

California's oaks in the 21st century: Oak habitat for endangered, threatened, and candidate species

by Angela Moskow, California Oaks

California's oak ecosystems provide food and vital habitat for California's native species, including 2,000 plants, 5,000 insects and arachnids, 80 amphibians and reptiles, 160 birds, and 80 mammals.¹ The *Red List of Oaks 2020* international report, described on page 8, observes that global distribution of oaks overlaps substantially with biodiversity hotspots. That report, which builds upon two other Red List publications, also documents threats confronting oaks.

California Wildlife Foundation/California Oaks (CWF/CO) requested lists of sensitive species associated with oaks from California Department of Fish and Wildlife (CDFW). This information is important for understanding what is at stake with oak ecosystems under threat. The statement from CWF/CO executive officer Janet Cobb on page 2 details the steps necessary to protect California's oak ecosystems, and the article about the Global Conservation Consortium for Oak on page 5 describes international efforts to protect imperiled oak species.

Inside

Pages 2-5 and 8

Statement from Executive Officer
Table 1: Oak-dependent state and federal endangered, threatened, and candidate (listed) vertebrates
Table 2: Oak-associated listed plant species and subspecies

California Oaks Coalition Reports and Resources

Global Conservation Consortium for Oak, Red List oak reports

Pages 6-7

Table 3: Oak-associated listed invertebrate species and subspecies

California Wildlife Foundation Partner Reports

California Land Conservation Partnership, Monitoring of rocky intertidal key-stone species



Photo courtesy of Sarah Gordon, Laguna de Santa Rosa Foundation (a member of California Oaks Coalition)

Vine Hill clarkia (*Clarkia imbricata*), designated as state and federally-endangered, and Vine Hill manzanita (*Arctostaphylos densiflora*), designated as state-endangered, growing amidst oaks

Tables 1–3 show federally and/or state designated endangered, threatened, and candidate plant, vertebrate, and invertebrate (crustacean, insect, and mollusk) species associated with oak habitat. The tables were created from spreadsheets produced by the CDFW Biogeographic Data Branch.

Vertebrate data were derived from the California Wildlife Habitat Relationship (CWHHR) information system (<https://wildlife.ca.gov/Data/CWHHR>), which contains life history, geographic range, habitat relationships, and management information on 712 species of amphibians, reptiles, birds, and mammals known to occur in the state; a species list of California's terrestrial vertebrates; and a habitat classification scheme for California containing 59 habitats, structural stages for most habitats, and 124 special habitat elements.²

The CWHHR query focused on vertebrate species that utilize oak (*Quercus* and *Notholithocarpus*) habitat for reproduction, cover, or feeding. The resulting tables include fully protected California species as well as listed and candidate species. Habitats included in the search were Blue Oak Woodland, Blue Oak-Foothill Pine, Coastal Oak Woodland,

Montane Hardwood, Montane Hardwood-Conifer, and Valley Oak Woodland. The Montane Hardwood-Conifer systems include tanoaks (*Notholithocarpus densiflorus*), which are in the oak family (*Fagaceae*) and produce acorns but are not in the *Quercus* genus. Oaks also grow in Mixed Chaparral, Montane Chaparral, and Valley Foothill Riparian systems, but oak-dominated vegetation types only represent a small percentage of those CWHHR habitat types overall and thus were not included.

CWF/CO derived scientific and common names by consulting *State and federally listed endangered and threatened animals of California* (<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109405&inline>) and *Special Animals List* (<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109406&inline>). Next, we reviewed scientific and state and federal listing documentation to ensure that the subspecies were oak-dependent.

The plant and invertebrate tables were created first with a cross-reference of California Natural Diversity Database (CNDDDB) occurrence records with the oak woodland

— continued on page 7

California must protect oak ecosystems for endangered and threatened species

Photo courtesy of Santa Monica Mountains National Recreation Area



Mountain lion kitten with oak seedling. (In June of 2018, National Park Service researchers discovered a litter of four female mountain lion kittens in Simi Hills, in a small area of habitat wedged between larger Santa Monica and Santa Susana mountain ranges. The kittens are known as P-66, P-67, P-68, and P-69. Their mom is P-62.)

Oaks provide vital plant and animal habitat that supports California's biodiversity. Protecting and perpetuating California's primary old growth resource is a cost-effective way to sustain threatened, endangered, and other sensitive species so that future generations are able to reap the inherited benefits of wildlife habitat, healthy watersheds, and a livable climate.

We must stem the conversion of oak forests and woodlands to other uses by passing uniform statewide oak protection measures, upholding current laws, and expanding conservation areas.

The only statewide standard for protecting noncommercial oaks is the California Environmental Quality Act (CEQA), which calls for the mitigation of impacts but provides no protection from actions that damage essential habitat. CEQA does not apply to conversions of oaks on agricultural lands.

California must enact protections governing oak removal to prevent further habitat loss, fragmentation, and degradation. The alternative inevitably increases permanent species losses.

At the same time, it is critical that current protections for oaks be enforced. For example, California law defines oak woodlands as stands with greater than 10% canopy cover, or that formerly had such cover. This definition is frequently ignored during environmental reviews, which instead rely on land categorizations that may not identify oak woodlands present.

California State Concurrent Resolution Number 17: Oak Woodlands, enacted in September 1989, directs state agencies with responsibility for land use planning and the management of native oak woodlands to preserve and protect them to the maximum extent feasible or to provide for the replacement and long-term survival of plantings where blue, Engelmann, valley, or coast live oak are removed. Few state agencies uphold this measure.

