

A Rapid Assessment of the Vulnerability of Sensitive Wildlife to Extreme Drought



Wildlife Branch, Nongame Wildlife Program
California Department of Fish and Wildlife
7/15/2015, revised 1/22/2016

Cover Photo Credits:

Photo of adult Cascades Frog at Echo Lake by J. Garwood, CDFW.

Photo of completely dry Cascades Frog breeding pond by M. Van Hattem, CDFW.

A Rapid Assessment of the Vulnerability of Sensitive Wildlife to Extreme Drought

California Department of Fish and Wildlife, Wildlife Branch

Introduction

California is renowned for its biodiversity. The state's varied topography and climate have given rise to a remarkable diversity of habitats and a correspondingly varied array of both plant and animal species. California has more native species than any other state in the nation, including approximately 68 amphibians, 85 reptiles, 429 birds, and 185 mammals (CDFW 2014), and also has the greatest number of endemic species, those that occur nowhere else in the world (CDFG 2003). Many of these are rare and subject to a variety of threats and stressors other than drought (Figure 1).

The current extreme drought is having some level of effect on all animals. While California's native species are adapted to periods of drought, some are more vulnerable than others to extended or frequent severe drought and may be at risk of extirpation. Small population size, short life expectancy relative to the drought duration, and inability to adequately cope with extreme events are reasons some taxa are more vulnerable than others. The effects of drought on some types of animals are more obvious than others. For example, fish need oxygenated water to breath, so to put it simply, no water, no fish. Other species may not die from lack of water, but may fail to reproduce. Many adult amphibians (e.g., frogs, toads, and salamanders) can survive periods of no water, but most require water for the egg and larval/tadpole life stages. Other more terrestrial species are only able to successfully breed when food, such as vegetation or prey species that feed on vegetation, is available for the young. Severe, extended absence of precipitation can lead to population declines through lack of recruitment of young. Whether the current, unprecedented drought is causing a species to decline towards extinction depends on a number of factors, including how widely distributed the species is relative to extreme drought conditions, the degree to which microhabitats remain available to serve as refugia, and the ability for animals to relocate to less impacted areas. With adequate behavioral or genetic diversity and enough time, some animals can adapt to or evolve with changing conditions. For many species, however, the information required to predict drought vulnerability is not known.

The historically unprecedented severity of the recent drought and concern for the impact it might have on rare and endangered species led the Department to conduct a rapid assessment of vertebrate taxa most likely to be vulnerable to the effects of extreme, prolonged drought.

Methods

Priority Taxon Evaluation

All freshwater fish were considered highly vulnerable, so this effort focused on amphibians, reptiles, birds, and mammals. We began by compiling a list of 358 sensitive vertebrate taxa (species, or subspecies, or distinct population segments) that were listed as threatened or endangered under the federal Endangered Species Act (ESA), or the California Endangered Species Act (CESA), proposed or candidates for listing, California fully protected species, state

species of special concern, or species that had been identified as at high risk from climate change impacts in other reports, but not yet considered a species of special status (Gardali et al. 2012, Spencer and Osborn 2013, Thomson et al. 2012, Wright et al. 2013). Staff scientists who are experts for each taxa group compiled available information and used their professional opinion to evaluate drought risk for each sensitive taxon. Drought vulnerability was assessed by scoring how dependent on aquatic resources and precipitation each taxon is for three broad life history and ecological characteristics: annual survival, reproduction, and food resources. Possible scores for each of the three risk categories were 0, 1, and 2, with a higher score indicating higher risk due to drought for each category (Table 1).

Table 1. Scoring criteria for each of three drought risk categories, including annual survival, reproduction, and food resources. A higher score indicates a higher risk due to drought.

Score	Survival ^a	Reproduction ^b	Food Resources ^c
0	Precipitation or access to water has little to no effect on daily survival	Annual reproductive output is not tied to or limited directly by water availability	Organism is a dietary generalist or does not rely on food resources that are significantly impacted by annual precipitation or access to water
1	Daily survival declines moderately with no or limited access to water	Reproductive output is directly affected by precipitation or access to water, including aquatic or wetland habitat availability	Organism is a moderate specialist on food resources that are significantly impacted by annual precipitation or access to water
2	Daily survival declines significantly. Organism lives in water at least part time, requires moisture/humidity, or requires daily access to water for survival	Reproduction occurs in water or in wetland habitat, or without direct access to water, reproduction does not occur	Organism is an extreme specialist on food resources that are significantly impacted by annual precipitation or access to water

^a Survival is considered year-round (i.e. breeding and non-breeding seasons) and is evaluated for adults only.

^b Reproduction scores consider the degree to which certain habitats or direct access to water are required for reproduction. Potential effects of food on reproductive output are addressed in the food resources risk category.

^c Food resources that are significantly impacted by annual precipitation or access to water were defined as prey that is aquatic or has an obligatory aquatic stage, annual plants that are highly dependent on annual precipitation, or prey that cycle annually with annual plant production.

Taxa were further scored for three criteria representing the species' life history and status that might influence short and long-term drought risk: life span, population size, and geographic range size, with possible scores of 1, 2, or 3. For these criteria, a higher score indicates that a taxon is more resilient to impacts of drought (i.e., larger population or range; longer life span; (Table 2).

Table 2. Scoring criteria for each of three life history and status categories, including life span, population size, and geographic range size. A higher score indicates a lower risk due to drought.

Score	Life Span	Population Size	Mammal Range Size (km ² in CA)	Bird, Reptile, and Amphibian Range Size (% of CA in species range)
1	≤ 3 years	<1,000	Small (<10,000 km ²)	Small (< 10%)
2	3-10 years	1,000-10,000	Med (10,000 - 100,000 km ²)	Med (10-50%)
3	>10 years	>10,000	Large (> 100,000 km ²)	Large (> 50%)

The scores for the three risk categories and the three life history and status criteria were then used to create three separate metrics of drought risk: Direct Drought Risk, Index of Drought Risk, and Protracted Drought Risk (Table 3).

Table 3. Definitions and calculations for three metrics of drought risk: Direct Drought Risk, Index of Drought Risk, and Protracted Drought Risk.

Direct Drought Risk Definition	Direct Drought Risk Calculation
This metric is simply the sum of the three drought risk categories. Possible values range from zero to 6.	Annual Survival risk+Reproduction risk+Food Resources risk
Index of Drought Risk Definition	Index of Drought Risk Calculation
This metric uses the two species status criteria (Population Size and Range Size) as correction factors for drought risk. The Direct Drought Risk value is multiplied by 6 and then divided by the sum of these two criteria scores. Possible values range from zero to 18.	(Direct Drought Risk)6/(Pop Size+Range Size)
Protracted Drought Risk Definition	Protracted Drought Risk Calculation
This metric incorporates the species Life Span criterion into the Index of Drought Risk to produce a measure of long term risk due to a multi-year drought. The Index of Drought Risk is multiplied by 3 and then divided by the score for Life Span. Possible values range from zero to 54.	(Index of Drought Risk)3/(Life Span)

In order to prioritize the Department's monitoring and management efforts for at-risk taxa, values for each of the three drought risk metrics were evaluated and conditions developed for

assigning taxa to one of three priority groups. The following conditions were used to assign taxa to each group:

Priority I – Taxa in this group met the following condition:

Direct Drought Risk ≥ 4	To meet this condition at least one of the drought risk categories must be scored as a 2, which is the highest possible risk score for each category.
Or	
Index of Drought Risk ≥ 9	To meet this condition the Direct Drought Risk value must be at least 3 and both species status criteria (Population Size and Range Size) must be scored 1.
Or	
Protracted Drought Risk ≥ 12	To meet this condition the Direct Drought Risk value must be at least 2, Life Span must be scored a 1 (≤ 3 years), and at least one of the species status criteria (Population Size and Range Size) must be scored 1.

Priority II – Taxa in this group met the following condition:

Direct Drought Risk = 2 or 3 and Index of Drought Risk ≥ 6, but <9 or Protracted Drought Risk ≥ 9, but <12	This condition was created to capture taxa that have an elevated drought risk but do not meet the conditions of high priority taxa. To meet this condition, both the Direct Drought Risk value AND at least one of the other two drought risk metrics must have a moderate value.
---	---

Priority III - All other taxa not meeting the above conditions were assigned to the third group.

Figure 2 shows the decision tree used for assigning taxa to priority groups based on the resulting scores for the three drought risk metrics as described above.

The use of broad categories and qualitative as well as quantitative assessments of traits to assess species vulnerability is consistent with other conservation assessment metrics that are well established such as the IUCN's Red List criteria (ICUN 2015) and NatureServe's conservation status assessment methods (Faber-Langendoen et al. 2012).

In addition, taxa experts identified sensitive species which may be at significant risk from indirect drought-related threats, regardless of the taxon's life history traits. Indirect threats considered included the potential effects of reductions in agricultural water deliveries; the potential effects of larger, more frequent wildfires; the potential effects of increased exposure to disease and toxicants as aquatic environments recede and food sources decline (as assessed

by the Department's Wildlife Investigations Lab staff); and the potential effects of reduced availability and quality of managed wetlands. Assignment to these categories was largely speculative based on what information was on hand. These indirect drought-related effects were not used in taxa drought risk calculations, but were examined independently (Table 4).

Table 4. Definitions used for identifying sensitive species which may be at significant risk from four indirect drought-related threats, regardless of the taxon's life history traits.

Significant Population Risk from Ag Water Reduction	Yes	Agricultural water reductions will likely negatively impact a population locally or range-wide
	No	Agricultural water reductions will not negatively impact a population locally or range-wide
Significant Population Risk from Increased Wildfire	Yes	Increased wildfire will likely negatively impact a population locally or range-wide
	No	Increased wildfire will not negatively impact a population locally or range-wide
Significant Reliance on Managed Wetlands	Yes	The species is reliant on managed wetlands during some portion of its life cycle
	No	The species is not reliant on managed wetlands during any portion of its life cycle
Significant Population Risk from Disease/Toxin	Yes	Species has an increased prevalence of disease or contaminant loads during drought years, which may negatively impact a population locally or range-wide
	No	Species does not have an increased prevalence of disease or contaminant loads during drought years

The methodology and results were subsequently subjected to independent review by other Department scientists. Reviewers were selected based on their breadth of knowledge and field experience with wildlife taxa representing various habitats and regions of the state. Ultimately, evaluations were received from three regional scientists and the lead biologist for the California Natural Diversity Database Program. Their comments lead to clarification of the scoring criteria/conditions and were also incorporated into the discussion of the results below.

Geographic Priority Evaluation

After generating the priority taxa lists, the Department looked at the geographic distribution of the priority taxa in several different ways to determine the areas of the state where conservation actions are most likely to be needed. First, the geographic ranges of the Priority I taxa were overlaid upon one another. Geographic range maps used for this exercise were derived from Species of Special Concern (SSC) and California Wildlife Habitat Relationship (CWHR) documents (Williams 1986, Shuford and Gardali 2008, Thomson et al. 2012, Spencer and Osborn 2013; Mayer and Laudenslayer 1988; <http://www.dfg.ca.gov/biogeodata/cwhr/>). If the

specific taxon or subspecies ranges were not available in those sources, additional sources were consulted to support refinement of the ranges used, including U.S. Fish and Wildlife Service recovery plans, [Californiaherps.com](http://californiaherps.com), and California Natural Diversity Database (CNDDB). However, geographic range only represents the geographic extent within which a species might be found, but not the actual distribution of the species on the landscape.

Next, the number of priority taxa was tallied for each of the terrestrial conservation units described in the Department's update of its State Wildlife Action Plan (SWAP; CDFW 2015). These consist of the state's 19 ecoregions as mapped by the U.S. Department of Agriculture, Forest Service (sections in Bailey 1976) (Figure 3). Also consistent with SWAP, the taxa were tallied for each of the state's vegetation community types at the level of macrogroup as defined by California's Vegetation Classification and Mapping Program, based on the National Vegetation Classification System (<http://www.dfg.ca.gov/biogeodata/vegcamp/>). The Department's CWHR is a relational database that assigns wildlife species to habitat types. In order to assign the taxa to a macrogroup of California's Vegetation Classification System, the results of the crosswalk between CWHR habitats and vegetation classifications developed for the SWAP update were used for the whole species, then staff experts refined the results based on knowledge of the specific taxa involved, some of which were subspecies or other smaller taxonomic groups. This was done because CWHR only matches full species with habitat associations, and subspecies are often tied to a subset of habitats used by the full species.

Finally, using data available from NOAA National Weather Service (<http://water.weather.gov/precip/about.php>), the Department mapped which regions of the state were experiencing the greatest difference from the normal average rainfall for the period of Oct. 1, 2012 through May 18, 2015 (Figure 6). Normal was the average annual rainfall for water years 1981-2010. This was done to help focus where wildlife has been most exposed to the extended drought and where stressor monitoring or response actions may be most urgently needed.

Results

Scores for all species evaluated are included in Appendix A. Based on the rapid assessment conducted, a list of 48 "Priority I" taxa were identified as being the most at risk from drought related conditions (Table 5) with an additional 57 taxa that may also be vulnerable to drought ("Priority II") (Table 6). Priority I taxa included 14 amphibians (8 listed), 7 reptiles (3 listed), 15 birds (7 listed or candidate for listing), and 12 mammals (3 listed). Priority II taxa include 21 amphibians (9 listed), 9 birds (1 listed), and 27 mammals (mostly bats; 3 listed or candidate for listing). No reptiles fell into the Priority II group. These taxa totals included multiple subspecies and subpopulations of some species. When the subspecies are subsumed into the full species level, there are 41 Priority I species, and 51 Priority II species. Not surprisingly, approximately 80% of the state's sensitive amphibians were identified as being at risk from drought. Birds identified as priorities primarily included those that occur in inland marsh habitat. Likewise, the mammals (other than bats) were also associated with inland marshes. Several bats are included as Priority II species, which reflects the generally high dependence of bats as a group on free surface water for drinking. Bats' physical and physiological characteristics (high surface area,

high metabolic rate) increase their rate of water loss relative to other small mammals (Siebold et al. 2013 and references cited therein).

Table 7 provides the results of the rapid assessment of taxa which may be vulnerable to indirect drought-related threats. In addition to the 105 taxa identified as Priority I and II, taxa experts identified 7 Priority III birds potentially at risk from drought related changes in agricultural water deliveries, 73 Priority III taxa potentially at risk from drought-related increases in wildfire frequency, extent, and severity (6 amphibians, 21 birds, 25 mammals, and 21 reptiles), 24 Priority III taxa potentially at risk from drought-related changes in managed wetland environments (4 birds, 20 mammals), and 25 Priority III taxa potentially at risk from increased exposure to diseases and toxicants related to drought conditions (8 amphibians, 12 birds, 4 mammals, and 1 reptile).

