



Conservation Gap Analysis of Native U.S. Oaks

Species profile: *Quercus sadleriana*

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SPECIES OF CONSERVATION CONCERN

CALIFORNIA

Channel Island endemics:
Quercus pacifica, *Quercus tomentella*

Southern region:
Quercus cedrosensis, *Quercus dumosa*,
Quercus engelmannii

Northern region and /
or broad distribution:
Quercus lobata, *Quercus parvula*,
Quercus sadleriana

SOUTHWESTERN U.S.

Texas limited-range endemics
Quercus carmenensis,
Quercus graciliformis, *Quercus hinckleyi*,
Quercus robusta, *Quercus tardifolia*

Concentrated in Arizona:
Quercus ajoensis, *Quercus palmeri*,
Quercus toumeyii

Broad distribution:
Quercus havardii, *Quercus laceyi*

SOUTHEASTERN U.S.

State endemics:
Quercus acerifolia, *Quercus boyntonii*

Concentrated in Florida:
Quercus chapmanii, *Quercus inopina*,
Quercus pumila

Broad distribution:
Quercus arkansana, *Quercus austrina*,
Quercus georgiana,
Quercus oglethorpensis, *Quercus similis*



Quercus sadleriana R.Br.ter.

Synonyms: N/A Common Names: Sadler's Oak, Deer Oak

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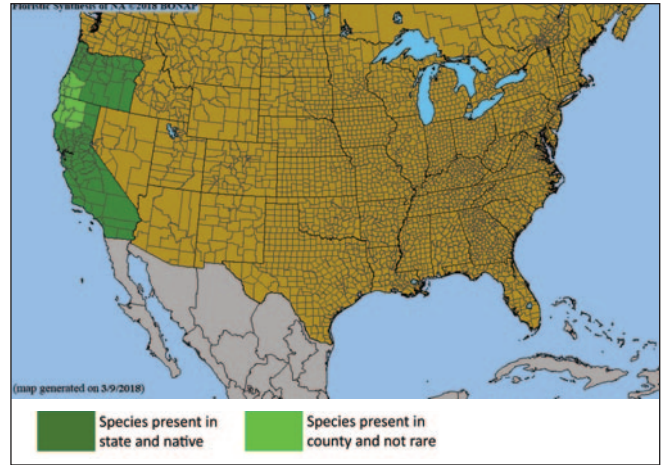


Figure 1. County-level distribution map for *Quercus sadleriana*. Source: Biota of North America Program (BONAP).²

DISTRIBUTION AND ECOLOGY

Quercus sadleriana, also known as Sadler's Oak, exists only in southwestern Oregon (Josephine, Curry, Douglas, and Coos Counties) and northwestern California (Humboldt, Trinity, Siskiyou, Shasta and Del Norte Counties), within the Klamath-Siskiyou mountain region of the U.S. Its current range is concentrated within the Six Rivers, Klamath, Rogue River, and Siskiyou National Forests. Sadler's Oak is one of the most distinctive western U.S. oaks due to its evident similarities to some eastern North American and Asian species of *Quercus* with "chestnut" leaves. With its restriction to the Klamath-Siskiyou region and uncertain taxonomic relationships within that area, *Q. sadleriana* is suggested to be a relictual species. This species is a montane shrub that is often a dominant member of the understory layer within middle to upper elevations, 600 to 2200 meters above sea level.¹ Sadler's oak thrives on open, rocky slopes and ridges in a variety of soil types and plant association groups including tanoak, Douglas fir, Hemlock, White fir, Red fir, and Port Orford cedar. Soils can be shallow or deep. The species percent cover varies in the different plant associations and can range up to 48% (S. Osbrack pers. comm., 2018).

