early detection/rapid response for exotic species treatment[2] • Include invasive species prevention strategies in all projects[2] • Inventory regularly to detect new invasive populations and species[2]
Promote resilience	Maintain and/or increase habitat resilience	• Manage tree and shrub encroachment[2] • Restore habitats[2]
	Identify potential resilience of different locations	• Increase resilience of native species where intact or productive communities exist[2] • Actively restore less resilient sites[2]
	Mitigate consequences of large disturbances by planning ahead	• Develop a gene conservation plan for *ex situ* collections for long-term storage[2]

[1] Denotes action identified by workshop participants.
[2] Actions were sourced from the Climate Adaptation Project for the Sierra Nevada and/or the Northern Rockies Adaptation Partnership.

Adaptation Category	Adaptation Strategy	Specific Adaptation Action
Facilitate transition	Promote the recovery of threatened or endangered plant and animal species	• Reintroduce/relocate plants and animals[1]
	Promote the conservation of Forest Service sensitive species and/or California State listed species of special concern	
	Identify and protect refugia	• Identify current and future refugia where relict plants could be established[2] • Designate conservation easements[2]
Increase knowledge	Improve understanding of effects of climatic variability and change on various endemic communities	• Install plots to measure species distribution, abundance, and physiological response[2] • Identify species and genotypes most resilient to change[2] • Collaborate with other agencies and entities to monitor endemic species[2] • Use monitoring information in implementation of adaptive management[2]
	Increase knowledge of patterns, characteristics, and rates of change in species distributions	• Expand long-term monitoring programs[2] • Use monitoring information in implementation of adaptive management[2]
	Increase knowledge of management impacts on endemic, threatened or endangered species persistence[3]	• Design and implement a monitoring system to evaluate management effectiveness and impacts[3] • Use monitoring information in implementation of adaptive management[3]
Engage coordination	Limit and change urban development patterns to reduce habitat fragmentation	• Conduct education and outreach with public, city managers, and land managers to protect endemic refugia[2]
	Work across jurisdictions	• Coordinate invasive species management, funding, and support between agencies • Communicate about projects and coordinate on-the-ground activities[2] (e.g., work with adjacent communities and counties to integrate and link conservation easements and conservation plans to protect existing endemic communities and potential future refugia[4]) • Align budgets and program of work priorities with adjacent lands[2]

[3] Runge, M. C. (2011). An introduction to adaptive management for threatened and endangered species. *Journal of Fish and Wildlife Management*, *2*(2), 220-233.

[4] Parker, S. (2012). Small reserves can successfully preserve rare plants despite management challenges. *Natural Areas Journal*, *32*(4), 403-411.

Table 2 identifies the key endemic habitat vulnerabilities that may be reduced and/or addressed by various adaptation actions. These linkages are based on expert opinion.

Linking vulnerabilities to adaptation options can help managers decide which actions to implement and aid prioritization based on multiple factors (e.g., habitat type, observed or projected changes, ecosystem service). However, when selecting adaptation actions for implementation, it is also important to consider secondary effects on other resources, both positive and negative. For example, trail or road decommissioning may benefit aquatic systems by limiting erosion impacts but could also remove important access points to fire-prone areas. For more information about endemic adaptation strategies and actions developed by participants during the workshop, including where and how to implement adaptation actions, implementation timeframe, collaborations and capacity required, and secondary effects on other resources (both positive and negative), please see the report *Climate Change Adaptation Strategies for Focal Habitats of Southern California*.

Table 2. Key vulnerabilities of endemic habitats linked to specific adaptation actions and management activities; implementation of adaptation actions (central column) may help to directly reduce and/or address the impacts of identified climate and non-climate stressors and disturbance regimes (right columns). Actions highlighted in **red** represent adaptation strategies that enhance resistance, those highlighted in **orange** promote resilience, and those highlighted in **green** facilitate transition. Adaptation actions aimed at increasing knowledge and engaging coordination are not included in this table as they address vulnerability indirectly. Adaptation actions listed in this table include those identified by participants, in the scientific literature, and in other similar efforts.