Drought sensitive taxa occur throughout the state in all nineteen ecoregions (Figure 4). The ecoregions supporting the highest number of Priority I taxa included Southern California Coast, Southern California Mountain and Valley, and the Sierra Nevada, followed by Mojave Desert, Great Valley, and Southern Cascades. The ecoregions supporting the highest number of Priority II taxa included Southern California Coast and Central California Coast, followed by Colorado Desert, Mojave Desert, and Southern California Mountain and Valley. Considering Priority I and II taxa combined, the ecoregions supporting the greatest number of drought-sensitive taxa include Southern California Coast, Southern California Mountain and Valley, Mojave Desert, Central California Coast, Sierra Nevada, and Colorado Desert.

The majority of the Priority I taxa are found in freshwater marsh type vegetative communities, followed by riparian and wet meadow communities throughout the temperate, mountain, and desert regions of the state (Figure 5).

Discussion

This process was a rapid, broad-brush approach to assessing the vulnerability of wildlife to drought, and in some cases, assumptions had to be made based on readily available information. Most notably, the geographic distributions of the focal species were inferred from broad habitat relationships or interpolated from a small number of records into coarse range maps. This may have led to underestimates of vulnerability due to overestimating the amount of available suitable habitat, especially for habitat specialists.

The original intent of this risk assessment was to identify the most immediately vulnerable taxa to severe drought, with vulnerability to prolonged drought a secondary goal. When scoring taxa for dependency on aquatic resources for food, a conservative approach was taken, with taxon directly reliant on aquatic food sources scoring higher than those that indirectly rely on aquatic sources. When assessing prolonged drought risk, both types of taxa (those directly and indirectly reliant on aquatic food resources) were scored high. This may have led to underestimation of the risk of drought to a taxon reliant on terrestrial food resources, even those which may be reduced due to drought. Other indirect ecological factors and interactions may also affect a taxon's vulnerability to drought. For example, the giant kangaroo rat (*Dipodomys ingens*) was ranked Priority III, but its populations have been reported to have declined in the

Carrizo Plain area from a density of 51 animals/ha in 2011 to 2 animals/ha in 2014 (Prugh and Brashares 2011b, 2012, 2013, and Prugh and Brashares unpublished data). San Joaquin kit foxes (*Vulpes macrotis mutica*), which prey heavily on giant kangaroo rats, have followed this decline, and now fewer than 200 kit foxes are estimated to reside on the Carrizo Plain National Monument (Stafford et al 2015). These declines have been attributed to lack of vegetation due to drought. Nevertheless, both of these species were grouped into the third priority category. Another example is the black swift (*Cypseloides niger*). This rare bird builds nests of moss behind waterfalls, and feeds primarily on flying ants. Drought no doubt impacts habitat suitability for this species, yet the metrics used here grouped it into the third priority category as well. For these reasons, it is possible that due to some unique life history attributes, some taxa assigned to Priority III may actually be more vulnerable than the rapid assessment indicated. We have included recommendations below for addressing these shortcomings,

Conversely, vulnerability may have been over estimated for some species on the list due to the fact that the behavioral ability of the animal to adjust to conditions (e.g., use of estivation, torpor or movement to avoid unsuitable conditions) was not taken into consideration. Another source of possible error comes from the lack of information for many taxa and the assumptions used (e.g., using data from a similar taxon in lieu of taxon-specific information). The assessment also did not take into account each taxon's fecundity or potential population growth rate (i.e., how quickly populations can increase once conditions improve), information that is not known for many of the at-risk taxa.

Additionally, our approach to identifying the areas where drought-related conservation efforts may be most needed was based in part on vulnerable species richness, and runs the risk of underemphasizing ecoregions where only a few species are at risk, although the risk to one or more of these species may be great.

We are currently collecting data that we hope will validate some of the rankings or allow us to re-evaluate as needed depending on drought conditions.

Review of species of all priorities identified as being potentially at risk from indirect drought-related threats (Table 7) revealed some patterns in species vulnerability independent of life history traits and ecosystem associations. Birds, mammals, and reptiles which have become dependent on the water deliveries and management actions that support the managed wetlands which have largely replaced natural wetlands in California are potentially at risk from curtailed water deliveries and management constraints related to prolonged drought. Species dependent on vegetative communities that support severe wildfires, particularly those in coastal scrub and montane forest communities may be at risk from increased frequency and extent of severe wildfires. And while no clear pattern was evident, species across all taxa groups may be at increased risk of population level effects from the increased prevalence of disease and contaminants resulting from receding habitats and the concentration of individuals in reduced habitat patches.

It is important to recognize that the true effects of drought on sensitive wildlife from extremely severe drought events or from an increase in frequency of severe drought events can only be known by continuing to monitor population-level response overtime. This rapid assessment

effort provided a means by which sensitive taxa could be prioritized for further investigation and focused monitoring efforts.

Recommendations

- Refine identification of species most sensitive to extended drought conditions:
 - Further investigate taxon vulnerability to severe drought using reports of localized die-offs/declines, as well as fine-scale climatic data and wildlife-habitat relationship models.
 - Fill data gaps by collecting focused information on the population-level drought effects of reduced food resources, and other ecological interactions involving sensitive species.
 - Monitor species impacted by indirect drought effects such as reduced availability of agricultural water, risk from increased wildfires, risk from wildlife disease exposure, and reduced availability of managed wetlands. Model potential population level impacts to sensitive species from indirect drought impacts.
 - Develop an approach to 1) long-term, statewide resource assessment to estimate baseline population levels of numerous wildlife species at the ecoregion level, and 2) model associations with drought and other stressors that could be used to provide timely, terrestrial vertebrate population status and stressor data, beginning in the areas of the state experiencing the greatest prolonged deviation from normal rainfall, then expand to other areas to inform decisions about drought response and other conservation challenges statewide.
 - Review and update the list of Priority I species in this report using new information as it becomes available. Consider additional or revised metrics, as appropriate. Expand peer review to include additional review/refinement by selected experts of taxa groups, and in scientific fields such as ecology, physiology, and climate science.
 - Commit to long-term monitoring of drought-sensitive taxa and ecosystems. Monitoring periods on the scale of decades may be necessary to identify trends in species populations through the annual precipitation fluctuations that are typical of California.
 - Maintain and improve a communication network with other state, federal, and local resource agencies and the public to rapidly identify species and populations experiencing substantial drought related impacts.

- Undertake actions to identify the status of priority taxa and the means by which resiliency may be improved, particularly in drought-sensitive areas:
 - For imperiled high elevation amphibians such as Sierra Nevada (*Rana sierra*) and southern mountain yellow-legged frogs (*Rana muscosa*), Yosemite toads (*Anaxyrus canorus*), and Cascades frogs (*Rana cascadae*):

- Expand the number of sites that are surveyed to determine the current population status of these taxa throughout their range.
 - Investigate the hydrologic and geomorphic factors controlling the relationship between surface water conditions and suitable breeding habitat to inform potential future meadow restoration projects.
 - For the endemic and endangered Amargosa vole (*Microtus californicus scirpensis*), a species completely dependent on bulrush marsh habitat in the center of the Mojave Desert:
 - Determine actions necessary to increase habitat resiliency of desert marshes near Shoshone in Inyo County.
 - For the Central Valley endemic and threatened giant garter snake (*Thamnophis gigas*), a highly aquatic species dependent on natural and artificial marshes:
 - Investigate the current distribution and demography of populations in the San Joaquin Valley, where the species is most imperiled.
 - Assess suitability of remaining habitat and opportunities for habitat enhancements to allow for potential future translocation/reintroduction of snakes to increase population size.
 - For the western pond turtle (northern and southern species, *Emys marmorata* spp.), California's only native extant freshwater turtles, and recently petitioned for listing under the federal Endangered Species Act:
 - Compile available information on population status and reported die-offs to direct focused surveys in drought-sensitive areas.
 - Implement population status surveys in priority drought-sensitive areas where data is lacking.
 - For montane wetland- and inland marsh-dependent birds:
 - Investigate the current distribution and demography of populations in drought-sensitive areas, particularly for the rarer and secretive taxa.
 - For all raptors:
 - Monitor the status of populations relative to decrease reproduction from low food availability due to drought.
 - Investigate potential relationship of the recent emergence of mange in golden eagles (*Aquila chrysaetos*) and drought-related stress, as well as potential transfer to other raptor species, if possible.
 - For all priority bats:
 - Implement population status surveys in priority drought-sensitive areas where data is lacking.
- Anthropogenic impacts such as the conversion, fragmentation, and degradation of native ecosystems, and introduced competitors and predators, have likely reduced the capacity of native species to withstand a prolonged drought. Because the impacts of drought are often additive to these anthropogenic impacts, it may be more efficient to direct drought relief resources towards addressing these anthropogenic stressors than directly at drought stressors (e.g. removing non-native fish to help mountain amphibians). With this in mind,

recommended actions to reduce threats and improve resiliency of priority taxa populations include:

- Develop policy on when active intervention is appropriate to rescue drought-impacted species or populations, including translocation, capture, and propagation.
- For imperiled high elevation amphibians such as Sierra Nevada and southern mountain yellow-legged frogs, Yosemite toads, and Cascades frogs:
 - Continue restoration efforts that include the removal of non-native predatory fishes from select sites to increase availability of predator-free, perennially wet habitat that's more resistant to drought-related drying or freezing.
- For the endemic and endangered Amargosa vole, a species completely dependent on bulrush marsh habitat in the center of the Mojave Desert:
 - Implement actions necessary to increase habitat resiliency of managed desert marshes within the range of the species.
 - Continue the captive breeding program to maintain a captive population for future release back into sustainable marshes.
- For the western pond turtle (northern and southern species), California's only native extant freshwater turtles:
 - Explore options for rescuing turtles for translocation to sustainable habitat, as appropriate. The Association of Zoos and Aquariums (AZA) has expressed interest in assisting specifically with pond turtle conservation and recovery.

References

Bailey, R.G. 1976. Ecoregions of the United States (map). USDA Forest Service Intermountain Region, Ogden, UT. Scale 1:7,500,000

California Department of Fish and Game (CDFG). 2003. Atlas of the Biodiversity of California. State of California, The Resources Agency, Department of Fish and Game.

California Department of Fish and Wildlife (CDFW). 2014. Complete List of Amphibian, Reptile, Bird and Mammal Species in California. <https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=87155&inline=1>

California Department of Fish and Wildlife (CDFW). 2015. California State Wildlife Action Plan, 2015 Update: A Conservation Legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, PhD. Prepared with assistance from Ascent Environmental, Inc., Sacramento, CA.

Gardali, T., N.E. Seavy, R.T. DiGaudio, and L.A. Comrack. 2012. A Climate Change Vulnerability Assessment of California's At-Risk Birds. PLoS ONE 7(3): e29507. doi:10.1371/journal.pone.0029507.

Mayer K.E. and W.F. Laudenslayer. 1988. A Guide to Wildlife Habitats of California. State of California, Resources Agency, Sacramento, CA.

Prugh L. and J. Brashares. 2011a. Partitioning the effects of an ecosystem engineer: kangaroo rats control community structure via multiple pathways. Journal of Animal Ecology. doi: 10.1111/j.1365-2656.2011.01930.x

Prugh L. and J. Brashares. 2011b. Carrizo Plain ecosystem project, December 2011. Prepared in compliance with USFWS permit conditions.

Prugh L. and J. Brashares. 2012. Carrizo Plain ecosystem project, December 2012. Prepared in compliance with USFWS permit conditions.

Prugh L. and J. Brashares. 2013. Carrizo Plain ecosystem project, December 2013. Prepared in compliance with USFWS permit conditions.

Shuford, W.D., and Gardali, T., editors. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, CA and California Department of Fish and Game, Sacramento.

Siebold, S., J. Buchner, C. Baessler, and J. Mueller. 2013. Ponds in acidic mountains are more important for bats in providing drinking water than insect prey. J. Zool., 290:302-308.

Spencer, W.D., and S.D. Osborn, editors. 2013. Interim Draft: Terrestrial Mammal Species of Special Concern in California, Part 1 – Overview. Report submitted to California Department of Fish and Wildlife, Wildlife Branch, Nongame Wildlife Program for Contract No. P0880022."

Stafford, R., C. Fiehler, B. Cypher, L. Prugh, and S. Butterfield. 2015. Long term population trends and density estimates for San Joaquin kit fox on Carrizo Plain National Monument. Presentation at Western Section of the Wildlife Society Conference, Santa Rosa, CA.

Thomson, R.C., Amber N. Wright, and H. Bradley Shaffer. 2012. California Amphibian and Reptile Species of Special Concern (in press).

Williams, D. F. 1986. Mammalian species of special concern in California. Wildlife Management Division Administrative Report 86-1. California Department of Fish and Game, Sacramento, USA.

Wright, Amber N., Robert J. Hijmans, Mark W Schwartz, and H. Bradley Shaffer. 2013. California Amphibian and Reptile Species of Future Concern: Conservation and Climate Change. Final Report to the California Department of Fish and Wildlife Nongame Wildlife Program, Task 12, Contract No. P0685904.

List of Preparers

Dan Applebee, Senior Environmental Scientist (threatened and endangered species)
Carie Battistone, Senior Environmental Scientist (raptors)
Neil Clipperton, Senior Environmental Scientist (birds)
Kristi Cripe, Research Program Specialist (GIS)
Karen Miner, Environmental Program Manager (report compilation)
Scott Osborn, PhD, Senior Environmental Scientist (mammals)
Laura Patterson, Senior Environmental Scientist (amphibians and reptiles)

List of Reviewers

Stacy Anderson, Environmental Scientist (North Central Region)
Betsy Bolster, Senior Environmental Scientist (Nongame Wildlife Program)
Esther Burkett, Senior Environmental Scientist (Nongame Wildlife Program)
Deana Clifford, Senior Wildlife Veterinarian (Wildlife Investigations Lab) for disease and toxins
Nancy Frost, Senior Environmental Scientist (South Coast Region)
Rhianna Lee, Senior Environmental Scientist (Nongame Wildlife Program)
Patrick McIntyre, PhD., Senior Environmental Scientist Supervisor (CNDDDB)
Krysta Rogers, Senior Environmental Scientist (Wildlife Investigations Lab) for avian disease
Hans Sin, Senior Environmental Scientist Supervisor (South Coast Region)
Chris Stermer, Senior Environmental Scientist (Nongame Wildlife Program)

TABLE 5. Drought risk Priority I taxa listed in alphabetical order by scientific name within each taxonomic group.