Expanded conservation of oak woodlands and oak-forested areas is also important. Oaks should be a central part of the state's 30% by 2030 broad sustainability goal. The *Conservation Gap Analysis of Native U.S. Oaks* estimated inferred native range of oaks contained within protected areas. The report estimated that seven of nine oak species of concern have less than 50% of their habitat protected, and two of the species have less than 75%. (See pages 5 and 8.)

California's oaks provide benefits that extend beyond biodiversity. They sustain culturally-significant landscapes, protect our essential watersheds, and sequester millions of tons of carbon. California's oaks and the species they support are at risk until responsible, forward-thinking executive and legislative branches enact and enforce measures to ensure NO NET LOSS of OAKS.

Sincerely,

Janet S. Cobb, Executive Officer California Wildlife Foundation/California Oaks

California Oaks Coalition

California Oaks Coalition brings together national, state, regional, and local organizations to conserve and perpetuate the state's primary old growth resource. Members of California Oaks Coalition are united by the vital role of oaks in sequestering carbon, maintaining healthy watersheds, providing habitat, and sustaining cultural values.

Amah Mutsun Land Trust; American River Conservancy; American River Watershed Institute; AquAlliance; Banning Ranch Conservancy; Butte Environmental Council; California Institute for Biodiversity; California Invasive Plant Council (Cal-IPC); California Native Plant Society (CNPS), including Dorothy King Young Chapter, San Diego Restoration Committee, and Sanhedrin Chapter; California Rangeland Trust; California Water Impact Network (C-WIN); California Wilderness Coalition (CalWild); Californians for Western Wilderness (CalUWild); Canopy; Center for Biological Diversity; Chimineas Ranch Foundation; Clover Valley Foundation; Conejo Oak Tree Advocates; Confluence West; Dumbarton Oaks Park Conservancy; Elder Creek Oak Sanctuary; Endangered Habitats Conservancy; Endangered Habitats League; Environmental Defense Center; Environmental Protection Information Center (EPIC); Environmental Water Caucus; Foothill Conservancy; Forests Forever; Friends of the Richmond Hills; Friends of Spenceville; Global Conservation Consortium for Oak; Hills For Everyone; Laguna de Santa Rosa Foundation; Lomakatsi Restoration Project; Los Padres ForestWatch; Lower Kings River Association; Napa County Water, Forest and Oak Woodland Protection Committee; Northern California Regional Land Trust; Planning and Conservation League; Redlands Conservancy; Resource Conservation District of Santa Monica Mountains; River Partners; River Ridge Institute; Rural Communities United; Sacramento Tree Foundation; Santa Clarita Organization for Planning and the Environment (SCOPE); Save Lafayette Trees; Shasta Environmental Alliance; Sierra Club Placer Group; Sierra Foothill Conservancy; Tejon Ranch Conservancy; Templeton Heritage Tree Foundation; Tuleyome; Tuolumne River Trust; University of California Los Angeles Mildred E. Mathias Botanical Garden

California Oaks provides four areas of support for coalition members:

- 1) Research and advocacy updates.
- 2) Information to educate and engage the public.
- 3) Tools for participating in planning processes and educating opinion leaders.
- 4) Materials to inform local, regional, and state governmental agencies of the opportunities for and benefits of protecting oak woodlands.

For more information, please contact Oaks Network Manager Angela Moskow, amoskow@californiaoaks.org.

RESOURCES

INTERNET RESOURCES

California Natural Diversity Database (CNDDDB) (<https://wildlife.ca.gov/Data/CNDDDB>) is part of a nationwide network of natural heritage programs overseen by NatureServe. These programs provide location and natural history information on special status plants, animals, and natural communities for the public, agencies, and conservation organizations. A strength of the natural heritage network and associated programs is that they utilize uniform methodologies to enter and analyze data on rare species and vegetation types.

NatureServe (natureserve.org) is the Red List authority for North American plants. The International Union for Conservation of Nature Red List of Threatened Species utilizes an objective global approach for evaluating the conservation status of plant and animal species, which draws on a network of scientists and partner organizations working in almost every country in the world. Visit: www.natureserve.org/conservation-tools/ucn-red-list-threatened-species and see page 8 for Red List oak reports.

Areas of Conservation Emphasis (ACE) (<https://wildlife.ca.gov/Data/Analysis/ACE#523731769-overview>) is a California Department of Fish and Wildlife effort to analyze large amounts of map-based data in a visual format, so that conservation of biodiversity, habitat connectivity, and climate change resiliency goals can inform decisions. ACE maps provide a coarse-level view of information on terrestrial biodiversity, connectivity, climate change resilience, and terrestrial significant habitats, the latter of which includes oak woodlands.

PUBLICATION

The Nature of Oaks: The Rich Ecology of Our Most Essential Native Trees by Douglas W. Tallamy, Workman Publishing/Timber Press, Portland, OR, 2021 (<https://www.workman.com/products/the-nature-of-oaks>).

Subspecies that may be oak-dependent

Perognathus longimembris pacificus, little pocket mouse, endangered (f), is one of the subspecies found to feed on *Quercus agrifolia* and *Q. dumosa* in a study described by Peter L. Meserve in "Food relationships of a rodent fauna in a California coastal sage scrub community," *Journal of Mammalogy*, v. 57, Issue 2, 20 May 1976, p. 300-319. <https://doi.org/10.2307/1379690>.

The April 24, 2003, proposed rules for *Polioptila californica californica*, coastal California gnatcatcher, threatened (f), published in the *Federal Register*, list *Quercus dumosa* in the description of *Polioptila californica californica* habitat in the foothills of the San Gabriel Mountains in the Etiwanda Fan and Lytle and Cajon Washes of San Bernadino County.

¹ This species was not listed as oak-dependent in CHWR. A research article documents 30% of nests in oak trees: Joanna X. Wu et al. "Diversity of great gray owl nest sites and nesting habitats in California." *The Journal of Wildlife Management* 79(6):937-947; 2015, SOI: 10.1002/jwmg.910.