Management Activity	Adaptation Actions	Climate Stressors				Disturbance Regimes	Non-Climate Stressors						
		Altered precipitation (timing & amount); ↓ Soil moisture	↑ Drought	↑ Extreme high temperature events	↓ Snowpack	Altered wildfire regimes	Energy production & mining	Fire suppression practices	Recreation	Land use conversion	Invasive & problematic species	Livestock grazing	Transportation corridors
Habitat Management & Restoration Activities	Increase habitat suitability through habitat enhancement	✔	✔										
	Minimize non-climate stressors (e.g., manage road, trail and recreation impacts)	✔				✔	✔	✔	✔		✔	✔	✔
	Restore habitats	✔	✔			✔	✔	✔	✔		✔	✔	
	Increase seed collection and seed banks (*ex situ*)	✔	✔	✔	✔	✔							
	Implement early detection/rapid response for exotic species treatment										✔		
	Include invasive species prevention strategies in all projects										✔		
	Inventory regularly to detect new invasive populations and species										✔		
	Manage tree and shrub encroachment		✔	✔	✔								
	Develop a gene conservation plan for *ex situ* collections for long-term storage		✔			✔							
	Reintroduce/relocate plants and animals	✔	✔	✔		✔							
	Identify current and future refugia where relict plants could be established	✔	✔	✔	✔	✔							
Land Use Planning	Rezone, change, or supplement land management plans or zoning plans						✔		✔	✔		✔	✔
	Create a moratorium on developing in undisturbed areas, focusing development in previously developed and/or abandoned areas						✔			✔			✔
	Designate conservation easements	✔	✔	✔	✔	✔	✔		✔	✔		✔	✔

In addition to directly reducing some vulnerabilities (Table 2), some adaptation actions may indirectly address other vulnerabilities. For example, implementing early detection/rapid response for exotic species treatment may help mitigate shifting fire regimes, as invasive grasses often have shorter fire return intervals than native vegetation. Similarly, restoring habitats can also indirectly reduce vulnerability to increased extreme high temperature events if endemic plants with higher heat thresholds are utilized for restoration plantings.

Two other important considerations when selecting adaptation actions for implementation include feasibility (action capable of being implemented) and effectiveness (action reduces vulnerability). An adaptation action with high feasibility has no obvious barriers and a high likelihood of implementation whereas an action with low feasibility has obvious and/or significant barriers to implementation that may be difficult to overcome. An adaptation action with high effectiveness is very likely to reduce associated vulnerabilities (listed in Table 2) and may benefit additional management goals or resources whereas an action with low effectiveness is unlikely to reduce vulnerability and may have negative impacts on other resources.

Figure 1 plots adaptation actions listed in Table 1 according to feasibility and effectiveness. This figure can help managers prioritize actions for implementation (e.g., actions with high feasibility and high effectiveness), better target management efforts toward specific challenges (e.g., actions with low or moderate feasibility but high effectiveness), and/or evaluate whether to proceed with implementation (e.g., actions with high feasibility but low effectiveness). For the latter two purposes, managers may consider the following questions:

- **Low or Moderate Feasibility/High Effectiveness Actions**: What steps can be taken to increase the likelihood of this action being implemented in the future?
    - *Example*: Would improving public outreach and education or enhancing public/private collaboration facilitate the removal of dikes or recharge basins with the goal of restoring fluvial processes?
- **High Feasibility/Low or Moderate Effectiveness Actions**: Does this action still make sense given projected climate changes and impacts?
    - *Example*: If conditions are projected to become drier, should grazing continue in areas with drought-sensitive vegetation?

Alternatively, there may be some actions that do not reduce vulnerability directly but could provide important information, tools, or support to address vulnerability down the line. For example, actions aimed at increasing knowledge through monitoring or modeling could provide key information for future restoration activities (e.g., creating detailed species genetic profiles to select genetically and ecologically suitable plant species for future conditions). Managers may want to weigh the costs and benefits of implementing actions with the timeframe required to reduce vulnerability directly. Additionally, actions focused on coordination and collaboration may not directly address vulnerabilities, but these remain important steps toward better planning and management.