Priority I - Drought Vulnerable Amphibians, Reptiles, Birds, and Mammals		
Class	Common Name	Scientific Name (Listing Status)
Amphibian	arroyo toad	<i>Anaxyrus californicus</i> (FE/SSC)
Amphibian	Yosemite toad	<i>Anaxyrus canorus</i> (FT/SSC)
Amphibian	black toad	<i>Anaxyrus exsul</i> (ST/FP)
Amphibian	Pacific tailed frog	<i>Ascaphus truei</i> (SSC)
Amphibian	desert slender salamander	<i>Batrachoseps major aridus</i> (FE/SE)
Amphibian	relictual slender salamander	<i>Batrachoseps relictus</i> (SSC)
Amphibian	northern leopard frog	<i>Lithobates pipiens</i> (SSC)
Amphibian	foothill yellow-legged frog	<i>Rana boylei</i> (SSC)
Amphibian	Cascades frog	<i>Rana cascadae</i> (SSC)
Amphibian	California red-legged frog	<i>Rana draytonii</i> (FT/SSC)
Amphibian	southern mountain yellow-legged frog (Northern DPS)	<i>Rana muscosa</i> (FE/SE)
Amphibian	southern mountain yellow-legged frog (Southern DPS)	<i>Rana muscosa</i> (FE/SE)
Amphibian	Sierra Nevada yellow-legged frog	<i>Rana sierrae</i> (FE/ST)
Amphibian	southern torrent salamander	<i>Rhyacotriton variegatus</i> (SSC)
Reptile	northwestern pond turtle	<i>Emys marmorata marmorata</i> (SSC)
Reptile	southwestern pond turtle	<i>Emys marmorata pallida</i> (SSC)
Reptile	giant garter snake	<i>Thamnophis gigas</i> (Sacramento Valley/Delta) (FT/ST)
Reptile	giant garter snake	<i>Thamnophis gigas</i> (San Joaquin Valley) (FT/ST)
Reptile	two-striped garter snake	<i>Thamnophis hammondi</i> (SSC)
Reptile	south coast garter snake	<i>Thamnophis sirtalis</i> ssp. (SSC)
Reptile	San Francisco garter snake	<i>Thamnophis sirtalis tetrataenia</i> (FE/SE/FP)
Bird	tricolored blackbird	<i>Agelaius tricolor</i> (SCL)
Bird	redhead	<i>Aythya americana</i> (SSC)
Bird	western snowy plover - interior population	<i>Charadrius alexandrinus nivosus</i> (FT/SSC)
Bird	black tern	<i>Chlidonias niger</i> (SSC)
Bird	yellow rail	<i>Coturnicops noveboracensis</i> (SSC)
Bird	fulvous whistling-duck	<i>Dendrocygna bicolor</i> (SSC)
Bird	willow flycatcher (exclusive of E. t. extimus)	<i>Empidonax traillii</i> (SE)
Bird	southwestern willow flycatcher	<i>Empidonax traillii extimus</i> (FE/SE)
Bird	greater sandhill crane	<i>Grus canadensis tabida</i> (ST/FP)
Bird	harlequin duck	<i>Histrionicus histrionicus</i> (SSC)
Bird	least bittern	<i>Ixobrychus exilis</i> (SSC)

Priority I - Drought Vulnerable Amphibians, Birds, Mammals, and Reptiles (continued)		
Class	Common Name	Scientific Name (Listing Status)
Bird	California black rail - interior	<i>Laterallus jamaicensis coturniculus</i> (ST/FP)
Bird	wood stork	<i>Mycteria americana</i> (SSC)
Bird	American white pelican	<i>Pelecanus erythrorhynchos</i> (SSC)
Bird	Yuma clapper rail	<i>Rallus longirostris yumanensis</i> (FE/ST/FP)
Mammal	Sonora beaver	<i>Castor canadensis frondator</i> (including <i>repentinus</i>) (SSC*)
Mammal	Mexican long-tongued bat	<i>Choeronycteris mexicana</i> (SSC)
Mammal	Lesser long-nosed bat.	<i>Leptonycteris yerbabuenae</i> (FE/SSC)
Mammal	Sonora river otter	<i>Lontra canadensis sonora</i> (SSC*)
Mammal	Marsh vole	<i>Microtus californicus paludicola</i> (SSC*)
Mammal	San Pablo vole	<i>Microtus californicus sanpabloensis</i> (SSC)
Mammal	Amargosa vole	<i>Microtus californicus scirpensis</i> (FE/SE)
Mammal	Stephens' California vole	<i>Microtus californicus stephensi</i> (SSC*)
Mammal	San Bernardino Mountains long-tailed vole	<i>Microtus longicaudus bernardinus</i> (SSC*)
Mammal	Arizona myotis	<i>Myotis occultus</i> (SSC)
Mammal	Arizona cave myotis	<i>Myotis velifer velifer</i> (SSC)
Mammal	Buena Vista Lake shrew	<i>Sorex ornatus relictus</i> (FE/SSC)

Status Codes

FE = Federally endangered; FT = Federally threatened; SE = State endangered; ST = State threatened; FP = Fully Protected; SSC = CDFW Species of Special Concern (Shuford and Gardali 2008, Thomson et al. 2012; Williams 1986); SSC* = Proposed for inclusion in update of Mammal SSC (Spencer and Osborn 2013).

TABLE 6. Drought risk Priority II taxa listed in alphabetical order by scientific name within each taxonomic group. Note: There were no reptiles assigned as Priority II.

Priority II - Drought Vulnerable Amphibians, Birds, Mammals, and Reptiles		
Class	Common Name	Scientific Name (Listing Status)
Amphibian	California tiger salamander (Sonoma DPS)	Ambystoma californiense (FE/ST)
Amphibian	California tiger salamander (Santa Barbara DPS)	Ambystoma californiense (FE/ST)
Amphibian	California tiger salamander (Central California DPS)	Ambystoma californiense (FT/ST)
Amphibian	Santa Cruz long-toed salamander	Ambystoma macrodactylum croceum (FE/SE/FP)
Amphibian	southern long-toed salamander	Ambystoma macrodactylum sigillatum (SSC)
Amphibian	Santa Cruz black salamander	Aneides flavipunctatus niger (SSC)
Amphibian	Inyo Mountains slender salamander	Batrachoseps campi (SSC)
Amphibian	lesser slender salamander	Batrachoseps minor (SSC)
Amphibian	Kern Canyon slender salamander	Batrachoseps simatus (ST)
Amphibian	Tehachapi slender salamander	Batrachoseps stebbinsi (ST)
Amphibian	California giant salamander	Dicamptodon ensatus (SSC)
Amphibian	limestone salamander	Hydromantes brunus (ST/FP)
Amphibian	Mount Lyell salamander	Hydromantes platycephalus
Amphibian	Shasta salamander	Hydromantes shastae (ST)
Amphibian	Scott Bar salamander	Plethodon asupak (ST)
Amphibian	Dunn's salamander	Plethodon dunni
Amphibian	northern red-legged frog	Rana aurora (SSC)
Amphibian	Couch's spadefoot	Scaphiopus couchii (SSC)
Amphibian	western spadefoot	Spea hammondi (SSC)
Amphibian	red-bellied newt	Taricha rivularis (SSC)
Amphibian	Coast Range newt	Taricha torosa (Monterey Co. and south) (SSC)
Bird	tule greater white-fronted goose	Anser albifrons elgasi (SSC)
Bird	Clark's marsh wren	Cistothorus palustris clarkae (SSC)
Bird	gull-billed tern	Gelochelidon nilotica (SSC)
Bird	Inyo California towhee	Melospiza crissalis eremophilus (FT/SE)
Bird	vermillion flycatcher	Pyrocephalus rubinus (SSC)
Bird	black skimmer	Rynchops niger (SSC)
Bird	Bendire's thrasher	Toxostoma bendirei (SSC)
Bird	Le Conte's thrasher	Toxostoma lecontei (SSC)
Bird	yellow-headed blackbird	Xanthocephalus xanthocephalus (SSC)
Mammal	Pallid bat	Antrozous pallidus pacificus (SSC)
Mammal	Pallid bat	Antrozous pallidus pallidus (SSC)
Mammal	Point Arena mountain beaver	Aplodontia rufa nigra (FE/SSC)

Priority II - Drought Vulnerable Amphibians, Birds, Mammals, and Reptiles (continued)		
Class	Common Name	Scientific Name (Listing Status)
Mammal	Townsend's big-eared bat	<i>Corynorhinus townsendii</i> (SCL/SSC)
Mammal	Spotted bat	<i>Euderma maculatum</i> (SSC)
Mammal	Western mastiff bat	<i>Eumops perotis</i> (SSC)
Mammal	California mastiff bat	<i>Eumops perotis californicus</i> (SSC)
Mammal	Silver-haired bat	<i>Lasionycteris noctivagans</i>
Mammal	Western red bat	<i>Lasiurus blossevillei</i> (SSC)
Mammal	Hoary bat	<i>Lasiurus cinereus</i>
Mammal	Southwestern yellow bat	<i>Lasiurus xanthinus</i> (SSC)
Mammal	California leaf-nosed bat	<i>Macrotus californicus</i> (SSC)
Mammal	Owens Valley vole	<i>Microtus californicus vallicola</i> (SSC)
Mammal	Small-footed myotis	<i>Myotis ciliolabrum</i>
Mammal	Long-eared myotis	<i>Myotis evotis evotis</i> (SSC*)
Mammal	Long-eared myotis	<i>Myotis evotis pacificus</i> (SSC*)
Mammal	Little brown myotis	<i>Myotis lucifugus</i>
Mammal	Fringed myotis	<i>Myotis thysanodes thysanodes</i> (SSC*)
Mammal	Fringed myotis	<i>Myotis thysanodes vespertinus</i> (SSC*)
Mammal	Cave myotis	<i>Myotis velifer</i> (SSC)
Mammal	Long-legged myotis	<i>Myotis volans</i> (SSC*)
Mammal	Yuma myotis	<i>Myotis yumanensis</i>
Mammal	Pocketed free-tailed bat	<i>Nyctinomops femorosaccus</i> (SSC)
Mammal	Big free-tailed bat	<i>Nyctinomops macrotis</i> (SSC)
Mammal	Colorado River cotton rat	<i>Sigmodon arizonae plenus</i> (SSC)
Mammal	Yuma Hispid cotton rat	<i>Sigmodon hispidus eremicus</i> (SSC)
Mammal	Riparian brush rabbit	<i>Sylvilagus bachmani riparius</i> (FE/SE)

Status Codes

FE = Federally endangered; FT = Federally threatened; SE = State endangered; ST = State threatened; FP = Fully Protected; SCL = State Candidate for listing; SSC = CDFW Species of Special Concern (Shuford and Gardali 2008, Thomson et al. 2012; Williams 1986); SSC* = Proposed for inclusion in update of Mammal SSC (Spencer and Osborn 2013).

TABLE 7. Drought Priority I and II taxa with populations at significant risk from indirect threats associated with drought or reliant on managed wetlands. See Appendix A for Priority III taxa and Table 4 for indirect threat descriptions

Common Name	Scientific Name	Drought Priority	Ag Water Reduction	Increased Wildfire	Disease /Toxins	Managed Wetlands
Amphibians						
arroyo toad	<i>Anaxyrus californicus</i>	I	No	Yes	No	No
Yosemite toad	<i>Anaxyrus canorus</i>	I	No	Yes	Yes	No
black toad	<i>Anaxyrus exsul</i>	I	No	No	No	No
Pacific tailed frog	<i>Ascaphus truei</i>	I	No	Yes	No	No
desert slender salamander	<i>Batrachoseps major aridus</i>	I	No	No	No	No
relictual slender salamander	<i>Batrachoseps relictus</i>	I	No	Yes	No	No
northern leopard frog	<i>Lithobates pipiens</i>	I	No	No	No	No
foothill yellow-legged frog	<i>Rana boylei</i>	I	No	Yes	Yes	No
Cascades frog	<i>Rana cascadae</i>	I	No	No	Yes	No
California red-legged frog	<i>Rana draytonii</i>	I	No	Yes	Yes	No
southern mountain yellow-legged frog (Southern DPS)	<i>Rana muscosa</i>	I	No	Yes	Yes	No
southern mountain yellow-legged frog (Northern DPS)	<i>Rana muscosa</i>	I	No	No	Yes	No
Sierra Nevada yellow-legged frog	<i>Rana sierrae</i>	I	No	No	Yes	No
southern torrent salamander	<i>Rhyacotriton variegatus</i>	I	No	Yes	Yes	No
California tiger salamander (Sonoma DPS)	<i>Ambystoma californiense</i>	II	No	No	Yes	No
California tiger salamander (Santa Barbara DPS)	<i>Ambystoma californiense</i>	II	No	Yes	Yes	No
California tiger salamander (Central California DPS)	<i>Ambystoma californiense</i>	II	No	Yes	Yes	No
Santa Cruz long-toed salamander	<i>Ambystoma macrodactylum croceum</i>	II	No	Yes	Yes	No
southern long-toed salamander	<i>Ambystoma macrodactylum sigillatum</i>	II	No	No	Yes	No
Santa Cruz black salamander	<i>Aneides flavipunctatus niger</i>	II	No	Yes	No	No
Inyo Mountains slender salamander	<i>Batrachoseps campi</i>	II	No	No	Yes	No
lesser slender salamander	<i>Batrachoseps minor</i>	II	No	Yes	No	No
Kern Canyon slender salamander	<i>Batrachoseps simatus</i>	II	No	Yes	No	No
Tehachapi slender salamander	<i>Batrachoseps stebbinsi</i>	II	No	Yes	No	No
California giant salamander	<i>Dicamptodon ensatus</i>	II	No	Yes	Yes	No