Table 1: Endangered, threatened, and candidate vertebrate species and subspecies dependent upon oak habitat: federal (f) and state (s) lists, including California fully protected designations

Amphibians *Ambystoma californiense* California tiger salamander, threatened (s), Santa Barbara County Distinct Population Segment, endangered (f), threatened (s), Sonoma County Distinct Population Segment, endangered (f), threatened (s), Central California Distinct Population Segment, threatened (f, s) • *Ambystoma macrodactylum croceum* Santa Cruz long-toed salamander, endangered (f, s) and fully protected • *Batrachoseps simatus* Kern Canyon slender salamander, threatened (s) • *Batrachoseps stebbinsi* Tehachapi slender salamander, threatened (s) • *Hydromantes brunus* limestone salamander, threatened (s) and fully protected • *Hydromantes shastae* Shasta salamander, threatened (s) • *Rana boylei* Foothill yellow-legged frog, endangered (s: Southwest/South Coast, West/Central Coast, and East/Southern Sierra clades) and threatened (s: Northeast/Northern Sierra and Feather River clades) • *Rana draytonii* California red-legged frog, threatened (f) • *Rana muscosa* southern mountain yellow-legged frog, endangered (s), mountain yellow-legged frog, Northern California and Southern California Distinct Population Segments, endangered (f, s) • *Rana sierrae* Sierra Nevada yellow-legged frog, threatened (f, s)

Birds *Aquila chrysaetos* golden eagle, fully protected • *Buteo swainsoni* Swainson's hawk, threatened (s) • *Elanus leucurus* white-tailed kite, fully protected • *Falco peregrinus anatum* American peregrine falcon, fully protected • *Gymnogyps californianus* California condor, endangered (f, s) and fully protected • *Haliaeetus leucocephalus* bald eagle, endangered (s) and fully protected • *Lanius ludovicianus mearnsi* San Clemente Loggerhead shrike, endangered (f) • *Strix nebulosa*¹ great gray owl, endangered (s) • *Strix occidentalis caurina* Northern spotted owl, threatened (f, s)

Mammals *Aplodontia rufa nigra* Point Arena mountain beaver, endangered (f) • *Bassariscus astutus* ringtail, fully protected • *Dipodomys nitratoides exilis* Fresno kangaroo rat, endangered (f, s) • *Gulo gulo* wolverine, threatened (s) and fully protected • *Neotoma fuscipes riparia* riparian woodrat, endangered (f) • *Pekania [=Martes] pennanti* pop. 2 fisher, endangered (f: Southern Sierra Nevada Distinct Population Segment) and threatened (s: Southern Sierra Evolutionarily Significant Unit) • *Puma concolor* mountain lion (Southern California and Central Coastal Evolutionarily Significant Unit), candidate (s) • *Urocyon littoralis* island gray fox, threatened (s: Listing includes all subspecies on all six Channel Islands.) • *Urocyon littoralis catalinae* Santa Catalina Island fox, threatened (f, s) • *Sylvilagus bachmani riparius* riparian brush rabbit, endangered (f, s) • *Vulpes macrotis mutica* San Joaquin kit fox, endangered (f) and threatened (s)

Reptiles *Gambelia sila* blunt-nosed leopard lizard, endangered (f, s) and fully protected • *Masticophis lateralis euryxanthus* Alameda whipsnake, threatened (f, s) • *Thamnophis gigas/Thamnophis couchi gigas* giant garter snake, threatened (f, s) • *Thamnophis sirtalis tetrataenia* San Francisco garter snake, endangered (f, s) and fully protected



Ringtail (*Bassariscus astutus*) peeking from behind an oak trunk at Sutter Buttes. Ringtails are fully protected in California.

Special thanks to Melanie Gogol-Prokurat, PhD, Biogeographic Data Branch, California Department of Fish and Wildlife, for generating information for the vertebrate table from the California Wildlife Habitat Relationship information system; and to Dr. Gogol-Prokurat, Ryan Hill, and Brian Acord for providing guidance as all of the tables were prepared.

Table 2: Endangered (end.), threatened (thr.), and candidate plants associated with oaks: federal (f) and state (s) lists