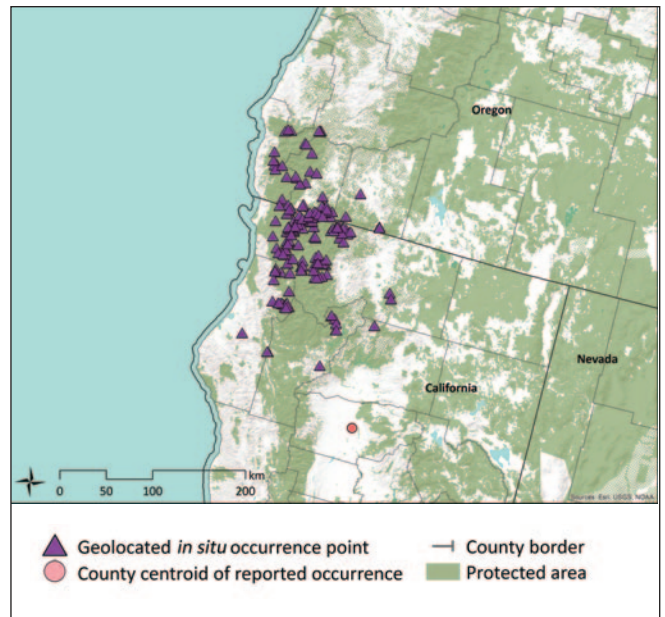


Figure 2. Documented *in situ* occurrence points for *Quercus sadleriana*. Protected areas layer from U.S. Geological Survey Gap Analysis Program (GAP) 2016 Protected Areas Database of the U.S. (PAD-US).³

VULNERABILITY OF WILD POPULATIONS

Table 1. Scoring matrix identifying the most severe demographic issues affecting *Quercus sadleriana*. Cells are highlighted when the species meets the respective vulnerability threshold for each demographic indicator. Average vulnerability score is calculated using only those demographic indicators with sufficient data (i.e., excluding unknown indicators).

Demographic indicators	Level of vulnerability						Score
	Emergency Score = 40	High Score = 20	Moderate Score = 10	Low Score = 5	None Score = 0	Unknown No score	
Population size	< 50	< 250	< 2,500	< 10,000	> 10,000	Unknown	0
Range/endemism	Extremely small range or 1 location	E00 < 100 km ² or A00 < 10 km ² or 2-4 locations	E00 < 5,000 km ² or A00 < 500 km ² or 5-9 locations	E00 < 20,000 km ² or A00 < 2,000 km ² or 10+ locations	E00 > 20,000 km ² or A00 > 2,000 km ²	Unknown	5
Population decline	Extreme	>= 80% decline	>= 50% decline	>= 30% decline	None	Unknown	0
Fragmentation	Severe fragmentation	Isolated populations	Somewhat isolated populations	Relatively connected populations	Connected populations	Unknown	5
Regeneration/recruitment	No regeneration or recruitment	Decline of >50% predicted in next generation	Insufficient to maintain current population size	Sufficient to maintain current population size	Sufficient to increase population size	Unknown	5
Genetic variation/integrity	Extremely low	Low	Medium	High	Very high	Unknown	-
Average vulnerability score							3.0
Rank relative to all U.S. oak species of concern (out of 19)							19

THREATS TO WILD POPULATIONS

High Impact Threats

Human modification of natural systems — disturbance regime modification, pollution, and/or eradication: Fire suppression threatens the integrity of low elevation *Q. sadleriana* habitat.⁴ Frequent, low-intensity fires maintain the health of Sadler's oak habitat, and the removal of this natural disturbance regime has allowed the buildup of an extremely dense understory, diminishing overall forest health. This also leads to increased fuel loads, which can cause unusually severe wildfire.⁵ Fire beyond the natural range of variability for the Klamath Siskiyou National Forest would likely burn at a higher intensity than *Q. sadleriana* can survive. (L. Hoover pers. comm., 2018).

Moderate Impact Threats

Climate change — habitat shifting, drought, temperature extremes, and/or flooding: Climatic shift, resulting in the migration of *Q. sadleriana* to higher elevations, could be a threat. The USDA Forest Service is currently researching the potential effects of climate change regarding a species associated with *Q. sadleriana*: *Castanopsis nootkatensis*, or Alaska yellow cedar (L. Hoover pers. comm., 2018).

Low Impact Threats

Human use of landscape — agriculture, silviculture, ranching, and/or grazing: Decades of commercial logging, mineral extraction, and livestock grazing could threaten the integrity of *Q. sadleriana*'s habitat, though most of the significant blocks of protected land encompass high elevation habitats where Sadler's Oak thrives.⁴

Human use of landscape — residential/commercial development, mining, and/or roads: Because the majority of *Q. sadleriana*'s range is protected within national forests, there is not extreme pressure from human land use; however, threats may still occur in specific locations. Increasing population growth and development in residential communities may put pressure on Sadler's oak in the Rogue River National Forest, Oregon. This forest stretches along the California border, where the nationally-owned land is fragmented by private ownership of developed landscapes.⁴ These concerns are not applicable to the Six Rivers National Forest in California (L. Hoover pers. comm., 2018).