Table 7 continued.		Drought Priority	Ag Water Reduction	Increased Wildfire	Disease /Toxins	Managed Wetlands
Common Name	Scientific Name					
limestone salamander	Hydromantes brunus	II	No	Yes	No	No
Mount Lyell salamander	Hydromantes platycephalus	II	No	No	No	No
Shasta salamander	Hydromantes shastae	II	No	No	No	No
Scott Bar salamander	Plethodon asupak	II	No	No	No	No
Dunn's salamander	Plethodon dunni	II	No	No	No	No
northern red-legged frog	Rana aurora	II	No	No	Yes	No
Couch's spadefoot	Scaphiopus couchii	II	No	No	No	No
western spadefoot	Spea hammondii	II	No	Yes	No	No
red-bellied newt	Taricha rivularis	II	No	Yes	No	No
Coast Range newt	Taricha torosa (Monterey Co. and south)	II	No	Yes	No	No
Reptiles						
northwestern pond turtle	Emys marmorata marmorata	I	Yes	No	Yes	No
southwestern pond turtle	Emys marmorata pallida	I	Yes	Yes	Yes	No
giant garter snake	Thamnophis gigas (Sacramento Valley/Delta)	I	Yes	No	No	Yes
giant garter snake	Thamnophis gigas (San Joaquin Valley)	I	Yes	No	No	Yes
two-striped garter snake	Thamnophis hammondii	I	No	Yes	No	No
south coast garter snake	Thamnophis sirtalis ssp.	I	No	Yes	No	No
San Francisco garter snake	Thamnophis sirtalis tetrataenia	I	No	No	No	No
Note: There were no reptiles assigned as Priority II						
Birds						
tricolored blackbird	Agelaius tricolor	I	No	No	No	Yes
redhead	Aythya americana	I	No	No	No	Yes
western snowy plover - interior population	Charadrius alexandrinus nivosus	I	Yes	No	No	No
black tern	Chlidonias niger	I	Yes	No	No	No
yellow rail	Coturnicops noveboracensis	I	No	No	No	No
fulvous whistling-duck	Dendrocygna bicolor	I	Yes	No	No	No
willow flycatcher (exclusive of E. t. extimus)	Empidonax traillii	I	No	No	No	No
southwestern willow flycatcher	Empidonax traillii extimus	I	No	No	No	No
greater sandhill crane	Grus canadensis tabida	I	Yes	No	No	Yes
harlequin duck	Histrionicus histrionicus	I	No	No	No	No
least bittern	Ixobrychus exilis	I	No	No	No	Yes
California black rail - interior	Laterallus jamaicensis	I	Yes	No	No	Yes

	coturniculus					
Table 7 continued.						
Common Name	Scientific Name	Drought Priority	Ag Water Reduction	Increased Wildfire	Disease /Toxins	Managed Wetlands
wood stork	Mycteria americana	I	Yes	No	No	No
American white pelican	Pelecanus erythrorhynchos	I	No	No	Yes	Yes
Yuma clapper rail	Rallus longirostris yumanensis	I	No	No	No	No
tule greater white-fronted goose	Anser albifrons elgasi	II	Yes	No	Yes	Yes
Clark's marsh wren	Cistothorus palustris clarkae	II	No	No	No	No
gull-billed tern	Gelochelidon nilotica	II	Yes	No	No	No
Inyo California towhee	Melospiza crissalis eremophilus	II	No	Yes	No	No
vermillion flycatcher	Pyrocephalus rubinus	II	No	No	No	No
black skimmer	Rynchops niger	II	Yes	No	No	No
Bendire's thrasher	Toxostoma bendirei	II	No	Yes	No	No
Le Conte's thrasher	Toxostoma lecontei	II	No	Yes	No	No
yellow-headed blackbird	Xanthocephalus xanthocephalus	II	No	No	No	Yes
Mammals						
Sonora beaver	Castor canadensis frondator (including repentinus)	I	Yes	No	No	No
Mexican long-tongued bat	Choeronycteris mexicana	I	No	No	No	No
Lesser long-nosed bat.	Leptonycteris yerbabuenae	I	No	No	No	No
Sonora river otter	Lontra canadensis sonora	I	Yes	No	Yes	No
Marsh vole	Microtus californicus paludicola	I	No	No	No	Yes
San Pablo vole	Microtus californicus sanpabloensis	I	No	No	No	Yes
Amargosa vole	Microtus californicus scirpensis	I	No	No	No	Yes
Stephens' California vole	Microtus californicus stephensi	I	No	No	No	Yes
San Bernardino Mountains long-tailed vole	Microtus longicaudus bernardinus	I	No	No	No	Yes
Arizona myotis	Myotis occultus	I	No	No	No	No
Arizona cave myotis	Myotis velifer velifer	I	No	No	No	No
Buena Vista Lake shrew	Sorex ornatus relictus	I	No	No	No	Yes
Pallid bat	Antrozous pallidus	II	No	No	No	No
Point Arena mountain beaver	Aplodontia rufa nigra	II	No	No	No	No
Townsend's big-eared bat	Corynorhinus townsendii	II	No	No	No	No

Table 7. continued		Drought Priority	Ag Water Reduction	Increased Wildfire	Disease /Toxins	Managed Wetlands
Common Name	Scientific Name					
Pale big-eared bat	Corynorhinus townsendii	II	No	No	No	No
Spotted bat	Euderma maculatum	II	No	No	No	No
Western mastiff bat	Eumops perotis	II	No	No	No	No
California mastiff bat	Eumops perotis californicus	II	No	No	No	No
Silver-haired bat	Lasionycteris noctivagans	II	No	Yes	No	No
Western red bat	Lasiurus blossevillii	II	No	Yes	No	No
Hoary bat	Lasiurus cinereus	II	No	Yes	No	No
Southwestern yellow bat	Lasiurus xanthinus	II	No	Yes	No	No
California leaf-nosed bat	Macrotus californicus	II	No	No	No	No
Owens Valley vole	Microtus californicus vallicola	II	No	No	No	Yes
Small-footed myotis; small-footed bat	Myotis ciliolabrum	II	No	No	No	No
Long-eared bat; long-eared myotis	Myotis evotis	II	No	Yes	No	No
Little Brown bat; little brown myotis	Myotis lucifugus	II	No	No	No	No
Fringed myotis	Myotis thysanodes	II	No	No	No	No
Cave myotis	Myotis velifer	II	No	No	No	No
Long-legged bat; long-legged myotis	Myotis volans	II	No	No	No	No
Yuma bat; Yuma myotis	Myotis yumanensis	II	No	No	No	No
Pocketed free-tailed bat	Nyctinomops femorosaccus	II	No	No	No	No
Big free-tailed bat	Nyctinomops macrotis	II	No	No	No	No
Colorado River cotton rat	Sigmodon arizonae plenus	II	Yes	No	No	Yes
Yuma Hispid cotton rat	Sigmodon hispidus eremicus	II	Yes	No	No	Yes
Riparian brush rabbit	Sylvilagus bachmani riparius	II	No	Yes	No	No

NatureServe Rarity-Weighted Richness Model of Critically Imperiled and Imperiled Species in the United States

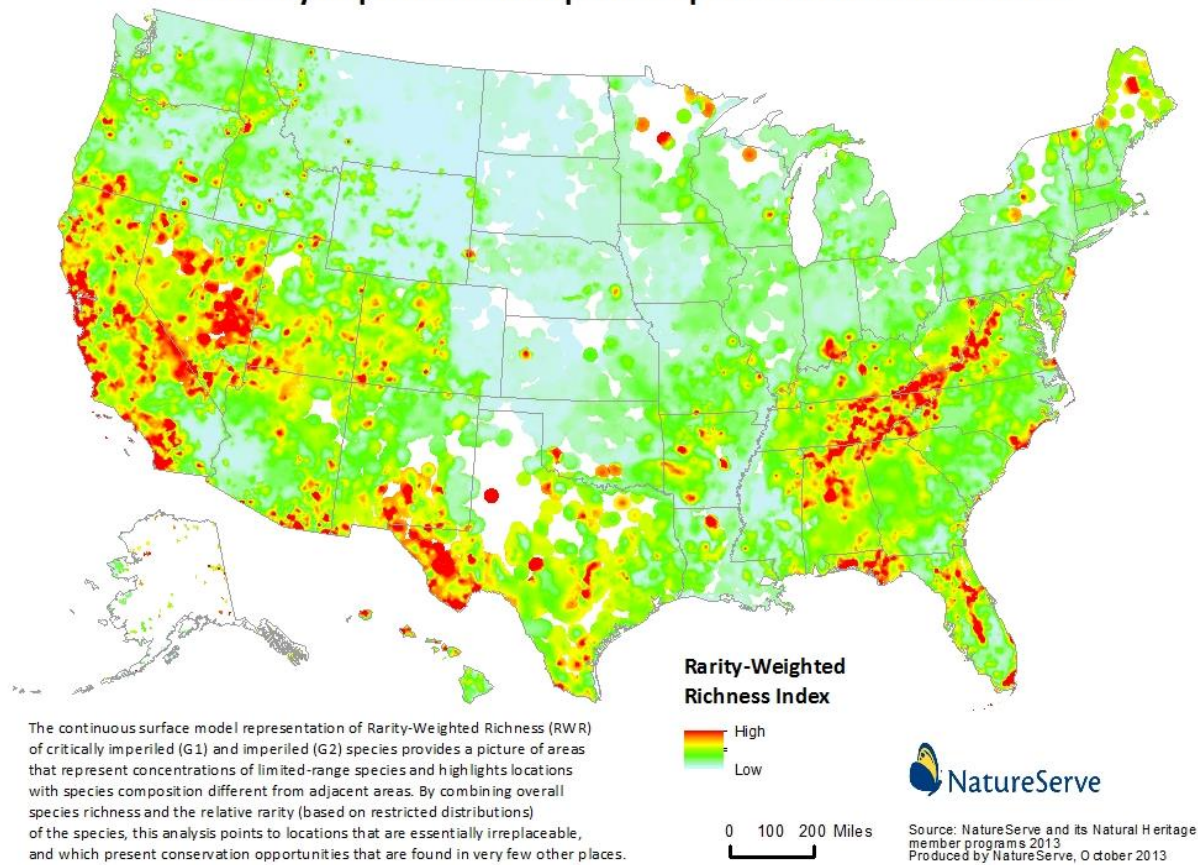


FIGURE 1. Rarity-weighted richness model of species identified as imperiled or critically imperiled by NatureServe. Red and yellow indicates areas where multiple imperiled endemic species co-occur.

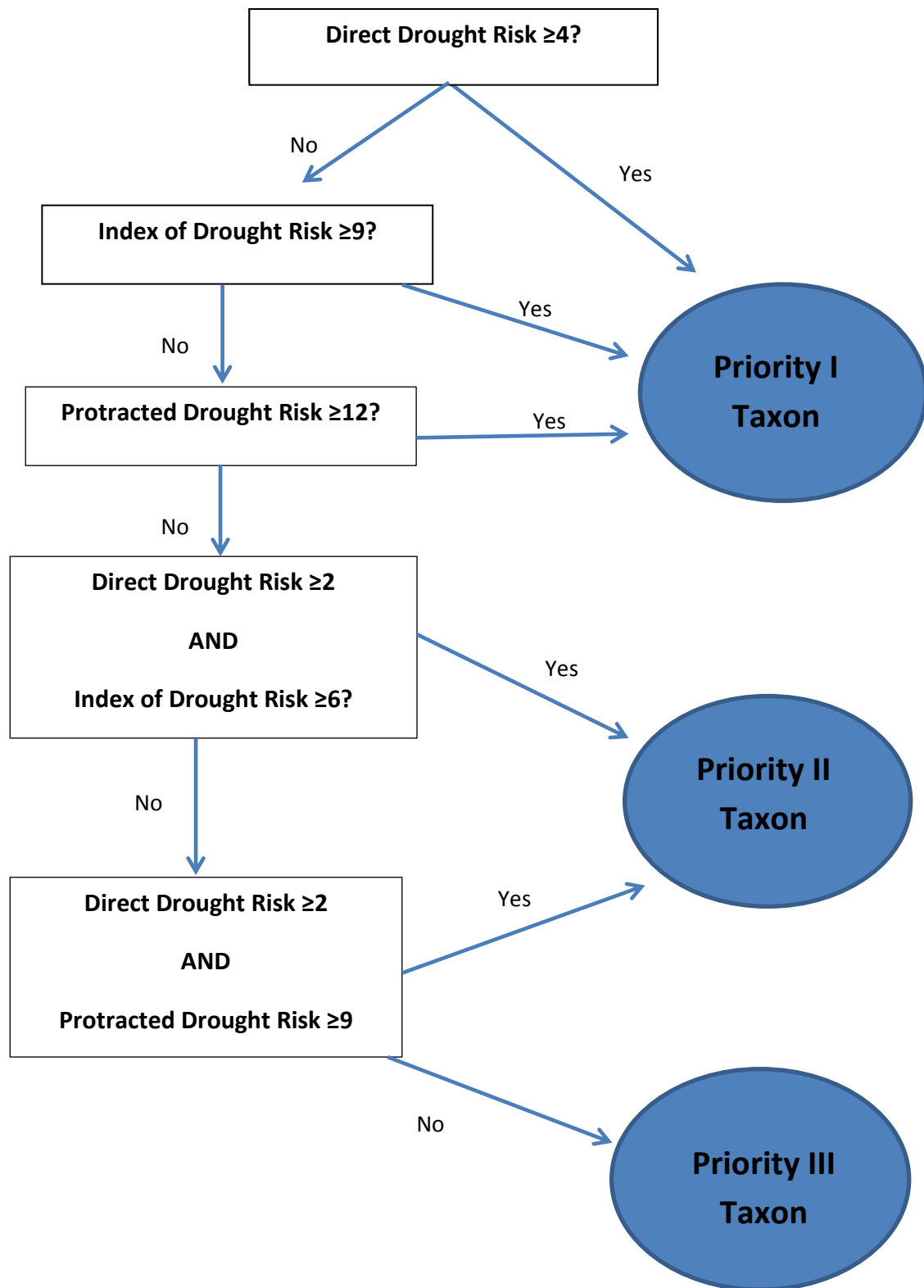


FIGURE 2. Decision tree used for assigning taxa to priority groups based on the resulting scores for the three drought risk measures: Direct Drought Risk, Index of Drought Risk, and Prolonged Drought Risk.