Acanthomintha duttonii San Mateo thornmint, end. (f, s) • *Acanthomintha ilicifolia* San Diego thornmint, thr. (f), end. (s) • *Acmispon argophyllus* var. *niveus* Santa Cruz Island bird's-foot trefoil, end. (s) • *Alopecurus aequalis* var. *sonomensis* Sonoma alopecurus, end. (f) • *Ambrosia pumila* San Diego ambrosia, end. (f) • *Amsinckia grandiflora* large-flowered fiddleneck, end. (f, s) • *Arabis mcdonaldiana* McDonald's rockcress, end. (f, s) • *Arctostaphylos densiflora* Vine Hill manzanita, end. (s) • *Arctostaphylos franciscana* Franciscan manzanita, end. (f) • *Arctostaphylos hookeri* ssp. *hearthiorum* Hearst's manzanita, end. (s) • *Arctostaphylos montana* ssp. *ravenii* Presidio manzanita, end. (f, s) • *Arctostaphylos morroensis* Morro manzanita, thr. (f) • *Arctostaphylos myrtifolia* Ione manzanita, thr. (f) • *Arctostaphylos pallida* pallid manzanita, thr. (f), end. (s) • *Arenaria paludicola* marsh sandwort, end. (f, s) • *Astragalus agnicidus* Humboldt County milk-vetch, end. (s) • *Astragalus brauntonii* Braunton's milk-vetch, end. (f) • *Astragalus claranus* Clara Hunt's milk-vetch, end. (f), thr. (s, candidate end.) • *Astragalus pycnostachyus* var. *lanosissimus* Ventura Marsh milk-vetch, end. (f, s) • *Baccharis vanessae* Encinitas baccharis, thr. (f), end. (s) • *Berberis nevinii* Nevin's barberry, end. (f, s) • *Berberis pinnata* ssp. *insularis* island barberry, end. (f, s) • *Blennosperma bakeri* Sonoma sunshine, end. (f, s) • *Boechea hoffmannii* Hoffmann's rockcress, end. (f) • *Brodiaea filifolia* thread-leaved brodiaea, thr. (f), end. (s) • *Brodiaea insignis* Kaweah brodiaea, end. (s) • *Brodiaea pallida* Chinese Camp brodiaea, thr. (f), end. (s) • *Brodiaea rosea* Indian Valley brodiaea, end. (s) • *Calyptridium pulchellum* Mariposa pussypaws, thr. (f) • *Calystegia stebbinsii* Stebbins' morning-glory, end. (f, s) • *Camissonia benitensis* San Benito evening-primrose, thr. (f) • *Carpenteria californica* tree-anemone, thr. (s) • *Castilleja campestris* var. *succulenta* succulent owl's-clover, thr. (f), end. (s) • *Castilleja uliginosa* Pitkin Marsh paintbrush, end. (s) • *Ceanothus ferrisiae* coyote ceanothus, end. (f) • *Ceanothus ophiophilus* Vail Lake ceanothus, thr. (f), end. (s) • *Ceanothus roderickii* Pine Hill ceanothus, end. (f) • *Chlorogalum purpureum* var. *purpureum* Santa Lucia purple amole, thr. (f) • *Chlorogalum purpureum* var. *reductum* Camatta Canyon amole, thr. (f) • *Chloropyron maritimum* ssp. *maritimum* salt marsh bird's-beak, end. (f, s) • *Chorizanthe pungens* var. *hartwegiana* Ben Lomond spineflower, end. (f) • *Chorizanthe pungens* var. *pungens* Monterey spineflower, thr. (f) • *Chorizanthe robusta* var. *hartwegii* Scotts Valley spineflower, end. (f) • *Chorizanthe robusta* var. *robusta* robust spineflower, end. (f) • *Cirsium ciliolatum* Ashland thistle, end. (s) • *Cirsium fontinale* var. *fontinales* fountain thistle, end. (f, s) • *Cirsium fontinale* var. *obispoense* Chorro Creek bog thistle, end. (f, s) • *Cirsium scariosum* var. *loncholepis* La Graciosa thistle, end. (f), thr. (s) • *Clarkia franciscana* Presidio clarkia, end. (f, s) • *Clarkia imbricata* Vine Hill clarkia, end. (f, s) • *Clarkia lingulate* Merced clarkia, end. (s) • *Clarkia speciosa* ssp. *immaculata* Pismo clarkia, end. (f) • *Clarkia springvillensis* Springville clarkia, thr. (f), end. (s) • *Cordylanthus rigidus* ssp. *littoralis* seaside bird's-beak, end. (s) • *Crocanthemum greenei* island rush-rose, thr. (f) • *Deinandra mohavensis* Mojave tarplant, end. (s) • *Delphinium bakeri* Baker's larkspur, end. (f, s) • *Diplacus vandenbergensis* Vandenberg monkeyflower, end. (f) • *Dodecahema leptoceras* slender-horned spineflower, end. (f, s) • *Dudleya abramsii* ssp. *setchellii* Santa Clara Valley dudleya, end. (f) • *Dudleya cymosa* ssp. *agourensis* Agoura Hills dudleya, thr. (f) • *Dudleya cymosa* ssp. *marcescens* marcescent dudleya, thr. (f) • *Dudleya cymosa* ssp. *ovatifolia* Santa Monica dudleya, thr. (f) • *Dudleya stolonifera* Laguna Beach dudleya, thr. (f, s) • *Eremalche parryi* ssp. *kernensis* Kern mallow, end. (f) • *Eremogone ursina* Big Bear Valley sandwort, thr. (f) • *Eriodictyon altissimum* Indian Knob mountainbalm, end. (f, s) • *Eriodictyon capitatum* Lompoc yerba santa, end. (f) • *Eriogonum apricum* var. *apricum* Ione buckwheat, end. (f, s) • *Eriogonum apricum* var. *prostratum* Irish Hill buckwheat, end. (f, s) • *Eriogonum kennedyi* var. *austromontanum* southern mountain buckwheat, thr. (f) • *Eriophyllum latilobum* San Mateo woolly sunflower, end. (f, s) • *Eryngium aristulatum* var. *parishii* San Diego button-celery, end. (f, s) • *Eryngium constancei* Loch Lomond button-celery, end. (f, s) • *Eryngium racemosum* Delta button-celery, end. (s) • *Erysimum capitatum* var. *angustatum* Contra Costa wallflower, end. (f, s) • *Erysimum teretifolium* Santa Cruz wallflower, end. (f, s) • *Euphorbia hooveri* Hoover's spurge, thr. (f) • *Fremontodendron decumbens* Pine Hill flannelbush, end. (f) • *Fritillaria gentneri* Gentner's fritillary, end. (f) • *Fritillaria roderickii* Roderick's fritillary, end. (s) • *Fritillaria striata* striped adobe-lily, thr. (s) • *Galium buxifolium* box bedstraw, end. (f) • *Galium californicum* ssp. *sierrae* El Dorado bedstraw, end. (f) • *Gilia tenuiflora* ssp. *arenaria* Monterey gilia, end. (f), thr. (s) • *Gratiola heterosepala* Boggs Lake hedge-hyssop, end. (s) • *Hesperocyparis abramsiana* var. *abramsiana* Santa Cruz cypress, thr. (f), end. (s) • *Hesperolinon congestum* Marin western flax, thr. (f, s) • *Hesperolinon didymocarpum* Lake County western flax, end. (s) • *Holocarpha macradenia* Santa Cruz tarplant, thr. (f), end. (s) • *Howellia aquatilis* water howellia, thr. (f) • *Lasthenia burkei* Burke's goldfields, end. (f, s) • *Lasthenia conjugens* Contra Costa goldfields, end. (f) • *Lilium pardalinum* ssp. *pitkinense* Pitkin Marsh lily, end. (f, s) • *Limnanthes alba* ssp. *parishii* Parish's meadowfoam, end. (s) • *Limnanthes floccosa* ssp. *californica* Butte County meadowfoam, end. (f, s) • *Limnanthes vincularis*