Human modification of natural systems — invasive species competition: Noxious weeds and invasive plants are an increasing threat to lower elevations within the Klamath National Forest ecosystem. The neighboring Rogue River-Siskiyou National Forest also considers invasive plants to be an increasing problem on their land.⁶ However, these invasives are unlikely to threaten *Q. sadleriana*, due to the species' typical habitation at higher elevations than areas experiencing increasing exotic plant presence (L. Hoover pers. comm., 2018).

CONSERVATION ACTIVITIES

In 2017 *Quercus* accessions data were requested from *ex situ* collections. A total of 162 institutions from 26 countries submitted data for native U.S. oaks (Figures 3 and 4). Past, present, and planned conservation activities for U.S. oak species of concern were also examined through literature review, expert consultation, and conduction of a questionnaire. Questionnaire respondents totaled 328 individuals from 252 organizations, including 78 institutions reporting on species of concern (Figure 6).

Results of 2017 *ex situ* survey

Number of <i>ex situ</i> collections reporting this species:	13
Number of plants in <i>ex situ</i> collections:	76
Average number of plants per institution:	6
Percent of <i>ex situ</i> plants of wild origin:	80%
Percent of wild origin plants with known locality:	70%

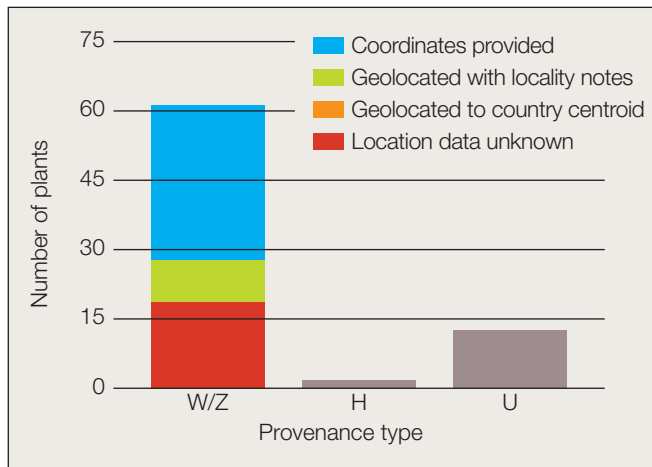


Figure 3. Number and origin of *Quercus sadleriana* plants in *ex situ* collections. Provenance types: W = wild; Z = indirect wild; H = horticultural; U = unknown.

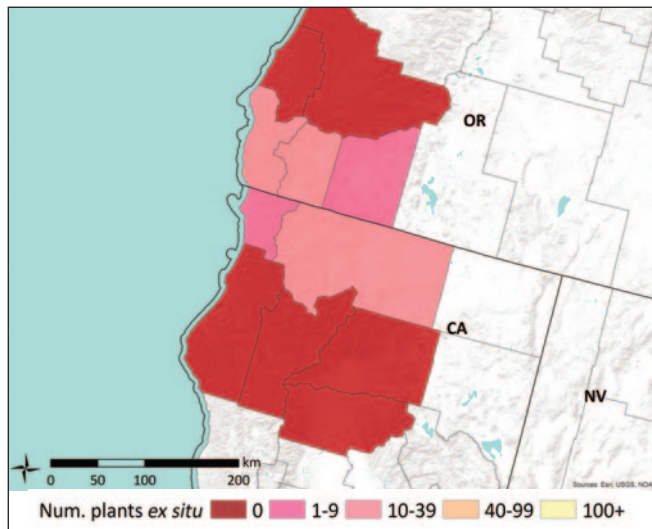


Figure 4. *Quercus sadleriana* counties of *in situ* occurrence, reflecting the number of plants from each county in *ex situ* collections.