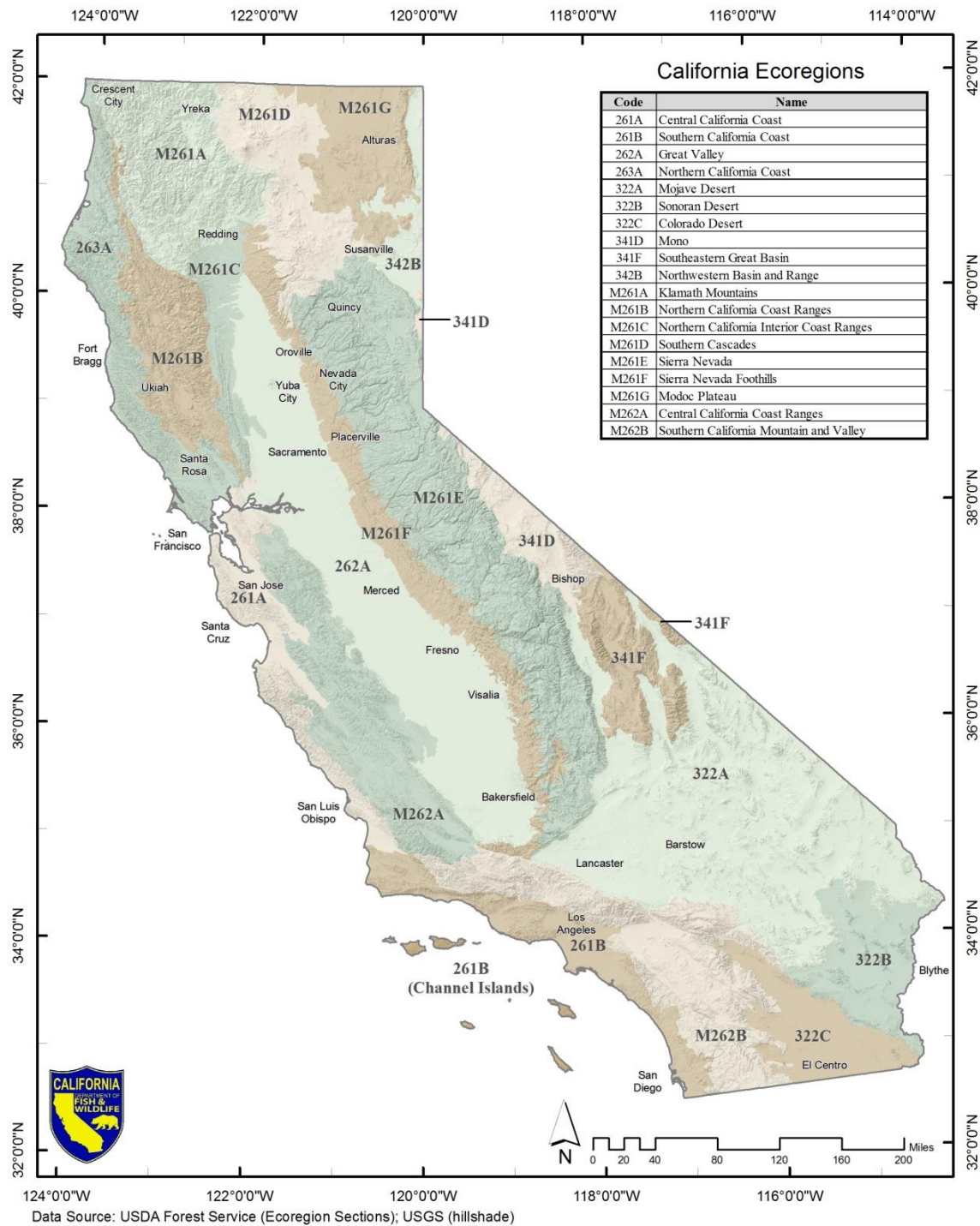


FIGURE 3. The Ecoregions of California. Cities are shown to provide geographic reference.

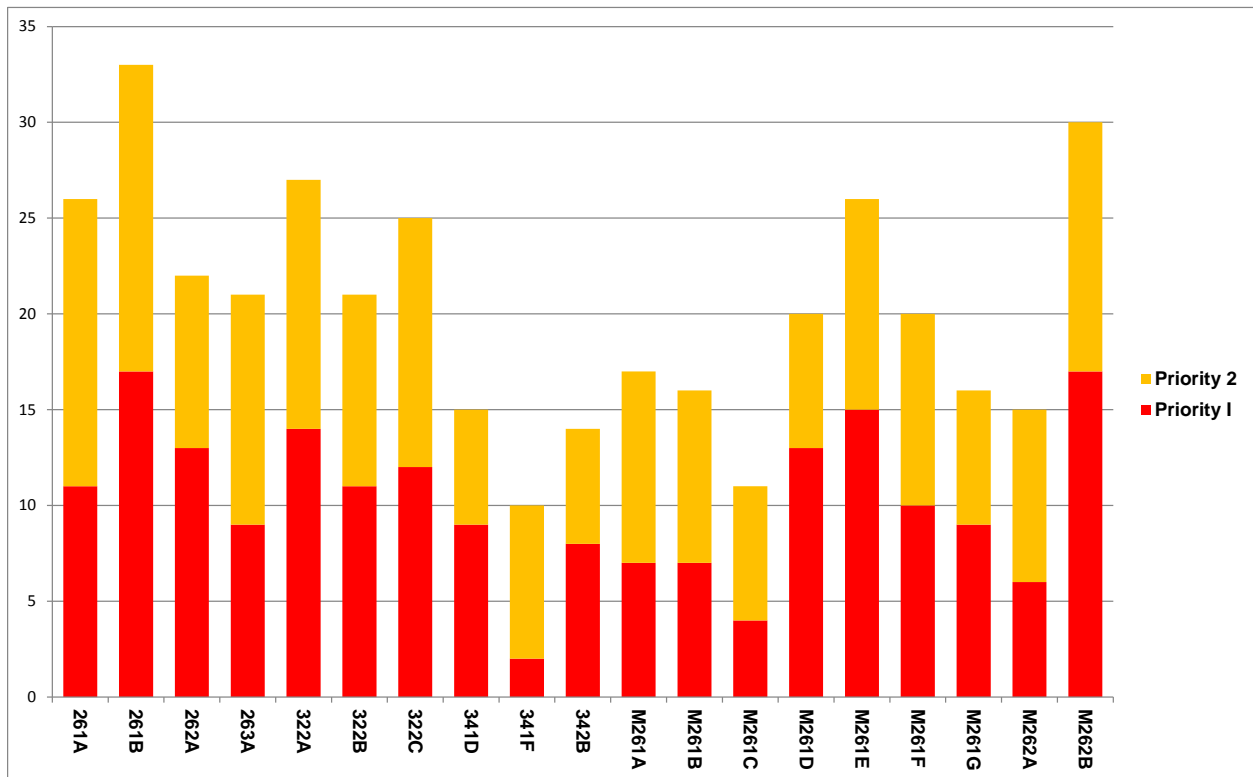


FIGURE 4. Number of Priority I and II species found in each ecoregion of California. Ecoregion codes correspond to those in Figure 3.

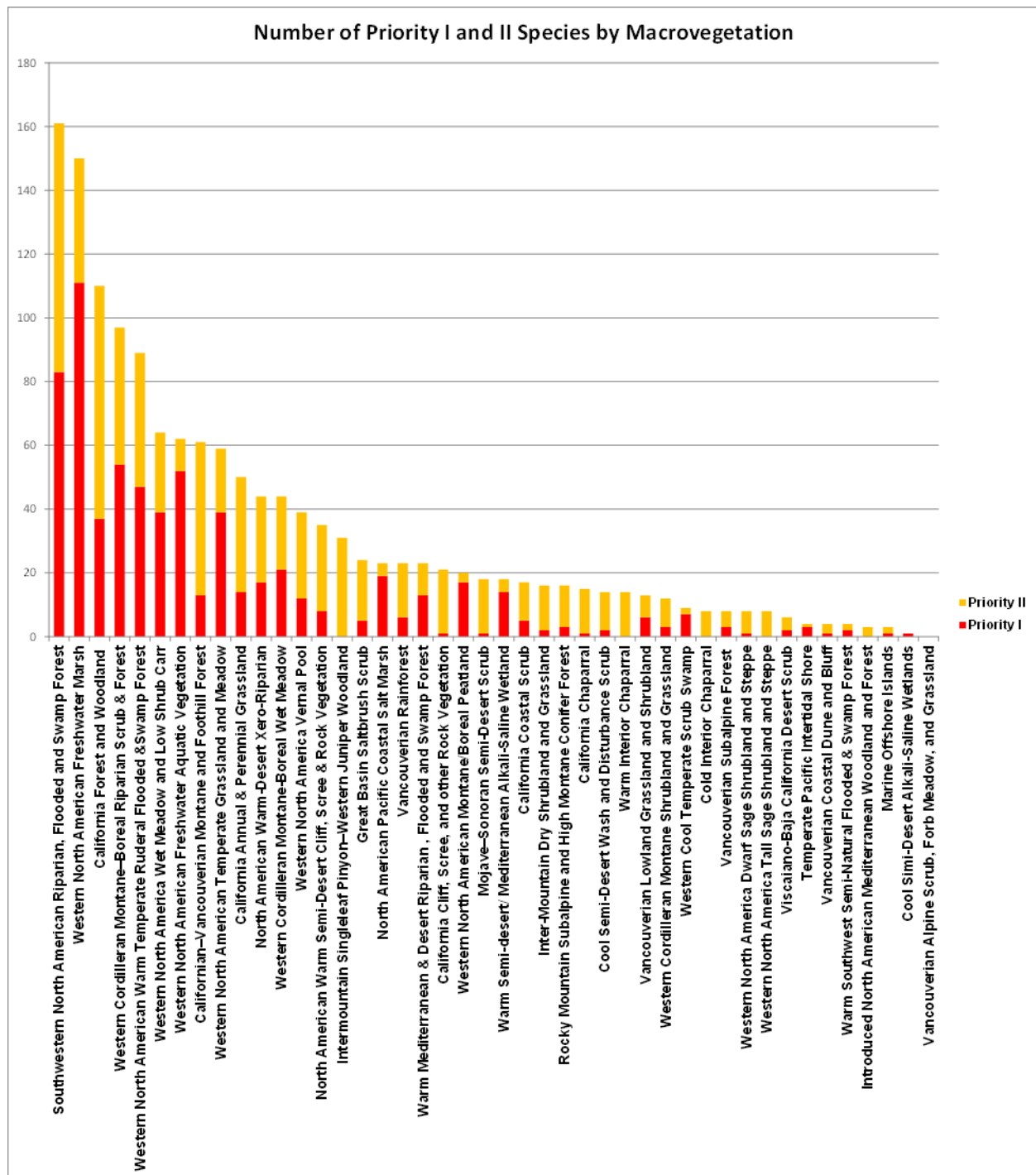


FIGURE 5. Species richness of Drought Priority I and II taxa by habitat as classified by California's Vegetation Classification and Mapping Program, based on the National Vegetation Classification System (<http://www.dfg.ca.gov/biogeodata/vegcamp/>).

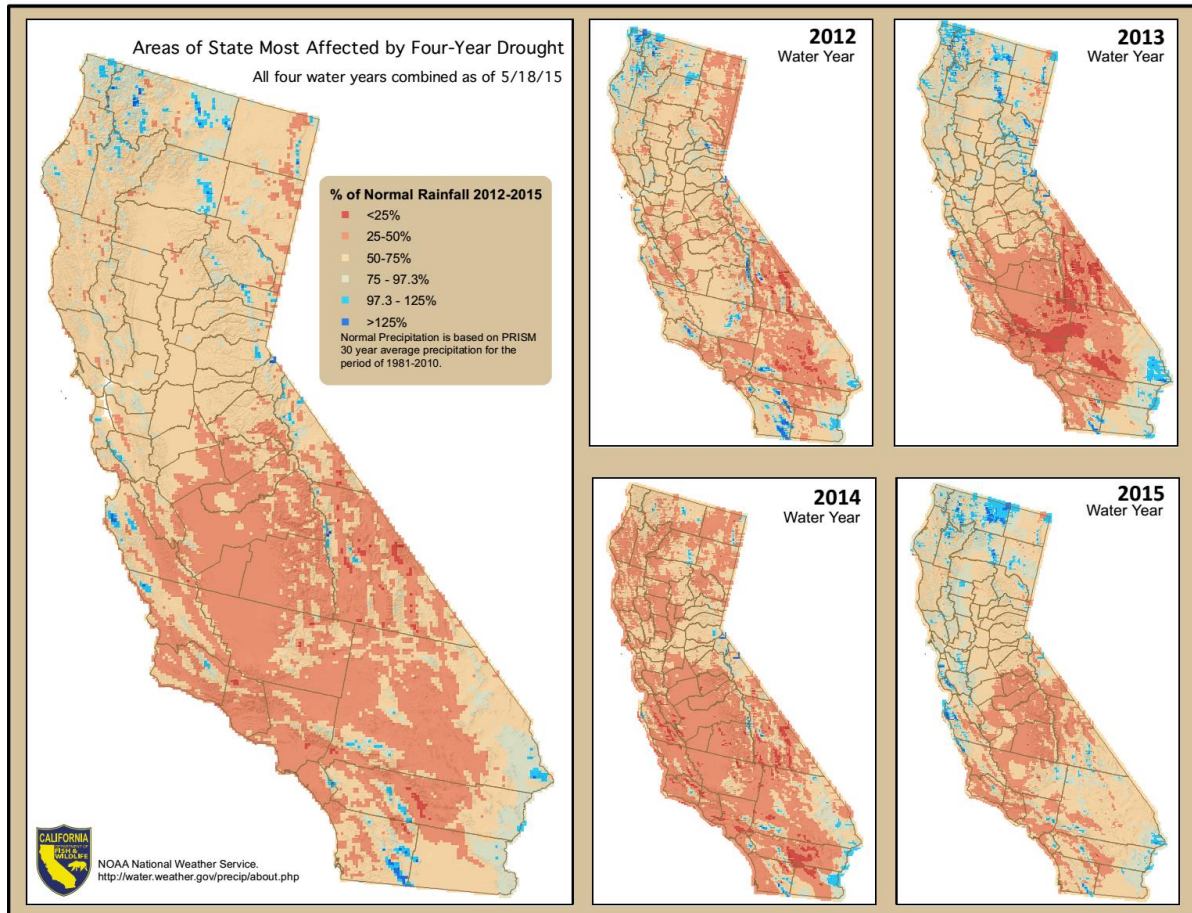


FIGURE 6. Geographic distribution of the areas of California that experienced the greatest difference from the normal average rainfall for the period of Oct. 1, 2012 through May 18, 2015, based on NOAA National Weather Service data (<http://water.weather.gov/precip/about.php>). Normal was defined as the average annual rainfall for water years 1981-2010.