Photograph courtesy of Carolyn Chaney

Franciscan manzanita (*Arctostaphylos franciscana*), federally-endangered, photographed with oaks at Santa Barbara Botanic Garden.

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Sebastopol meadowfoam, end. (f, s) • *Lupinus citrinus* var. *deflexus* Mariposa lupine, thr. (s) • *Lupinus milo-bakeri* Milo Baker's lupine, thr. (s, candidate end.) • *Lupinus tidestromii* Tidestrom's lupine, end. (f, s) • *Malacothamnus fasciculatus* var. *nesioticus* Santa Cruz Island bush-mallow, end. (f, s) • *Malacothrix squalida* island malacothrix, end. (f) • *Monardella viminea* willow monardella, end. (f, s) • *Navarretia fossalis* spreading navarretia, thr. (f) • *Navarretia leucocephala* ssp. *pauciflora* few-flowered navarretia, end. (f), thr. (s) • *Navarretia leucocephala* ssp. *pliantha* many-flowered navarretia, end. (f, s) • *Neostaphia colusana* Colusa grass, thr. (f), end. (s) • *Neviusia cliftonii* Shasta snow-wreath (s, candidate end.) • *Oenothera deltooides* ssp. *howellii* Antioch Dunes evening-primrose, end. (f, s) • *Opuntia basilaris* var. *treleasei* Bakersfield cactus, end. (f, s) • *Orcuttia californica* California Orcutt grass, end. (f, s) • *Orcuttia tenuis* slender Orcutt grass, thr. (f), end. (s) • *Packera layneae* Layne's ragwort, thr. (f) • *Panicum acuminatum* var. *thermale* Geysers panicum, end. (s) • *Pentachaeta bellidiflora* white-rayed pentachaeta, end. (f, s) • *Pentachaeta lyonia* Lyon's pentachaeta, end. (f, s) • *Piperia yadonii* Yadon's rein orchid, end. (f) • *Plagiobothrys diffuses* San Francisco popcornflower, end. (s) • *Plagiobothrys strictus* Calistoga popcornflower, end. (f), thr. (s) • *Pleuropogon hooverianus* North Coast semaphore grass, thr. (s) • *Pogogyne clareana* Santa Lucia mint, end. (s) • *Polygonum hickmanii* Scotts Valley polygonum, end. (f, s) • *Potentilla hickmanii* Hickman's cinquefoil, end. (f, s) • *Pseudobahia bahiifolia* Hartweg's golden sunburst, end. (f, s) • *Pseudobahia peirsonii* San Joaquin adobe sunburst, thr. (f), end. (s) • *Sibara filifolia* Santa Cruz Island winged-rockcress, end. (f) • *Sidalcea keckii* Keck's checkerbloom, end. (f) • *Sidalcea pedate* bird-foot checkerbloom, end. (f, s) • *Sidalcea stipularis* Scadden Flat checkerbloom, end. (s) • *Taraxacum californicum* California dandelion, end. (f) • *Thysanocarpus conchuliferus* Santa Cruz Island fringe-pod, end. (f) • *Trifolium amoenum* two-fork clover, end. (f) • *Tuctoria greenei* Greene's tuctoria, end. (f) • *Verbena californica* Red Hills vervain, thr. (f, s)

Special thanks to Misty Nelson, formerly with California Department of Fish and Wildlife, for generating, with California Natural Diversity Database colleagues, the information in table 2 (plants) and table 3 (invertebrates).

Global Conservation Consortium for Oak collaborates to preserve California oaks

by Amy Byrne, Global Tree Conservation Coordinator, Oak Consortium, The Morton Arboretum



Abby Meyer

Nuttall's scrub oak at San Elijo Lagoon Ecological Reserve and Nature Center in northern San Diego County, CA.

The Global Conservation Consortium for Oak (GCCO) brings together oak experts and the botanic garden community to prevent extinction of the world's oak species and ensure healthy oaks for the future. Led by The Morton Arboretum (located in Lisle, Illinois), in collaboration with Botanic Gardens Conservation International, GCCO is mobilizing a network to develop and implement a comprehensive global oak-conservation strategy.

GCCO recently joined California Oaks Coalition to share resources and expertise to help conserve and protect the state's unique oak species and habitats. Established in 2019 under the leadership of Murphy Westwood, PhD, GCCO advances the following objectives:

Ensure that threatened species are conserved *in situ*: GCCO works to reinforce wild populations through restoration and land management, among other *in situ*

conservation practices, to ensure long-term sustainability. Land management and protection are among GCCO priorities and recommended activities for California species of conservation concern.

Build capacity to empower and mobilize in-country partners: The oak consortium is establishing a strong foundation of collaborators in centers of oak diversity, including the United States, Mexico and Central America, Southeast Asia, and China. GCCO works with experts and institutions in these regions to identify at-risk species, develop strategic work plans, and create and sustain partnerships to advance the long-term conservation of oaks.