A spatial analysis was conducted to estimate the geographic and ecological coverage of *ex situ* collections (Figure 5). Fifty-kilometer buffers were placed around each *in situ* occurrence point and the source locality of each plant living in *ex situ* collections. Collectively, the *in situ* buffer area serves as the inferred native range of the species, or “combined area *in situ*” (CAI50). The *ex situ* buffer area represents the native range “captured” in *ex situ* collections, or “combined area *ex situ*” (CAE50). Geographic coverage of *ex situ* collections was estimated by dividing CAI50 by CAE50. Ecological coverage was estimated by dividing the number of EPA Level IV Ecoregions present in CAE50 by the number of ecoregions in CAI50.

Estimated *ex situ* representation

Geographic coverage:	34%
Ecological coverage:	56%

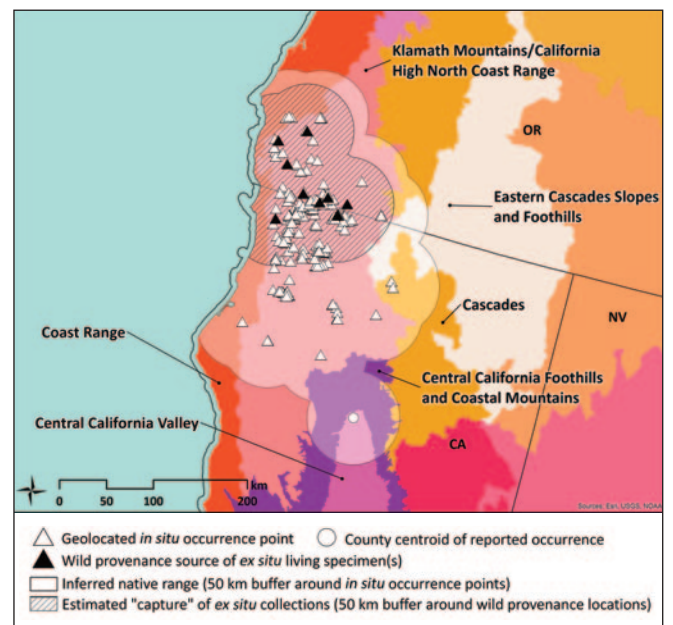


Figure 5. *Quercus sadleriana* *in situ* occurrence points and *ex situ* collection source localities. U.S. EPA Level III Ecoregions are colored and labelled.⁷ County centroid is shown if no precise locality data exist for that county of occurrence. Email treeconservation@mortonarb.org for information regarding specific coordinates.



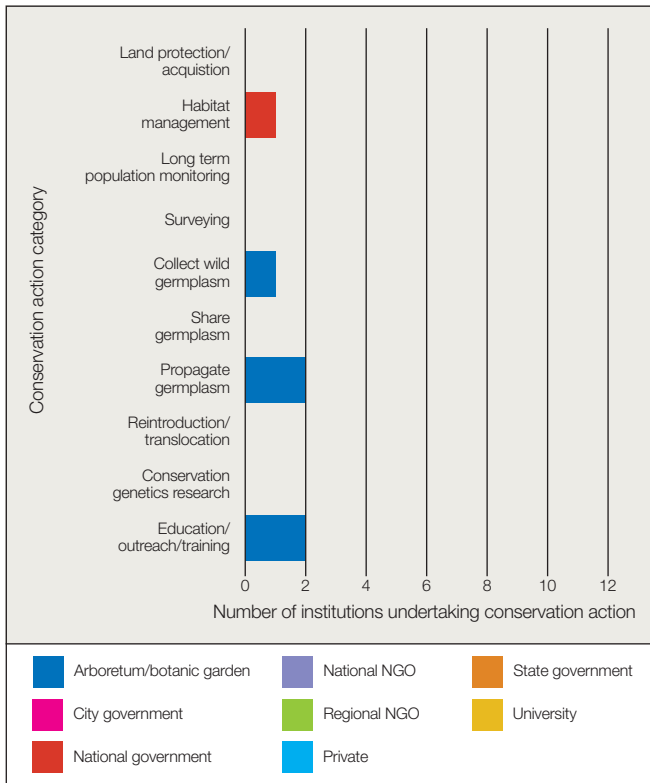


Figure 6. Number of institutions reporting conservation activities for *Quercus sadleriana* grouped by organization type. Four of 252 institutions reported activities focused on *Q. sadleriana* (see Appendix D for a list of all responding institutions).