APPENDIX A
A Rapid Assessment of the Vulnerability of Sensitive Wildlife to Extreme Drought- Resulting Scores

Class	Scientific Name	Common Name	Drought Concern Priority	Drought Risk (sum)	Drought Risk (index)	Protracted Drought Risk	Annual Survival	Reproduction	Food Production	Pop. Size (1-3)	Range Size (1-3)	Life Span (1-3)	Sig Pop Risk from Ag Water Reduction	Sig Pop Risk from Increased Wildfire	Sig Reliant on Managed Wetlands	Sig Pop Risk from Disease/Toxin
Amphibian	Anaxyrus californicus	arroyo toad	I	4	4.8	7.2	2	2	0	3	2	2	No	Yes	No	No
Amphibian	Anaxyrus canorus	Yosemite toad	I	4	6.0	6.0	2	2	0	3	1	3	No	Yes	No	No
Amphibian	Anaxyrus exsul	black toad	I	5	7.5	11.3	2	2	1	3	1	2	No	No	No	No
Amphibian	Ascaphus truei	Pacific tailed frog	I	5	7.5	7.5	2	2	1	3	1	3	No	Yes	No	No
Amphibian	Batrachoseps major aridus	desert slender salamander	I	3	9.0	13.5	2	1	0	1	1	2	No	No	No	Yes
Amphibian	Batrachoseps relictus	relictual slender salamander	I	3	9.0	13.5	2	1	0	1	1	2	No	Yes	No	Yes
Amphibian	Lithobates pipiens	northern leopard frog	I	3	9.0	13.5	1	2	0	1	1	2	No	No	No	No
Amphibian	Rana boylei	foothill yellow-legged frog	I	5	6.0	9.0	2	2	1	3	2	2	No	Yes	No	Yes
Amphibian	Rana cascadae	Cascades frog	I	5	7.5	11.3	2	2	1	3	1	2	No	No	No	Yes
Amphibian	Rana draytonii	California red-legged frog	I	5	6.0	9.0	2	2	1	3	2	2	No	Yes	No	Yes
Amphibian	Rana muscosa	southern mountain yellow-legged frog (Southern DPS)	I	5	15.0	22.5	2	2	1	1	1	2	No	Yes	No	Yes
Amphibian	Rana muscosa	southern mountain yellow-legged frog (Northern DPS)	I	5	10.0	15.0	2	2	1	2	1	2	No	No	No	Yes
Amphibian	Rana sierrae	Sierra Nevada yellow-legged frog	I	5	10.0	15.0	2	2	1	2	1	2	No	No	No	Yes
Amphibian	Rhyacotriton variegatus	southern torrent salamander	I	6	9.0	9.0	2	2	2	3	1	3	No	No	No	Yes
Amphibian	Ambystoma californiense	California tiger salamander (Sonoma DPS)	II	3	6.0	9.0	1	2	0	2	1	2	No	No	No	Yes
Amphibian	Ambystoma californiense	California tiger salamander (Santa Barbara DPS)	II	3	6.0	9.0	1	2	0	2	1	2	No	Yes	No	Yes
Amphibian	Ambystoma californiense	California tiger salamander (Central California DPS)	II	3	3.6	5.4	1	2	0	3	2	2	No	Yes	No	Yes
Amphibian	Ambystoma macrodactylum croceum	Santa Cruz long-toed salamander	II	3	6.0	9.0	1	2	0	2	1	2	No	Yes	No	Yes
Amphibian	Ambystoma macrodactylum sigillatum	southern long-toed salmander	II	3	3.6	5.4	1	2	0	3	2	2	No	No	No	Yes
Amphibian	Aneides flavipunctatus niger	Santa Cruz black salamander	II	3	6.0	6.0	2	1	0	2	1	3	No	Yes	No	Yes
Amphibian	Batrachoseps campi	Inyo Mountains slender salamander	II	2	6.0	9.0	1	1	0	1	1	2	No	No	No	Yes
Amphibian	Batrachoseps minor	lesser slender salamander	II	2	6.0	9.0	1	1	0	1	1	2	No	Yes	No	Yes
Amphibian	Batrachoseps simatus	Kern Canyon slender salamander	II	2	6.0	9.0	1	1	0	1	1	2	No	Yes	No	Yes
Amphibian	Batrachoseps stebbinsi	Tehachapi slender salamander	II	2	6.0	9.0	1	1	0	1	1	2	No	Yes	No	Yes
Amphibian	Dicamptodon ensatus	California giant salamander	II	3	6.0	6.0	1	2	0	2	1	3	No	Yes	No	Yes
Amphibian	Hydromantes brunus	limestone salamander	II	2	6.0	9.0	1	1	0	1	1	2	No	Yes	No	Yes
Amphibian	Hydromantes platycephalus	Mount Lyell salamander	II	3	4.5	6.8	2	1	0	3	1	2	No	No	No	Yes
Amphibian	Hydromantes shastae	Shasta salamander	II	2	6.0	9.0	1	1	0	1	1	2	No	No	No	Yes
Amphibian	Plethodon asupak	Scott Bar salamander	II	2	6.0	9.0	1	1	0	1	1	2	No	No	No	Yes
Amphibian	Plethodon dunni	Dunn's salamander	II	3	6.0	9.0	2	1	0	2	1	2	No	No	No	Yes
Amphibian	Rana aurora	northern red-legged frog	II	3	4.5	6.8	1	2	0	3	1	2	No	No	No	Yes
Amphibian	Scaphiopus couchii	Couch's spadefoot	II	3	6.0	9.0	1	2	0	2	1	2	No	No	No	No
Amphibian	Spea hammondi	western spadefoot	II	3	3.6	5.4	1	2	0	3	2	2	No	Yes	No	No
Amphibian	Taricha rivularis	red-bellied newt	II	3	4.5	4.5	1	2	0	3	1	3	No	Yes	No	Yes
Amphibian	Taricha torosa (Monterey Co. and south)	Coast Range newt	II	3	6.0	6.0	1	2	0	2	1	3	No	Yes	No	Yes
Amphibian	Batrachoseps altasierrae	Greenhorn Mountains slender salamander	III	2	2.4	3.6	1	1	0	3	2	2	No	Yes	No	Yes
Amphibian	Batrachoseps bramei	Fairview slender salamander	III	2	4.0	6.0	1	1	0	2	1	2	No	Yes	No	Yes
Amphibian	Batrachoseps incognitus	San Simeon slender salamander	III	2	4.0	6.0	1	1	0	2	1	2	No	Yes	No	Yes
Amphibian	Batrachoseps luciae	Santa Lucia Mountains slender salamander	III	2	4.0	6.0	1	1	0	2	1	2	No	Yes	No	Yes
Amphibian	Ensatina eschscholtzii croceater	yellow-blotched salamander	III	2	4.0	4.0	1	1	0	2	1	3	No	Yes	No	Yes
Amphibian	Ensatina klauberi	large-blotched salamander	III	2	4.0	4.0	1	1	0	2	1	3	No	Yes	No	Yes
Amphibian	Plethodon elongatus	Del Norte salamander	III	2	4.0	6.0	1	1	0	2	1	2	No	No	No	Yes
Amphibian	Plethodon stormi	Siskiyou Mountains salamander	III	2	4.0	6.0	1	1	0	2	1	2	No	No	No	Yes
Amphibian	Incilius alvarius	Sonoran desert toad	NS													No
Amphibian	Lithobates yavapaiensis	lowland (=Yavapai, San Sebastian & San Felipe) leopard frog	NS													No
Amphibian	Rana pretiosa	Oregon spotted frog	NS													Yes
Bird	Agelaius tricolor	tricolored blackbird	I	4	4.8	7.2	0	2	2	3	2	2	No	No	Yes	No
Bird	Aythya americana	redhead	I	6	9.0	9.0	2	2	2	2	2	3	No	No	Yes	No
Bird	Charadrius alexandrinus nivosus	western snowy plover - interior population	I	4	8.0	12.0	1	2	1	2	1	2	Yes	No	No	No
Bird	Chlidonias niger	black tern	I	4	8.0	12.0	1	2	1	2	1	2	Yes	No	No	No
Bird	Coturnicops noveboracensis	yellow rail	I	4	12.0	18.0	1	2	1	1	1	2	No	No	No	No
Bird	Dendrocygna bicolor	fulvous whistling-duck	I	4	12.0	18.0	1	2	1	1	1	2	Yes	No	No	No
Bird	Empidonax traillii	willow flycatcher (exclusive of E. t. extimus)	I	3	9.0	13.5	0	2	1	1	1	2	No	No	No	No
Bird	Empidonax traillii extimus	southwestern willow flycatcher	I	3	9.0	13.5	0	2	1	1	1	2	No	No	No	No
Bird	Grus canadensis tabida	greater sandhill crane	I	4	8.0	12.0	1	2	1	2	1	2	Yes	No	Yes	No
Bird	Histrionicus histrionicus	harlequin duck	I	4	12.0	18.0	1	1	2	1	1	2	No	No	No	No
Bird	Ixobrychus exilis	least bittern	I	5	10.0	15.0	1	2	2	2	1	2	No	No	Yes	No
Bird	Laterallus jamaicensis coturniculus	California black rail - interior	I	4	12.0	18.0	1	2	1	1	1	2	Yes	No	Yes	No
Bird	Mycteria americana	wood stork	I	3	9.0	13.5	0	1	2	1	1	2	Yes	No	No	No
Bird	Pelecanus erythrorhynchos	American white pelican	I	5	10.0	10.0	1	2	2	2	1	3	No	No	Yes	Yes
Bird	Rallus longirostris yumanensis	Yuma clapper rail	I	5	15.0	22.5	1	2	2	1	1	2	No	No	No	No

APPENDIX A
A Rapid Assessment of the Vulnerability of Sensitive Wildlife to Extreme Drought- Resulting Scores

Class	Scientific Name	Common Name	Drought Concern Priority	Drought Risk (sum)	Drought Risk (index)	Protracted Drought Risk	Annual Survival	Reproduction	Food Production	Pop. Size (1-3)	Range Size (1-3)	Life Span (1-3)	Sig Pop Risk from Ag Water Reduction	Sig Pop Risk from Increased Wildfire	Sig Reliant on Managed Wetlands	Sig Pop Risk from Disease/Toxin
Bird	Anser albifrons elgasi	tule greater white-fronted goose	II	3	6.0	6.0	1	0	2	2	1	3	Yes	No	Yes	Yes
Bird	Cistothorus palustris clarkae	Clark's marsh wren	II	3	6.0	9.0	1	1	1	2	1	2	No	No	No	No
Bird	Gelochelidon nilotica	gull-billed tern	II	2	6.0	9.0	0	1	1	1	1	2	Yes	No	No	No
Bird	Melozone crissalis eremophilus	Inyo California towhee	II	2	6.0	9.0	1	0	1	1	1	2	No	Yes	No	No
Bird	Pyrocephalus rubinus	vermilion flycatcher	II	2	6.0	9.0	0	1	1	1	1	2	No	No	No	No
Bird	Rynchops niger	black skimmer	II	3	6.0	9.0	1	1	1	2	1	2	Yes	No	No	No
Bird	Toxostoma bendirei	Bendire's thrasher	II	2	6.0	9.0	0	0	2	1	1	2	No	Yes	No	No
Bird	Toxostoma lecontei	Le Conte's thrasher	II	2	6.0	9.0	0	0	2	1	1	2	No	Yes	No	No
Bird	Xanthocephalus xanthocephalus	yellow-headed blackbird	II	3	4.5	6.8	0	2	1	2	2	2	No	No	Yes	No
Bird	Accipiter gentilis	Northern goshawk	III	0	0.0	0.0	0	0	0	2	2	3	No	Yes	No	No
Bird	Agelaius phoeniceus aciculatus	Kern red-winged blackbird	III	2	4.0	6.0	0	1	1	2	1	2	No	No	Yes	No
Bird	Aimophila ruficeps obscura	Santa Cruz Island rufous-crowned sparrow	III	0	0.0	0.0	0	0	0	2	1	2	No	Yes	No	No
Bird	Ammodramus savannarum	grasshopper sparrow	III	1	1.2	1.8	0	0	1	3	2	2	No	No	No	No
Bird	Aquila chrysaetos	golden eagle	III	0	0.0	0.0	0	0	0	2	3	3	No	Yes	No	Yes
Bird	Artemisiospiza belli clementeae	San Clemente sage sparrow	III	0	0.0	0.0	0	0	0	1	1	2	No	Yes	No	No
Bird	Asio flammeus	short-eared owl	III	0	0.0	0.0	0	0	0	2	2	3	Yes	No	No	Yes
Bird	Asio otus	long-eared owl	III	0	0.0	0.0	0	0	0	2	2	3	No	Yes	No	No
Bird	Athene cunicularia	burrowing owl	III	1	1.2	1.8	0	0	1	3	2	2	No	No	No	Yes
Bird	Brachyramphus marmoratus	marbled murrelet	III	0	0.0	0.0	0	0	0	2	1	2	No	Yes	No	No
Bird	Branta bernicla	brant	III	0	0.0	0.0	0	0	0	2	1	3	No	No	No	No
Bird	Bucephala islandica	Barrow's goldeneye	III	2	4.0	6.0	1	0	1	2	1	2	No	No	No	No
Bird	Buteo swainsoni	Swainson's hawk	III	1	1.5	1.5	0	0	1	2	2	3	Yes	No	No	No
Bird	Callipepla californica catalinensis	Catalina California quail	III	0	0.0	0.0	0	0	0	2	1	2	No	No	No	No
Bird	Campylorhynchus brunneicapillus sandiegensis	coastal cactus wren (= San Diego cactus wren)	III	1	3.0	4.5	0	0	1	1	1	2	No	Yes	No	No
Bird	Centrocercus urophasianus	greater sage-grouse	III	2	4.0	6.0	0	0	2	2	1	2	No	Yes	No	No
Bird	Chaetura vauxi	Vaux's swift	III	1	1.5	2.3	0	0	1	2	2	2	No	No	No	No
Bird	Charadrius alexandrinus nivosus	western snowy plover - coastal population	III	0	0.0	0.0	0	0	0	2	1	2	No	No	No	No
Bird	Charadrius montanus	mountain plover	III	2	4.0	6.0	0	0	2	2	1	2	Yes	No	No	No
Bird	Circus cyaneus	northern harrier	III	0	0.0	0.0	0	0	0	2	3	3	Yes	No	No	Yes
Bird	Coccyzus americanus occidentalis	western yellow-billed cuckoo	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Bird	Colaptes chrysoides	gilded northern flicker	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Bird	Contopus cooperi	olive-sided flycatcher	III	1	1.2	1.8	0	0	1	3	2	2	No	No	No	No
Bird	Cygnus buccinator	trumpeter swan	III	2	4.0	4.0	1	0	1	2	1	3	Yes	No	No	No
Bird	Cypseloides niger	black swift	III	1	3.0	4.5	0	1	0	1	1	2	No	No	No	No
Bird	Dendragapus fuliginosus howardi	Mount Pinos sooty grouse	III	2	4.0	6.0	0	1	1	2	1	2	No	No	No	No
Bird	Dendroica petechia brewsteri	yellow warbler	III	1	1.0	1.5	0	0	1	3	3	2	No	No	No	No
Bird	Dendroica petechia sonorana	Sonoran yellow warbler	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Bird	Elanus leucurus	white-tailed kite	III	0	0.0	0.0	0	0	0	3	3	2	No	No	No	No
Bird	Falco peregrinus anatum	American peregrine falcon	III	0	0.0	0.0	0	0	0	3	3	3	No	No	No	Yes
Bird	Fratercula cirrhata	tufted puffin	III	1	2.0	3.0	0	1	0	1	2	2	No	No	No	No
Bird	Gavia immer	common loon	III	0	0.0	0.0	0	0	0	2	2	3	No	No	No	No
Bird	Geothlypis trichas sinuosa	saltmarsh common yellowthroat (= SF common yellowthroat)	III	2	4.0	6.0	0	1	1	2	1	2	No	No	Yes	No
Bird	Grus canadensis canadensis	lesser sandhill crane	III	2	3.0	4.5	1	0	1	3	1	2	Yes	No	Yes	No
Bird	Gymnogyps californianus	California condor	III	0	0.0	0.0	0	0	0	1	2	3	No	Yes	No	Yes
Bird	Haematopus bachmani	black oystercatcher	III	0	0.0	0.0	0	0	0	2	1	3	No	No	No	No
Bird	Haliaeetus leucocephalus	bald eagle	III	0	0.0	0.0	0	0	0	2	3	3	No	Yes	No	Yes
Bird	Icteria virens	yellow-breasted chat	III	1	1.5	2.3	0	0	1	2	2	2	No	No	No	No
Bird	Icterus parisorum	Scott's oriole	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Bird	Lanius ludovicianus	loggerhead shrike (mainland populations)	III	2	2.0	3.0	0	0	2	3	3	2	No	No	No	No
Bird	Lanius ludovicianus anthonyi	Island loggerhead shrike	III	1	3.0	4.5	0	0	1	1	1	2	No	Yes	No	No
Bird	Lanius ludovicianus mearnsi	San Clemente loggerhead shrike	III	1	3.0	4.5	0	0	1	1	1	2	No	Yes	No	No
Bird	Laterallus jamaicensis coturniculus	California black rail - coastal tidal marshes	III	0	0.0	0.0	0	0	0	2	1	2	No	No	No	No
Bird	Melanerpes uropygialis	Gila woodpecker	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Bird	Melospiza melodia	song sparrow ("Modesto" population)	III	2	3.0	4.5	0	1	1	3	1	2	Yes	No	No	No
Bird	Melospiza melodia graminea	Channel Island song sparrow	III	2	3.0	4.5	1	1	0	3	1	2	No	Yes	No	No
Bird	Melospiza melodia maxillaris	Suisun song sparrow	III	0	0.0	0.0	0	0	0	3	1	2	No	No	Yes	No
Bird	Melospiza melodia pusillula	Alameda song sparrow	III	0	0.0	0.0	0	0	0	3	1	2	No	No	No	No
Bird	Melospiza melodia samuelis	San Pablo song sparrow (=Samuels song sparrow)	III	0	0.0	0.0	0	0	0	3	1	2	No	No	No	No
Bird	Micrathene whitneyi	elf owl	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Bird	Oceanodroma furcata	fork-tailed storm-petrel	III	1	3.0	4.5	0	1	0	1	1	2	No	No	No	No
Bird	Oceanodroma homochroa	ashy storm-petrel	III	0	0.0	0.0	0	0	0	2	2	2	No	No	No	No