Identify and prioritize species of greatest conservation concern: In the United States GCCO is focusing on priority conservation and research activities outlined in the

*Conservation Gap Analysis of Native U.S. Oaks.*¹ It identifies 28 priority species, including nine of concern in California: Cedros Island oak (*Quercus cedrosensis*), Nuttall's scrub oak (*Q. dumosa* Nutt.), Engelmann oak (*Q. engelmannii*), valley oak (*Q. lobata*), island scrub oak (*Q. pacifica*), Palmer oak (*Q. palmeri*), Santa Cruz Island oak (*Q. parvula*), Sadler's oak (*Q. sadleriana*), and island oak (*Q. tomentella* Engelm.). Visit <https://www.mortonarb.org/science-conservation/research-themes/oaks/conservation-gap-analysis-native-us-oaks-study> to read these species profiles.

Increase public awareness and engage-

GCCO provides partners and collaborators with tools and support to overcome challenges, catalyze action, and build capacity to conserve threatened oak species around the world.

ment: Social media, newsletters, and conference presentations are employed to engage oak experts and the botanic garden sector and educate the broader public. The Institute of Museum and Library Services recently

awarded GCCO a National Leadership Grant for activities in the United States, including development of interpretative panels for oak conservation groves to educate the public about the importance of conserving oak species in living collections and highlight GCCO's vital role in coordinating these efforts.

Additional objectives of the oak consortium include establishing and managing coordinated *ex situ* collections of high conservation value, undertaking and facilitating applied research (e.g., conservation biology, population genetics, taxonomy), and fundraising to scale-up conservation action.

¹ See Beckman et al., 2019, *Conservation Gap Analysis of Native U.S. Oaks*, table 6. <https://www.mortonarb.org/files/conservation-gap-analysis-of-native-US-oaks.pdf>

Partnership seeks to conserve California's exceptional biodiversity and foster healthy landscapes and communities

by Debra Schlafmann, California Landscapes Coordinator, U.S. Fish and Wildlife Service, and Kim Tenggardjaja, PhD, Biodiversity Coordinator, California Department of Fish and Wildlife

Since 2010, California Land Conservation Partnership (CA LCP) has provided a forum for partners to develop shared conservation goals, objectives, and strategies to address climate change and other environmental stressors at landscape scales. The best way to ensure progress on the many conservation needs of our uniquely biodiverse state is to reach agreement on concepts that each organization can address, and which, collectively, can lead to significant ecological benefits. CA LCP uses this approach to help resource managers and scientists join together to protect California's habitats, which sustain numerous species found nowhere else on Earth.

CA LCP is an alliance of public and private land managers, scientists, and interested groups committed to solving natural resource challenges that are too large or complex for any single entity to undertake alone. CA LCP focuses on climate change with the vision of supporting thriving ecosystems through lasting collaborative conservation partnerships for all Californians.

Formerly known as the California Landscape Conservation Cooperative, CA LCP recently generated a strategic plan for the next five years and updated our mission, vision, and charter, with California Wildlife Foundation as fiscal and administrative sponsor of the effort. The strategic planning process recognized that diversification of partnerships should be informed by an understanding that climate change and other environmental challenges can exert negative impacts on human health and well-being—with impacts often greater in under-resourced communities. The new plan seeks to make conservation in California more inclusive by incorporating voices and perspectives from diverse communities in shaping conservation outcomes.

The strategic plan also seeks to advance California's ambitious biodiversity and climate goals by building the capacity of the conservation community to respond to emerging threats; valuing and incorporating Traditional Ecological Knowledge and Indigenous community expertise in conservation practice; and incorporating innovative adaptation strategies to advance climate-informed management, restoration, and protection.

CWF's partnership with CA LCP has also been in support of the creation of the website (<http://climate.calcommons.org/>). The Climate Commons, CA LCP's digital library, contains links to climate change assessments and reports, climate-smart conservation, scenario planning, vulnerability assessments, and climate adaptation strategies. The website also profiles over 40

CA LCP science-management projects, from threat assessments on California's rangelands, to effects of climate change on inland fishes, to building habitat connectivity for climate adaptation.

CA LCP welcomes organizations to join as partners or via an ad hoc working group.



Beach layia (*Layia carnosa*) a state and federally-endangered plant. CA LCP previously funded a project to assess and map rare plant species vulnerable to climate change.

CA LCP includes steering committee members from: California Department of Fish and Wildlife, California Department of Water Resources, California Fish Passage Forum, California State Coastal Conservancy, Central Valley Joint Venture, Climate Science Alliance, Conservation Biology Institute, National Oceanic and Atmospheric Administration, National Park Service, Natural Resources Conservation Service, Point Blue Conservation Science, San Francisco Bay Joint Venture, Sonoran Joint Venture Binational Bird Conservation, Southwest Climate Adaption Science Center, U.S. Bureau of Land Management, U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, U.S. Forest Service, and U.S. Geological Survey.

Table 3: Endangered, threatened, and candidate invertebrates associated with oaks: federal (f) and state (s) lists



Two monarch butterflies under a coast live oak tree. California's overwintering population of monarch butterflies (*Danaus plexippus* pop. 1) is a candidate for federal Endangered Species Act protection.