Land protection: Within the inferred native range of *Q. sadleriana*, 53% of the land is covered by protected areas (Figure 7). However, because Sadler’s oak has a well-documented distribution, the vast majority of its population is known to be within federally protected areas.

Both Klamath National Forest and Six Rivers National Forest house exceptionally diverse flora, with many rare and endemic species. Most documented populations of *Q. sadleriana* are found within this enriched mixed conifer forest, which is already a high priority for continued protection (L. Hoover pers. comm., 2018).⁶ The species can also be found within the Smith River National Recreation Area and the Bear Basin Butte Botanical Area (7,500 acres total), as well as the Broken Rib Ecological Area (1,069 acres; L. Hoover pers. comm., 2018).

Sustainable management of land: Conservation actions specific to *Q. sadleriana* are not prevalent, and therefore its conservation stems from the protection of its habitat due to the high biodiversity in that area and its prevalence on USDA Forest Service lands. It is very likely though, that the integrity of certain Klamath-Siskiyou forest

communities relies on the health of Sadler’s oak subpopulations, since the species is a main component within that habitat.⁴ This could lead to further conservation efforts for *Q. sadleriana*, if the tree is linked to other threatened species of high priority in the region. Sadler’s Oak is present within Mt. Shasta Wilderness, Red Buttes Wilderness, Siskiyou Wilderness, and Wild Rogue Wilderness, which, under the Wilderness Act (1964), are required to be “protected and managed so as to preserve [their] natural conditions.”⁸ In the Six Rivers National Forest, most occurrences of Sadler’s Oak are found within the Smith River National Recreation Area (SRNRA), where management activities focus on fuels and biological related projects. The SRNRA houses the Siskiyou Wilderness and adjoining Bear Basin Butte Botanical Area and Broken Rib Ecological Area, which are managed for conservation purposes (L. Hoover pers. comm., 2018). The Klamath National Forest Land and Resource Management Plan is robust, though has not been updated since 2010.⁹

The North Willamette Valley Upland Oak Restoration Partnership project implements long-term land conservation strategies as well as short-term investments such as land acquisitions and conservation easements. A team of federal, state, local, and other conservation agencies work to restore oak habitat in 19 key areas throughout Yamhill and Polk counties. Partners include the Polk Soil and Water Conservation District, Natural Resources Conservation Service, U.S. Fish and Wildlife Service, Oregon Department of Fish and Wildlife, The Trust for Public Lands, Greater Yamhill Watershed Council, The Nature Conservancy, and Confederated Tribes of Grand Ronde.¹⁰

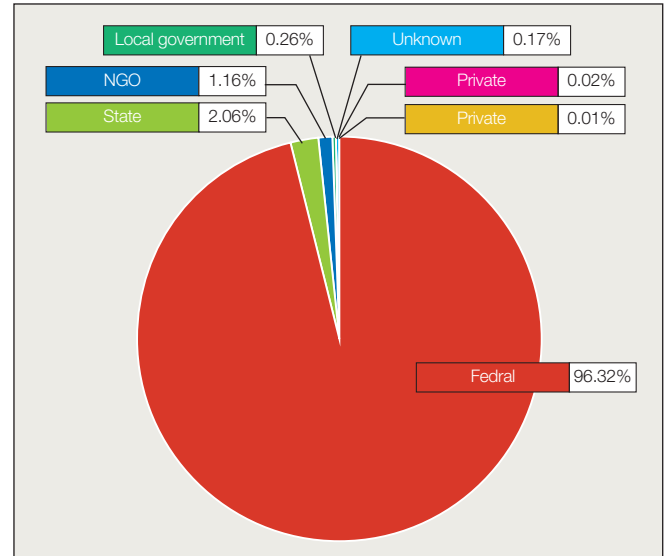


Figure 7. Management type of protected areas within the inferred native range of *Quercus sadleriana*. Protected areas data from the U.S. Geological Survey Gap Analysis Program (GAP) 2016 Protected Areas Database of the U.S. (PAD-US).³

The North Pacific Landscape Conservation Cooperative facilitated a 2014 project that worked towards cross-boundary planning for the restoration of dry forest and savannah habitats in The Georgia Basin, which aimed to “synthesize existing data into GIS tools that prioritized land acquisition and conservation investment” for use “throughout British Columbia, Washington & Oregon to facilitate cross-boundary planning for the endangered forest and Savannah habitat.”¹¹ Since 1995 the non-profit organization Lomakatsi Restoration Project has been a leader in collaborative, holistic approaches to oak ecosystem restoration in southern Oregon and northern California.⁵

Population monitoring and/or occurrence surveys: The Happy Camp/Oak Knoll Ranger District of Klamath National Forest closely monitors Bald eagles, Peregrine falcons, Northern goshawk, and Northern spotted owls, which all rely on an ecosystem which includes *Q. sadleriana*.⁶ However, land-based surveys specifically for Sadler’s oak seem to be lacking (L. Hoover pers. comm., 2018).