APPENDIX A
A Rapid Assessment of the Vulnerability of Sensitive Wildlife to Extreme Drought- Resulting Scores

Class	Scientific Name	Common Name	Drought Concern Priority	Drought Risk (sum)	Drought Risk (index)	Protracted Drought Risk	Annual Survival	Reproduction	Food Production	Pop. Size (1-3)	Range Size (1-3)	Life Span (1-3)	Sig Pop Risk from Ag Water Reduction	Sig Pop Risk from Increased Wildfire	Sig Reliant on Managed Wetlands	Sig Pop Risk from Disease/Toxin
Bird	Oceanodroma melania	black storm-petrel	III	0	0.0	0.0	0	0	0	1	1	2	No	No	No	No
Bird	Oreothlypis luciae	Lucy's warbler	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Bird	Passerculus sandwichensis alaudinus	Bryant's savannah sparrow	III	1	1.5	2.3	0	0	1	3	1	2	No	No	No	No
Bird	Passerculus sandwichensis beldingi	Belding's savannah sparrow	III	0	0.0	0.0	0	0	0	2	1	2	No	No	No	No
Bird	Passerculus sandwichensis rostratus	large-billed savannah sparrow	III	0	0.0	0.0	0	0	0	2	1	2	No	No	No	No
Bird	Pelecanus occidentalis californicus	California brown pelican	III	0	0.0	0.0	0	0	0	3	2	2	No	No	No	Yes
Bird	Phoebastria albatrus	short-tailed albatross	III	0	0.0	0.0	0	0	0	1	1	3	No	No	No	No
Bird	Pipilo maculatus clementae	San Clemente spotted towhee	III	0	0.0	0.0	0	0	0	2	1	2	No	Yes	No	No
Bird	Piranga rubra	summer tanager	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Bird	Polioptila californica californica	coastal California gnatcatcher (=Alta CA Gnatcatcher)	III	1	2.0	6.0	0	0	1	2	1	1	No	Yes	No	No
Bird	Poocetes gramineus affinis	Oregon vesper sparrow	III	1	1.5	2.3	0	0	1	2	2	2	No	No	No	No
Bird	Progne subis	purple martin	III	1	1.5	2.3	0	0	1	2	2	2	No	No	No	Yes
Bird	Ptychoramphus aleuticus	Cassin's auklet	III	1	1.2	1.8	0	1	0	3	2	2	No	No	No	No
Bird	Rallus longirostris levipes	light-footed clapper rail	III	0	0.0	0.0	0	0	0	1	1	2	No	No	No	No
Bird	Rallus longirostris obsoletus	California clapper rail	III	0	0.0	0.0	0	0	0	1	1	2	No	No	No	No
Bird	Riparia riparia	bank swallow	III	2	4.0	6.0	0	1	1	2	1	2	No	No	No	No
Bird	Sternula antillarum browni	California least tern	III	1	2.0	2.0	0	0	1	2	1	3	No	No	No	No
Bird	Strix nebulosa	great gray owl	III	1	3.0	4.5	0	0	1	1	1	2	No	Yes	No	Yes
Bird	Strix occidentalis caurina	northern spotted owl	III	0	0.0	0.0	0	0	0	2	2	3	No	Yes	No	Yes
Bird	Strix occidentalis occidentalis	California spotted owl	III	0	0.0	0.0	0	0	0	2	2	3	No	Yes	No	Yes
Bird	Synthliboramphus hypoleucus	Xantus' murrelet	III	0	0.0	0.0	0	0	0	2	1	2	No	No	No	No
Bird	Toxostoma crissale	Crissal thrasher	III	2	4.0	6.0	0	0	2	2	1	2	No	Yes	No	No
Bird	Vireo bellii arizonae	Arizona bell's vireo	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Bird	Vireo bellii pusillus	least Bell's vireo	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Bird	Vireo huttoni unitti	Catalina Hutton's vireo	III	0	0.0	0.0	0	0	0	1	1	2	No	Yes	No	No
Bird	Vireo vicinior	gray vireo	III	1	3.0	4.5	0	0	1	1	1	2	No	Yes	No	No
Bird	Melospiza melodia graminea	Santa Barbara song sparrow	NS													No
Bird	Thryomanes bewickii leucophrys	San Clemente Bewick's wren	NS													No
Bird	Tympanuchus phasianellus	sharp-tailed grouse	NS													No
Mammal	Castor canadensis frondator (including repentinus)	Sonora beaver	I	5	15.0	22.5	2	2	1	1	1	2	Yes	No	No	No
Mammal	Choeronycteris mexicana	Mexican long-tongued bat	I	3	9.0	9.0	2	0	1	1	1	3	No	No	No	No
Mammal	Leptonycteris yerbabuenae	Lesser long-nosed bat.	I	3	9.0	9.0	2	0	1	1	1	3	No	No	No	No
Mammal	Lontra canadensis sonora	Sonora river otter	I	3	9.0	13.5	0	2	1	1	1	2	Yes	No	No	Yes
Mammal	Microtus californicus paludicola	Marsh vole	I	2	4.0	12.0	1	0	1	2	1	1	No	No	Yes	No
Mammal	Microtus californicus sanpabloensis	San Pablo vole	I	2	4.0	12.0	1	0	1	2	1	1	No	No	Yes	No
Mammal	Microtus californicus scirpensis	Amargosa vole	I	2	4.0	12.0	1	0	1	2	1	1	No	No	Yes	No
Mammal	Microtus californicus stephensi	Stephens’ California vole	I	2	4.0	12.0	1	0	1	2	1	1	No	No	Yes	No
Mammal	Microtus longicaudus bernardinus	San Bernardino Mountains long-tailed vole	I	2	4.0	12.0	1	0	1	2	1	1	No	No	Yes	No
Mammal	Myotis occultus	Arizona myotis	I	3	9.0	9.0	2	0	1	1	1	3	No	No	No	No
Mammal	Myotis velifer velifer	Arizona cave myotis	I	3	9.0	9.0	2	0	1	1	1	3	No	No	No	No
Mammal	Sorex ornatus relictus	Buena Vista Lake shrew	I	2	4.0	12.0	0	1	1	2	1	1	No	No	Yes	No
Mammal	Antrozous pallidus	Pallid bat	II	3	3.6	3.6	2	0	1	2	3	3	No	No	No	No
Mammal	Antrozous pallidus pacificus		II	3	3.6	3.6	2	0	1	2	3	3	No	No	No	No
Mammal	Antrozous pallidus pallidus		II	3	4.5	4.5	2	0	1	2	2	3	No	No	No	No
Mammal	Aplodontia rufa nigra	Point Arena mountain beaver	II	2	6.0	9.0	1	0	1	1	1	2	No	No	No	No
Mammal	Corynorhinus townsendii	Townsend's big-eared bat	II	3	3.6	3.6	2	0	1	2	3	3	No	No	No	No
Mammal	Corynorhinus townsendii pallescens	Pale big-eared bat	II	3	3.6	3.6	2	0	1	2	3	3	No	No	No	No
Mammal	Corynorhinus townsendii townsendii		II	3	3.6	3.6	2	0	1	2	3	3	No	No	No	No
Mammal	Euderma maculatum	Spotted bat	II	3	3.6	3.6	2	0	1	2	3	3	No	No	No	No
Mammal	Eumops perotis	Western mastiff bat	II	3	3.6	3.6	2	0	1	2	3	3	No	No	No	No
Mammal	Eumops perotis californicus	California mastiff bat	II	3	3.6	3.6	2	0	1	2	3	3	No	No	No	No
Mammal	Lasionycteris noctivagans	Silver-haired bat	II	3	3.0	3.0	2	0	1	3	3	3	No	Yes	No	No
Mammal	Lasiurus blossevillii	Western red bat	II	3	3.6	3.6	2	0	1	2	3	3	No	Yes	No	No
Mammal	Lasiurus blossevillii teliotis		II	3	3.6	3.6	2	0	1	2	3	3	No	Yes	No	No
Mammal	Lasiurus cinereus	Hoary bat	II	3	3.0	3.0	2	0	1	3	3	3	No	Yes	No	No
Mammal	Lasiurus xanthinus	Southwestern yellow bat	II	3	6.0	6.0	2	0	1	1	2	3	No	Yes	No	No
Mammal	Macrotus californicus	California leaf-nosed bat	II	3	4.5	4.5	2	0	1	2	2	3	No	No	No	No
Mammal	Microtus californicus vallicola	Owens Valley vole	II	2	3.0	9.0	1	0	1	3	1	1	No	No	Yes	No
Mammal	Myotis ciliolabrum	Small-footed myotis; small-footed bat	II	3	3.0	3.0	2	0	1	3	3	3	No	No	No	No
Mammal	Myotis evotis	Long-eared bat; long-eared myotis	II	3	3.0	3.0	2	0	1	3	3	3	No	No	No	No
Mammal	Myotis evotis evotis		II	3	3.0	3.0	2	0	1	3	3	3	No	Yes	No	No

APPENDIX A
A Rapid Assessment of the Vulnerability of Sensitive Wildlife to Extreme Drought- Resulting Scores