Crustaceans *Branchinecta lynchi* vernal pool fairy shrimp, threatened (f) • *Lepidurus packardii* vernal pool tadpole shrimp, endangered (f) • *Pacifastacus fortis* Shasta crayfish, endangered (f, s) • *Streptocephalus woottoni* Riverside fairy shrimp, endangered (f) • *Syncaris pacifica* California freshwater shrimp, endangered (f, s)
Insects *Apodemia mormo langei* Lange's metalmark butterfly, endangered (f) • *Bombus crocthii* Crotch bumble bee, candidate endangered (s) • *Bombus franklini* Franklin's bumble bee, candidate endangered (s) • *Bombus occidentalis* western bumble bee, candidate endangered (s) • *Bombus suckleyi* Suckley's cuckoo bumble bee, candidate endangered (s) • *Callophrys mossii bayensis* San Bruno elfin butterfly, endangered (f) • *Cicindela ohlone* Ohlone tiger beetle, endangered (f) • *Danaus plexippus* pop. 1 Monarch butterfly, California overwintering population, candidate (f) • *Desmocerus californicus dimorphus* valley elderberry longhorn beetle, threatened (f) • *Euphilotes enoptes smithi* Smith's blue butterfly, endangered (f) • *Euphydryas editha bayensis* Bay checkerspot butterfly, threatened (f) • *Euphydryas editha quino* quino checkerspot butterfly, endangered (f), candidate endangered (s) • *Euproserpinus euterpe* Kern primrose sphinx moth, threatened (f) • *Lycaena hermes* Hermes copper butterfly, candidate threatened (f) • *Plebejus icarioides missionensis* Mission blue butterfly, endangered (f) • *Polyphylla barbata* Mount Hermon (= barbata) June beetle, endangered (f) • *Pyrgus ruralis lagunae* Laguna Mountains skipper, endangered (f) • *Speyeria callippe callippe* callippe silverspot butterfly, endangered (f) • *Trimerotropis infantilis* Zayante band-winged grasshopper, endangered (f)
Mollusks *Helminthoglypta walkeriana* Morro shoulderband (= banded dune) snail, endangered (f) • *Monadenia infumata setosa* Trinity bristle snail, threatened (s)

Photo courtesy of Elizabeth Wallace, California Native Plant Society, Orange County chapter

— continued from page 1

dataset in CDFW's Areas of Conservation Emphasis (ACE) system.³ (See Resources column on page 3 for more information on ACE.) This search generated a list of all special-status species that had at least part of an occurrence overlapping with oak ecosystems. CDFW then calculated the percentage of the CNDDDB occurrence polygon(s) that overlapped with oak woodlands to further narrow the list.

Next, a threshold was established to exclude species with a low average percentage overlap of all CNDDDB occurrences with the oak woodlands layer in ACE. Concerned that a high threshold might have eliminated species with few occurrences listed in the CNDDDB, CDFW compared the results with a list of sensitive plant species that occur on oak habitat that was published in *Guidelines for Managing California's Rangelands* 1996 by University of California. Following the recommendation of CDFW, CWF/CO excluded species with average percent overlap of all CNDDDB occurrence with the oak woodlands layer in ACE below 5%.

The CNDDDB listing includes 134 plant species that are designated as state or federally threatened or endangered, or are candidates for federal or state designations, out of 839 sensitive native plant species associated with oak habitat. It includes 26 candidate and listed invertebrate species out of 201 sensitive invertebrate species that are associated with oak habitat. The CNDDDB queries were exclusively for oak (*Quercus*), as CNDDDB does not track tanoak (*Notholithocarpus*).

¹ Meadows, R. 2007. "Oaks: Research and outreach to prevent oak woodland loss." *California Agriculture* 61(1):7-10.

² CWHR is maintained by CDFW's Conservation and Analysis Unit, which conducts scientific analysis and research to address conservation questions and produce products for use in conservation decision-making, with a focus on landscape-level spatial analysis that includes habitat suitability modeling, species range and distribution modeling, climate change vulnerability assessment, habitat connectivity modeling, and the compilation and integration of other landscape datasets.

³ CNDDDB staff work with partners to maintain current lists of rare species and an ever-growing database of locations mapped by geographic information system (GIS) for these species. These data inform conservation decisions, aid in environmental review of projects and analysis of land use changes, provide baseline information helpful in recovering endangered species, and inform research projects.

Monitoring of rocky intertidal keystone species yields critical conservation insights

by Keith Lombardo, PhD, Director, Southern California Research Learning Center, National Park Service

When most people think about the National Park Service (NPS), their minds race to raging waters of the Grand Canyon, dramatic rock outcroppings in Yosemite Valley, or abundant megafauna of Yellowstone. Few people associate NPS with the rocky intertidal, a unique ecological habitat exposed only during the lowest of tides where many people first experience marine wildlife. Along the western coast of the United States, NPS protects an abundance of rocky intertidal habitat, including Channel Islands National Park (CHIS) and Cabrillo National Monument (CABR) in Southern California.

NPS is charged with protecting and preserving all species and ecological systems under our purview. Its Southern California Research Learning Center partners with California Wildlife Foundation, employing a diverse team of biologists and communicators to collect intertidal monitoring data. Long-term monitoring data provide the necessary context for scientists and land managers working to discern species population trends and the status of ecosystems. But how do land managers and scientists accomplish this goal given the breadth of natural resources under NPS protection? The monitoring schemes employed by NPS and its partner agencies often focus on keystone species, ones so critical that the ecosystem would change dramatically without them.

Intertidal monitoring at CHIS and CABR began in 1990, as biologists noticed marked changes in the intertidal habitat, driven by the loss of several keystone species. When monitoring began at CABR, for example, 7 of the 13 keystone species had been extirpated or were in significant decline. Channel Islands and Cabrillo participate in a collaboration of agencies and institutions that monitor rocky intertidal habitats and their keystone species at more than 200 sites ranging from Baja California to Alaska. The group, known as MARINe (Multi-Agency Rocky Intertidal Network), has instituted similar data collection protocols across the North American West Coast.