Wild collecting and/or ex situ curation: The University of Washington Botanic Gardens is working to increase wild-sourced specimens within its collections, and acquired *Q. sadleriana* in a fall 2007 expedition to the Siskiyou Mountains of southern Oregon. Denver Botanic Gardens, in collaboration with Chicago Botanic Garden and Bartlett Tree Research Lab, have been awarded a 2017 APGA-USFS Tree Gene Conservation Partnership grant to scout suitable populations for collecting and hopefully gather germplasm for propagation (P. Allenstein pers. comm., 2017).¹²

Propagation and/or breeding programs: The MsK Rare and Native Plant Nursery was founded in 1970 by Kruckeberg Botanic Garden and continues to be an important source of native plants. In 2011, a variety of oaks were available, including *Q. garryana*, *Q. vaccinifolia*, *Q. sadleriana*, *Q. pontica*, *Q. gambelii*, *Q. kelloggii*, *Q. acutissima*, and *Q. macranthera*.¹³

Reintroduction, reinforcement, and/or translocation: Habitat restoration initiatives usually include reinforcement of populations for keystone species if significant declines have been detected. Though this is not currently the case for *Q. sadleriana*, there are many restoration projects (listed within the Sustainable management of land section) that would likely reinforce populations of *Q. sadleriana* should it become necessary.

Research: Specialist animals are reliant on the exact physical conditions that allow their survival. In a region with extensive diversity, such as the Klamath-Siskiyou mountains, a greater number of species become specialists. One example is *Cameraria sadlerianella*, a tiny leaf-mining moth found only on Sadler’s oak.¹⁴ The California Department of Fish and Wildlife is working to map and document all natural communities within the state, using the National Vegetation Classification Standard (NVCS). This initiative evaluates Natural Communities using NatureServe’s Heritage Methodology, with



communities ranked as vulnerable or higher considered Sensitive Natural Communities. These sensitive communities are mandated to be addressed in the environmental review processes of the California Environmental Quality Act and its equivalents. Nine Alliances or Associations (finest two levels of the NVCS) listed within the January 2018 California Sensitive Natural Communities database include *Q. sadleriana*. These nine communities are ranked globally as vulnerable (5 communities), apparently secure (1), and secure (3).¹⁵

Education, outreach, and/or training: Klamath National Forest hosts a significant volunteering program, which includes trail work, campground host, bird surveys, conservation education, fire lookout, Adopt-A-Trail, information receptionist, and wilderness restoration projects. These opportunities give participants the opportunity to learn about the valuable ecosystems represented within the Forest, as well as share this knowledge with park visitors.⁶ The Lomakatsi Restoration Project and North Willamette Valley Upland Oak Restoration Partnership both use education as an important conservation activity. The Willamette Valley Partnership works with landowners of oak habitats in Polk and Yamhill counties by providing information and assistance for participation in the National Resource Conservation Service (NRCS) voluntary Environmental Quality Incentives Program. Through this program, the NRCS facilitates conservation by giving financial and technical assistance to landowners implementing long-term oak habitat health and restoration projects. One example is the transition of marginal sites into more valuable habitat through measurement and control of invasive plants by landowners.^{5,9}

Species protection policies: No known initiatives at the time of publication.

