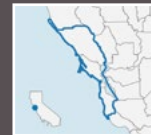


# California Black Oak

Climate Change Vulnerability  
and Adaptation Strategies for the  
Golden Gate Biosphere Region



## Species Description

California black oak (*Quercus kelloggii*) is a shade-intolerant, fire-dependent hardwood tree typically found as a component of hardwood or mixed hardwood and conifer communities in climates with hot, dry summers and cool, moist winters. The species is distributed from the southern Cascade mountains in central Oregon to southern California along the Coast Range and through the Sierra Nevada. Black oak reaches its highest abundances in northern California and in the northern Sierra Nevada and is patchily distributed within the Golden Gate Biosphere (GGB) region.

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## Species Vulnerability - Moderate

### Sensitivity & Exposure - Moderate

Projected Changes	Trend
Precipitation	▲▼ Varies
Drought	▲ Increase
Air temperature	▲ Increase
Wildfire	▲ Increase
Disease	▲ Increase

### Potential Impacts:

- Increased water stress, affecting acorn germination and seedling/sapling growth and survival to adulthood
- Likely range contractions due to significant losses of climatically suitable habitat within the GGB region
- Increased injury and mortality as a result of intense wildfires, particularly for sensitive seedlings and saplings
- Increased sudden oak death transmission and infection rates associated with warmer, wetter winter and spring conditions

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

- *Land-use conversion for development and agriculture* has led to loss of black oak ecosystems, reducing oak recruitment and genetic exchange in fragmented populations
- *Invasive plants* alter understory species composition in black oak ecosystems, competing for shallow soil moisture and light needed for establishment and growth of oak seedlings
- *Livestock grazing* can cause soil compaction, herbivory of acorns and seedlings, introduction of invasive annual grasses, and slower post-fire recovery, depending on grazing intensity and timing
- *Fire exclusion and suppression* is associated with shifts in species composition and habitat structure following conifer encroachment, and may also play a role in the incidence of sudden oak death



**Increased water stress and warmer temperatures impact black oak acorn germination, seedling/sapling growth and survival, and are likely to ultimately result in significant range contractions. Black oaks are also vulnerable to increased mortality as a result of wildfire and disease, particularly in dense stands.**

# Species Vulnerability - *Moderate*

## Adaptive Capacity - *Moderate*

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

#### **Enhance:**

- High phenotypic diversity and can hybridize with other oaks
- Generally resilient to disturbances, particularly mature trees
- Long lifespan increases resistance to changes

#### **Undermine:**

- Significant loss and fragmentation as a result of development and other land uses
- Seedlings and saplings sensitive to drought and wildfire, potentially limiting regeneration
- Can take decades to mature and produce seed

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

#### **Enhance:**

- High public and societal value
- Critically important to area tribes, who have maintained the species for thousands of years

#### **Undermine:**

- Loss of cultural burning and other tribal management have contributed to declines
- Prescribed fire can pose political challenges



**While mature oaks are well adapted to drought and wildfire, acorns and young oaks are sensitive to these stressors and their loss may limit the ability of this species to recover from future disturbances.**



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# Adaptation Strategies & Actions

Adaptation strategies can reduce climate change vulnerability of a given ecosystem or species by addressing any or all of the three components of vulnerability (i.e., by reducing sensitivity, reducing exposure, and/or increasing adaptive capacity). The table below presents examples of adaptation strategies and actions, which fall within five categories, or approaches: Resistance/Resilience **(R)**, Acceptance **(A)**, Direct/Response **(D)**, Knowledge **(K)**, and Collaboration **(C)**. *Please note that the strategies and actions provided here should not be considered a checklist or plan, but rather as a set of examples for land managers to consider for further study when developing site- or species-specific actions.*

Adaptation Strategies	Adaptation Actions
<b>Manage black oak habitat</b>	<ul style="list-style-type: none"> <li>Remove invasive species, especially those that create ladder fuels and/or are likely to carry fire <b>(R)</b></li> <li>Remove encroaching Douglas-fir in black oak ecosystems <b>(R)</b></li> <li>Plant shrubs that can serve as nurse plants for oak seedlings <b>(R)</b></li> <li>Remove California bay laurel to slow the spread of sudden oak death <b>(R)</b></li> </ul>
<b>Enhance the ability of black oak to resist and/or recover from introduced pests and pathogens</b>	<ul style="list-style-type: none"> <li>Set up monitoring networks focused on early detection of sudden oak death and insect pests, and manage key sites that are still uninfected <b>(R/K)</b></li> </ul>
<b>Increase seed collection and propagation of black oak</b>	<ul style="list-style-type: none"> <li>Research black oak acorn storage and germination to improve silviculture techniques <b>(K)</b></li> <li>Identify individual trees that are thriving and collect seed for use in restoration plantings <b>(R)</b></li> </ul>
<b>Restore the role of fire as an ecological process on the landscape</b>	<ul style="list-style-type: none"> <li>Restore the use of frequent prescribed fire to reduce fuel loads, moisture stress, and insect/disease outbreaks <b>(R)</b></li> <li>Increase public education and outreach to raise awareness of prescribed fire as a critical management tool in the context of climate change <b>(C)</b></li> <li>Partner with tribes to promote cultural burning and stewardship of ancestral lands <b>(C)</b></li> </ul>
<b>Prioritize and maintain sites that may be more resistant to changes in climate (e.g., cooler, wetter sites)</b>	<ul style="list-style-type: none"> <li>Protect and maintain potential refugia and areas that are projected to remain climatically suitable for dominant oak species <b>(R)</b></li> </ul>

*Adaptation strategies and actions suggested by individual stakeholders (not discussed during the December 2023 adaptation workshop).*