Each year the data are aggregated and made available for study, allowing scientists to see if observations and trends occur in just one or two locations, indicating a local issue such as poaching or pollution; or at multiple sites across larger geographic areas, indicating regional or global issues such as marine heat waves or disease outbreaks. The MARINe collaboration has produced science communications to increase public understanding of the importance of rocky intertidal ecosystems and published numerous scientific articles, which have shed light on critical issues facing rocky intertidal systems such as sea star wasting disease and ocean acidification.



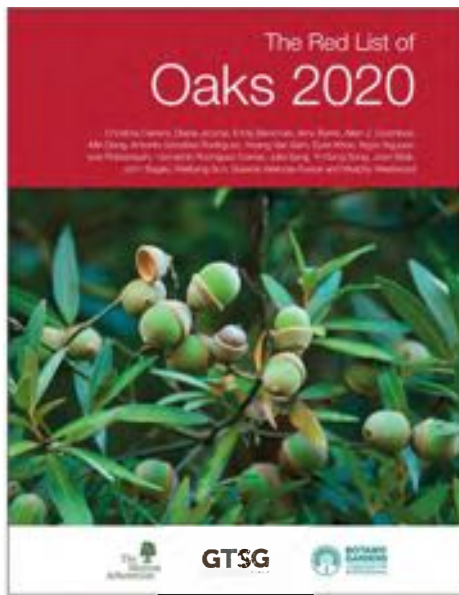
Michael Reedy Photography

A singular bolt indicates the location of a long-term owl limpet monitoring site, where a team of biologists collect rocky intertidal data at Cabrillo National Monument in San Diego, CA.

*Many important conservation stories have emerged about the cryptic species in rocky intertidal habitats. For example, the giant owl limpet (*Lottia gigantea*), a conspicuous marine snail, can be found clinging to bedrock and boulders of Pacific shores and adjacent islands. MARINe monitoring data from the past 30 years suggest local pressures may be driving changes in limpet populations at CABR while trends in oceanic conditions may be expanding limpet population changes elsewhere. Dive into the ESRI Story Map: <https://storymaps.arcgis.com/stories/5d06971d96414e35b49d9327cc3bb956>; for more information about the Southern California Learning Research Center, visit: <https://www.nps.gov/rlc/southern/cal/index.htm>.*

Reports assess extinction risk and conservation needs for oak species

by Christina Carrero, Tree Conservation Research Assistant, The Morton Arboretum



In December 2020, The Morton Arboretum, in partnership with Botanic Gardens Conservation International, published *The Red List of Oaks 2020*, the first comprehensive report on extinction risk for the world's 430 estimated oak species. The report utilizes the International Union for Conservation of Nature (IUCN) Red List threat categories for each species and includes detailed meta-analyses of threats to oaks by region.

According to the report, the United States has one of the highest numbers of oak species (91) in the world and the fourth highest number of *Threatened* oak species (16). See: <https://www.mortonarb.org/science-conservation/global-tree-conservation/projects/iucn-red-list-threat-assessments-priority>.

The Red List of Oaks 2020 follows two prior reports on the status of U.S. oaks. In 2017, *The Red List of US Oaks*, published assessments for the country's oaks, including 20 California species. IUCN standard methodology was used to assess the range, habitat, population size, population trends, and prevalent threats to each species, which were then assigned to one of eight Red List categories. The report identified 16 native U.S. species as *Threatened* (either Critically Endangered, Endangered, or Vulnerable, according to IUCN criteria), including 5 in California: Cedros Island Oak (*Quercus cedrosensis*), Nuttall's scrub oak (*Q. dumosa* Nutt.), Engelmann oak (*Q. engelmannii*), island scrub oak (*Q. pacifica*), and island oak (*Q. tomentella* Engelm.).¹ California is one of the states with the highest number of *Threatened* oak species. The report identified cli-

mate change, fire suppression, and land change for human use as the primary threats to California oaks, which mostly aligns with the overall significant threats to U.S. oaks. See: <https://globaltrees.org/wp-content/uploads/2017/09/Oaks5.pdf>.

The Arboretum subsequently collaborated to produce the *Conservation Gap Analysis of Native U.S. Oaks* in 2019, which provides in-depth analyses for oak species of conservation concern, including nine California oaks assessed as *Threatened* or *Near-Threatened*. The report evaluates the most common and significant threats and current conservation strategies by species and makes recommendations for future conservation action. See: <https://www.mortonarb.org/files/conservation-gap-analysis-of-native-US-oaks.pdf>. *The Red List of Oaks 2020* expands on these reports by analyzing all global oak species and oak threats regionally and providing context for how oaks in each region compare on a global scale.

The 2020 report identifies invasive pests and diseases as the most common threats in the United States, although these are not the most common threats to California oaks. The United States is the only major global region where invasive pests and diseases are the most reported threat. Other analyzed regions (Mexico/Central America/Caribbean, Asia, and Europe) are most threatened by habitat loss for agriculture and urban development.

The findings of these three publications point to *in situ* protections—managing invasive species, fire regimes, climate change, and human-influenced land change—as well as collaborative *ex situ* species collection as necessary strategies for conserving oaks in California and across the United States.

¹ The IUCN threat categories are separate from and do not align with state or federal threat designations associated with the California or federal Endangered Species Act.

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How you can help:

- Donate to California Wildlife Foundation/California Oaks. A secure donation can be made from our website: californiaoaks.org.
- Spend time in an oak woodland or forest. Click on californiaoaks.org/resources for a partial listing of oak landscapes around the state that have public access.
- Please consider including oak conservation in your financial and estate planning efforts. Information can be found at: californiaoaks.org/donate.
- Be vigilant about threats to oak woodlands and oak-forested lands in your community and consult californiaoaks.org for guidance.
- Sign up for the *Oaks* e-newsletter at californiaoaks.org.
- Support local and statewide measures to protect natural resources.
- Hold decision-makers accountable for protecting green infrastructure.

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