PRIORITY CONSERVATION ACTIONS

Sadler's oak sites are typically montane; consequentially much of its habitat exists within National Forests, which afford *Q. sadleriana* a certain amount of protection. This understory shrub also has a low susceptibility to fire and can readily sprout. Restoration needs for the species are not currently known or clearly identified. Sadler oak's small form appears to protect it from a common threat faced by oaks of a larger stature in oak savannas, oak woodlands, or other oak communities: understory species encroaching in or usurping the more open habitat necessary for oak regeneration. Additional conservation activities may not be required at this time since threats to this species persistence in the landscape are not known and may not exist. It is necessary for sustainable management of land to continue, and populations should be monitored in relation to changing climate. This could include the use of predictive modeling to identify preparatory actions to equip *Q. sadleriana* for shifting climate in the future. Although this species is already present within at least 13 *ex situ* collections and represented by more than 50 plants of known wild origin, less than half of Sadler's oak native distribution is represented *ex situ*. Collection from unrepresented locations is recommended for optimal preservation of genetic diversity.

Conservation recommendations for *Quercus sadleriana*

Highest Priority

- Sustainable management of land

Recommended

- Population monitoring and/or occurrence surveys
- Research (climate change modeling)
- Wild collecting and/or *ex situ* curation

REFERENCES

1. **Muth, G. J. (1979).** *Quercus sadleriana* R. Br. Campst., its distribution, ecology, and relationships to other oaks. In *Proceedings of the symposium on the ecology, management, and utilization of California oaks* (Gen. Tech. Rep. PSW-44). Claremont, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture. Retrieved from https://www.fs.fed.us/psw/publications/documents/psw_gtr044/psw_gtr044_fm.pdf
2. **Kartesz, J. T. (2018).** The Biota of North America Program (BONAP). Taxonomic Data Center, Floristic Synthesis of North America, Version 1.0. Chapel Hill, NC. Retrieved from <http://www.bonap.net/tdc>
3. **U.S. Geological Survey, Gap Analysis Program (GAP). (2016, May).** Protected Areas Database of the United States (PAD-US). Version 1.4 Combined Feature Class. Retrieved from <https://gapanalysis.usgs.gov/padus/data/download/>
4. **Oregon Department of Fish and Wildlife. (2006, January).** *Oregon conservation strategy: Klamath Mountains ecoregion*. Retrieved from http://library.state.or.us/repository/2009/200907171321185/b-eco_km.pdf
5. **Lomakatsi Restoration Project. (n.d.).** Oak habitat restoration program. Retrieved from <https://lomakatsi.org/oak-habitat-restoration/>
6. **USDA Forest Service. (n.d.).** Klamath National Forest. Retrieved from <https://www.fs.usda.gov/detail/klamath/>
7. **U.S. EPA Office of Research & Development. (2013, April).** Ecoregions of the Conterminous United States. National Health and Environmental Effects Research Laboratory (NHEERL). Retrieved from ftp://ftp.epa.gov/wed/ecoregions/us/us_eco_l4.zip
8. **Wilderness Act of 1964,** Pub. L. No. 88-577.
9. **Klamath National Forest. (1995).** Revised 2010. *Land and resource management plan: Klamath National Forest*. Pacific Southwest Region, Forest Service, U.S. Department of Agriculture. Retrieved from <https://www.fs.usda.gov/main/klamath/landmanagement/planning>
10. **Natural Resources Conservation Service Oregon. (n.d.).** North Willamette Valley Upland Oak Restoration Partnership. United States Department of Agriculture. Retrieved from <https://www.nrcs.usda.gov/wps/portal/nrcs/detail/or/home/?cid=nrcseprd346418>
11. **North Pacific Landscape Conservation Cooperative. (2016).** Cross-boundary planning for resilience and restoration of endangered oak savannah and coastal Douglas-fir forest ecosystems. Retrieved from <http://www.northpacificlcc.org/cross-boundary-planning-for-resilience-and-restoration-of-endangered-oak-savannah-and-coastal-douglas-fir-forest-ecosystems>
12. **American Public Gardens Association. (n.d.).** Tree Gene Conservation Partnership showcase.
13. **Giseburt, D. (2011).** Fagaceae at the Kruckeberg Botanic Garden. *Oak News & Notes, The Newsletter of the International Oak Society*, 15(1), 1-3.
14. **U.S. Fish and Wildlife Service. (1995).** *Draft environmental alternatives analysis for a 4(d) rule for the conservation of the Northern spotted owl on non-federal lands*.
15. **California Department of Fish and Wildlife. (n.d.).** Natural communities. Retrieved from <https://www.wildlife.ca.gov/Data/VegCAMP/Natural-Communities>