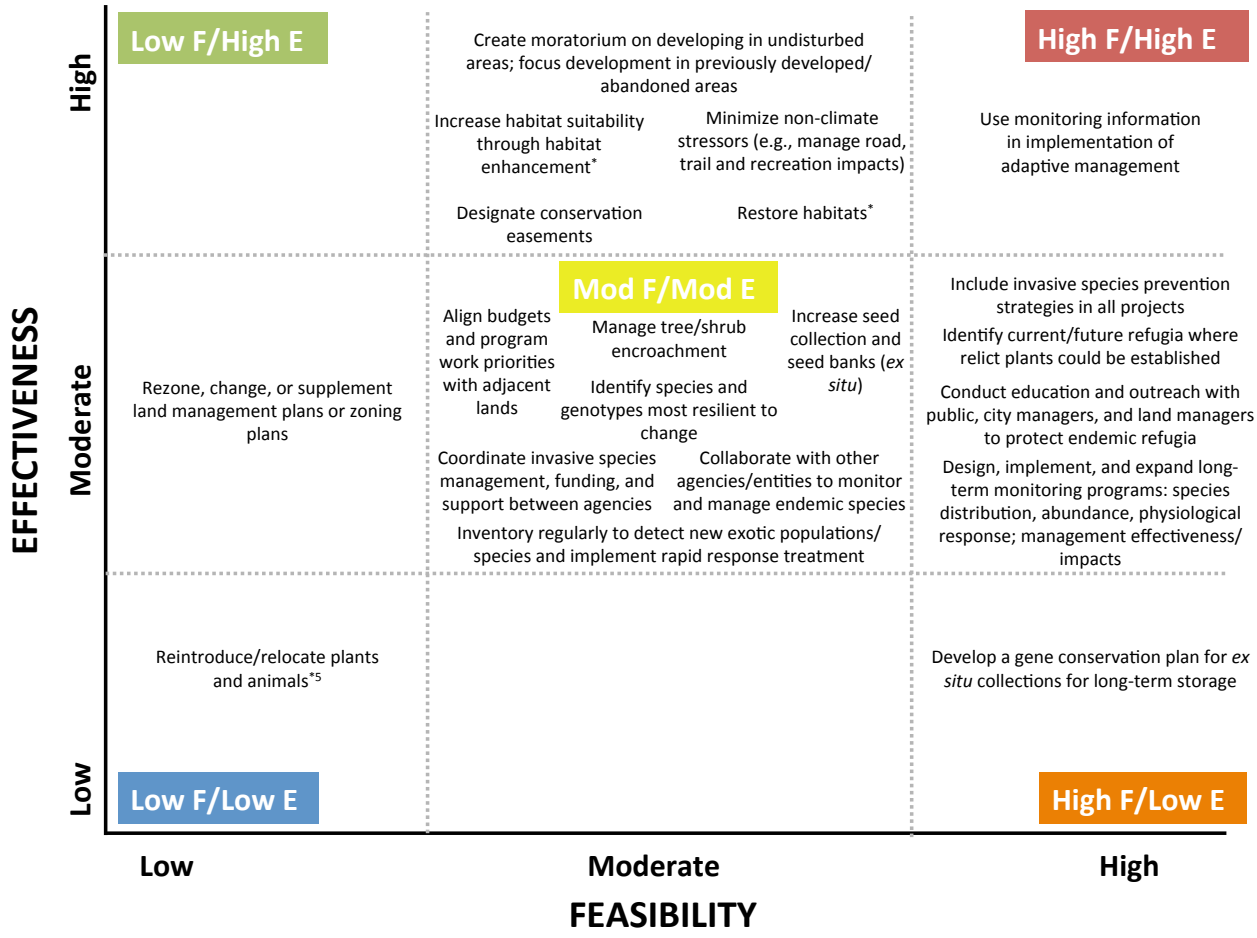

Figure 1. Endemic habitat adaptation actions plotted according to implementation feasibility (action capable of being implemented) and effectiveness (action reduces vulnerability). Those actions having high feasibility and effectiveness appear in the upper right corner and low feasibility and effectiveness in the bottom left corner. An asterisk (*) denotes adaptation actions evaluated for feasibility and effectiveness by workshop participants, although in some cases the ranking was shifted based on expert opinion. All other adaptation action evaluations are based on expert opinion.

Recommended Citation

Reynier, W.A., L.E. Hilberg, and J.M. Kershner. 2016. Southern California Endemic Habitats: Climate Change Adaptation Actions Summary. Version 1.0. EcoAdapt, Bainbridge Island, WA.

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

[5] Workshop participants indicated that this action may have higher effectiveness in the long-term, but variable feasibility depending on water or seed source, lack of brood stock, species disease vulnerability, habitat availability and suitability, permitting processes, and other factors.