Class	Scientific Name	Common Name	Drought Concern Priority	Drought Risk (sum)	Drought Risk (index)	Protracted Drought Risk	Annual Survival	Reproduction	Food Production	Pop. Size (1-3)	Range Size (1-3)	Life Span (1-3)	Sig Pop Risk from Ag Water Reduction	Sig Pop Risk from Increased Wildfire	Sig Reliant on Managed Wetlands	Sig Pop Risk from Disease/Toxin
Mammal	Myotis evotis pacificus		II	3	4.5	4.5	2	0	1	2	2	3	No	Yes	No	No
Mammal	Myotis lucifugus	Little Brown bat; little brown myotis	II	3	3.0	3.0	2	0	1	3	3	3	No	No	No	No
Mammal	Myotis thysanodes	Fringed myotis	II	3	3.0	3.0	2	0	1	3	3	3	No	No	No	No
Mammal	Myotis thysanodes thysanodes		II	3	3.0	3.0	2	0	1	3	3	3	No	No	No	No
Mammal	Myotis thysanodes vespertinus		II	3	6.0	6.0	2	0	1	2	1	3	No	No	No	No
Mammal	Myotis velifer	Cave myotis	II	3	6.0	6.0	2	0	1	2	1	3	No	No	No	No
Mammal	Myotis volans	Long-legged bat; long-legged myotis	II	3	3.0	3.0	2	0	1	3	3	3	No	No	No	No
Mammal	Myotis volans interior		II	3	3.6	3.6	2	0	1	2	3	3	No	No	No	No
Mammal	Myotis volans longicrus		II	3	3.6	3.6	2	0	1	2	3	3	No	No	No	No
Mammal	Myotis yumanensis	Yuma bat; Yuma myotis	II	3	3.0	3.0	2	0	1	3	3	3	No	No	No	No
Mammal	Nyctinomops femorosaccus	Pocketed free-tailed bat	II	3	4.5	4.5	2	0	1	2	2	3	No	No	No	No
Mammal	Nyctinomops macrotis	Big free-tailed bat	II	3	6.0	6.0	2	0	1	1	2	3	No	No	No	No
Mammal	Sigmodon arizonae plenus	Colorado River cotton rat	II	3	6.0	9.0	2	0	1	2	1	2	Yes	No	Yes	No
Mammal	Sigmodon hispidus eremicus		II	3	6.0	9.0	2	0	1	2	1	2	Yes	No	Yes	No
Mammal	Sylvilagus bachmani riparius	Riparian brush rabbit	II	2	6.0	9.0	0	1	1	1	1	2	No	Yes	No	No
Mammal	Ammospermophilus nelsoni	Nelson's antelope ground squirrel	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Antilocapra americana	Pronghorn	III	1	1.5	2.3	0	0	1	2	2	2	No	No	No	No
Mammal	Antilocapra americana americana		III	1	1.5	2.3	0	0	1	2	2	2	No	No	No	No
Mammal	Aplodontia rufa californica	Sierra Nevada mountain beaver	III	2	3.0	4.5	1	0	1	2	2	2	No	No	No	No
Mammal	Aplodontia rufa humboldtiana	Humboldt mountain beaver	III	2	4.0	6.0	1	0	1	2	1	2	No	No	No	No
Mammal	Aplodontia rufa phaea	Point Reyes mountain beaver	III	2	4.0	6.0	1	0	1	2	1	2	No	No	No	No
Mammal	Arborimus albipes	White-footed vole	III	1	2.0	6.0	0	0	1	2	1	1	No	Yes	No	No
Mammal	Arborimus pomo	Sonoma red tree vole; Red tree vole; California red tree vole	III	1	1.2	3.6	0	0	1	3	2	1	No	Yes	No	No
Mammal	Bassariscus astutus octavus	Southern California ringtail	III	1	1.5	2.3	0	0	1	2	2	2	No	Yes	No	No
Mammal	Bassariscus astutus willetti	Palo Verde Mountains ringtail	III	1	3.0	4.5	0	0	1	1	1	2	No	Yes	No	No
Mammal	Bassariscus astutus yumanensis	Yuma ringtail	III	1	2.0	3.0	0	0	1	2	1	2	No	Yes	No	No
Mammal	Brachylagus idahoensis	Pygmy rabbit	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Callospermophilus lateralis bernardinus	San Bernardino golden-mantled ground squirrel	III	1	2.0	3.0	0	0	1	2	1	2	No	Yes	No	No
Mammal	Cervus elaphus nannodes	Tule elk	III	2	3.0	3.0	1	0	1	2	2	3	No	No	No	No
Mammal	Chaetodipus californicus femoralis	Dulzura pocket mouse	III	1	1.5	4.5	0	0	1	3	1	1	No	No	No	No
Mammal	Chaetodipus fallax fallax	Northwestern San Diego pocket mouse	III	1	1.2	3.6	0	0	1	3	2	1	No	No	No	No
Mammal	Chaetodipus fallax pallidus	Pallid San Diego pocket mouse	III	1	1.5	4.5	0	0	1	3	1	1	No	No	No	No
Mammal	Dipodomys agilis	Agile [=Pacific] kangaroo rat	III	1	1.2	1.8	0	0	1	3	2	2	No	No	No	No
Mammal	Dipodomys agilis agilis	Gambel kangaroo rat	III	1	1.2	1.8	0	0	1	3	2	2	No	No	No	No
Mammal	Dipodomys californicus eximius	Marysville kangaroo rat	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Dipodomys heermanni arenae	Lompoc kangaroo rat	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Dipodomys heermanni berkeleyensis	Berkeley kangaroo rat	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Dipodomys heermanni dixonii	Merced kangaroo rat	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Dipodomys heermanni goldmani	Salinas kangaroo rat	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Dipodomys heermanni heermanni		III	1	1.5	2.3	0	0	1	3	1	2	No	No	No	No
Mammal	Dipodomys heermanni morroensis	Morro Bay kangaroo rat	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Dipodomys ingens	Giant kangaroo rat	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Dipodomys merriami collinus	Earthquake [=Aguanga] kangaroo rat	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Dipodomys merriami parvus	San Bernardino Merriam’s kangaroo rat	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Dipodomys merriami trinidadensis	Valle de la Trinidad kangaroo rat	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Dipodomys nitratoides	San Joaquin kangaroo rat	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Dipodomys nitratoides brevinasus	Short-nosed kangaroo rat	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Dipodomys nitratoides exilis	Fresno kangaroo rat	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Dipodomys nitratoides nitratoides	Tipton kangaroo rat	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Dipodomys panamintinus argusensis	Argus Mountains kangaroo rat	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Dipodomys panamintinus panamintinus	Panamint kangaroo rat	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Dipodomys simulans	Dulzura kangaroo rat	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Dipodomys simulans simulans		III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Dipodomys stephensi	Stephens kangaroo rat	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Dipodomys venustus	Narrow-faced kangaroo rat	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Dipodomys venustus elephantinus	Big-eared kangaroo rat	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Dipodomys venustus venustus	Santa Cruz kangaroo rat	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Erethizon dorsatum couesi		III	1	3.0	4.5	0	0	1	1	1	2	No	Yes	No	No
Mammal	Glaucomys sabrinus californicus	San Bernardino flying squirrel	III	1	2.0	3.0	0	0	1	2	1	2	No	Yes	No	No
Mammal	Lepus americanus klamathensis	Oregon snowshoe hare	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Lepus americanus tahoensis	Sierra Nevada snowshoe hare	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No

APPENDIX A
A Rapid Assessment of the Vulnerability of Sensitive Wildlife to Extreme Drought- Resulting Scores

Class	Scientific Name	Common Name	Drought Concern Priority	Drought Risk (sum)	Drought Risk (index)	Protracted Drought Risk	Annual Survival	Reproduction	Food Production	Pop. Size (1-3)	Range Size (1-3)	Life Span (1-3)	Sig Pop Risk from Ag Water Reduction	Sig Pop Risk from Increased Wildfire	Sig Reliant on Managed Wetlands	Sig Pop Risk from Disease/Toxin
Mammal	Lepus californicus bennettii	San Diego black-tailed jackrabbit.	III	1	1.2	1.8	0	0	1	3	2	2	No	No	No	No
Mammal	Lepus townsendii townsendii	Western white-tailed hare	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Lynx rufus pallescens		III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Martes caurina	Pacific marten	III	1	1.5	2.3	0	0	1	2	2	2	No	Yes	No	No
Mammal	Martes caurina humboldtensis	Humboldt marten	III	1	3.0	4.5	0	0	1	1	1	2	No	Yes	No	No
Mammal	Martes caurina sierrae	Sierra Nevada marten	III	1	1.5	2.3	0	0	1	2	2	2	No	Yes	No	No
Mammal	Microtus californicus halophilus	Monterey vole	III	1	2.0	6.0	0	0	1	2	1	1	No	No	Yes	No
Mammal	Microtus californicus mohavensis	Mojave River vole	III	1	3.0	9.0	0	0	1	1	1	1	No	No	Yes	No
Mammal	Mustela frenata inyoensis	Inyo long-tailed weasel	III	1	3.0	4.5	0	0	1	1	1	2	No	Yes	No	No
Mammal	Mustela frenata xanthogenys	San Joaquin long-tailed weasel	III	1	3.0	4.5	0	0	1	1	1	2	No	Yes	No	No
Mammal	Neotoma albigula venusta		III	1	1.2	3.6	0	0	1	3	2	1	No	Yes	Yes	No
Mammal	Neotoma bryanti intermedia	San Diego desert woodrat	III	1	1.2	3.6	0	0	1	3	2	1	No	Yes	Yes	No
Mammal	Neotoma fuscipes annectens	San Francisco dusky-footed woodrat	III	1	1.5	4.5	0	0	1	3	1	1	No	Yes	Yes	No
Mammal	Neotoma fuscipes riparia	Riparian (=San Joaquin Valley) woodrat	III	1	3.0	9.0	0	0	1	1	1	1	No	Yes	No	No
Mammal	Neotoma macrotis luciana	Santa Lucia big-eared woodrat	III	1	1.5	4.5	0	0	1	3	1	1	No	Yes	Yes	No
Mammal	Ochotona princeps	American pika	III	1	1.2	1.8	0	0	1	3	2	2	No	No	No	No
Mammal	Ochotona princeps schisticeps	Gray-headed pika	III	1	1.2	1.8	0	0	1	3	2	2	No	No	No	No
Mammal	Onychomys torridus ramona	Ramona grasshopper mouse	III	1	2.0	3.0	0	0	1	2	1	2	No	No	Yes	No
Mammal	Onychomys torridus tularensis	Tulare grasshopper mouse	III	1	2.0	3.0	0	0	1	2	1	2	No	No	Yes	No
Mammal	Ovis canadensis	Bighorn sheep	III	1	1.5	1.5	0	0	1	2	2	3	No	No	No	Yes
Mammal	Ovis canadensis nelsoni	Desert bighorn sheep	III	1	1.5	1.5	0	0	1	2	2	3	No	No	No	Yes
Mammal	Ovis canadensis nelsoni pop. 2	Peninsular Ranges bighorn sheep	III	1	3.0	3.0	0	0	1	1	1	3	No	No	No	Yes
Mammal	Ovis canadensis sierrae	Sierra Nevada bighorn sheep	III	1	3.0	3.0	0	0	1	1	1	3	No	No	No	Yes
Mammal	Pekania [Martes] pennanti	Fisher	III	1	1.5	2.3	0	0	1	2	2	2	No	Yes	No	No
Mammal	Pekania [Martes] pennanti pacifica	Pacific fisher	III	1	1.5	2.3	0	0	1	2	2	2	No	Yes	No	No
Mammal	Perognathus alticolus	White-eared pocket mouse	III	1	3.0	9.0	0	0	1	1	1	1	No	No	No	No
Mammal	Perognathus alticolus alticolus	San Bernardino Mtns white-eared pocket mouse	III	1	3.0	9.0	0	0	1	1	1	1	No	No	No	No
Mammal	Perognathus alticolus inexpectatus	Tehachapi pocket mouse	III	1	2.0	6.0	0	0	1	2	1	1	No	No	No	No
Mammal	Perognathus inornatus	San Joaquin pocket mouse	III	1	1.2	3.6	0	0	1	3	2	1	No	No	No	No
Mammal	Perognathus inornatus inornatus	Fresno pocket mouse	III	1	1.2	3.6	0	0	1	3	2	1	No	No	No	No
Mammal	Perognathus inornatus neglectus	McKittrick pocket mouse	III	1	2.0	6.0	0	0	1	2	1	1	No	No	No	No
Mammal	Perognathus inornatus psammophilus	Salinas pocket mouse	III	1	3.0	9.0	0	0	1	1	1	1	No	No	No	No
Mammal	Perognathus longimembris bangsi	Palm Springs pocket mouse	III	1	2.0	6.0	0	0	1	2	1	1	No	No	No	No
Mammal	Perognathus longimembris brevinasus	Los Angeles pocket mouse	III	1	2.0	6.0	0	0	1	2	1	1	No	No	No	No
Mammal	Perognathus longimembris internationalis	Jacumba pocket mouse	III	1	2.0	6.0	0	0	1	2	1	1	No	No	No	No
Mammal	Perognathus longimembris pacificus	Pacific pocket mouse	III	1	3.0	9.0	0	0	1	1	1	1	No	No	No	No
Mammal	Perognathus longimembris salinensis	Saline Valley pocket mouse	III	1	2.0	6.0	0	0	1	2	1	1	No	No	No	No
Mammal	Perognathus longimembris tularensis	Tulare pocket mouse	III	1	2.0	6.0	0	0	1	2	1	1	No	No	No	No
Mammal	Perognathus parvus xanthanotus	Yellow-eared pocket mouse	III	1	2.0	6.0	0	0	1	2	1	1	No	No	No	No
Mammal	Peromyscus maniculatus anacapae	Anacapa Island deer mouse	III	1	2.0	6.0	0	0	1	2	1	1	No	No	Yes	No
Mammal	Peromyscus maniculatus clementis	San Clemente Island deer mouse	III	1	2.0	6.0	0	0	1	2	1	1	No	No	Yes	No
Mammal	Puma concolor browni	Yuma mountain lion	III	1	1.5	1.5	0	0	1	2	2	3	No	No	No	No
Mammal	Reithrodontomys megalotis distichlis	Salinas harvest mouse	III	1	2.0	6.0	0	0	1	2	1	1	No	No	Yes	No
Mammal	Reithrodontomys megalotis limicola	Southern marsh harvest mouse	III	1	2.0	6.0	0	0	1	2	1	1	No	No	Yes	No
Mammal	Reithrodontomys megalotis longicaudus		III	1	1.0	3.0	0	0	1	3	3	1	No	No	Yes	No
Mammal	Reithrodontomys megalotis santacruzae	Santa Cruz Island harvest mouse	III	1	1.5	4.5	0	0	1	3	1	1	No	No	No	No
Mammal	Reithrodontomys raviventris	Salt Marsh Harvest mouse	III	1	1.5	4.5	0	0	1	3	1	1	No	No	Yes	No
Mammal	Reithrodontomys raviventris halicoetes	Petaluma marsh harvest mouse	III	1	2.0	6.0	0	0	1	2	1	1	No	No	Yes	No
Mammal	Reithrodontomys raviventris raviventris	San Francisco Bay harvest mouse	III	1	2.0	6.0	0	0	1	2	1	1	No	No	Yes	No
Mammal	Scapanus latimanus insularis	Angel Island broad-footed mole	III	1	2.0	6.0	0	0	1	2	1	1	No	No	No	No
Mammal	Scapanus latimanus parvus	Alameda Island mole	III	1	3.0	9.0	0	0	1	1	1	1	No	No	No	No
Mammal	Sorex lyelli	Mount Lyell shrew	III	1	2.0	6.0	0	0	1	2	1	1	No	Yes	No	No
Mammal	Sorex ornatus salarius	Monterey shrew; Salinas ornate shrew	III	1	2.0	6.0	0	0	1	2	1	1	No	No	No	No
Mammal	Sorex ornatus salicornicus	Southern California salt marsh shrew	III	1	2.0	6.0	0	0	1	2	1	1	No	No	Yes	No
Mammal	Sorex ornatus sinuosus	Suisun shrew	III	1	2.0	6.0	0	0	1	2	1	1	No	No	Yes	No
Mammal	Sorex ornatus willetti	Santa Catalina Island shrew	III	1	3.0	9.0	0	0	1	1	1	1	No	No	No	No
Mammal	Sorex vagrans halicoetes	Salt Marsh wandering shrew	III	1	2.0	6.0	0	0	1	2	1	1	No	No	Yes	No
Mammal	Sorex vagrans paludivagus	Monterey vagrant shrew	III	1	1.5	4.5	0	0	1	3	1	1	No	No	Yes	No
Mammal	Spilogale gracilis amphialus	Channel Islands spotted skunk	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Tamias alpinus	Alpine chipmunk	III	1	2.0	3.0	0	0	1	2	1	2	No	Yes	No	No
Mammal	Tamias panamintinus acrus	Kingston Mountains chipmunk	III	1	1.5	2.3	0	0	1	3	1	2	No	Yes	No	No

APPENDIX A
A Rapid Assessment of the Vulnerability of Sensitive Wildlife to Extreme Drought- Resulting Scores

Class	Scientific Name	Common Name	Drought Concern Priority	Drought Risk (sum)	Drought Risk (index)	Protracted Drought Risk	Annual Survival	Reproduction	Food Production	Pop. Size (1-3)	Range Size (1-3)	Life Span (1-3)	Sig Pop Risk from Ag Water Reduction	Sig Pop Risk from Increased Wildfire	Sig Reliant on Managed Wetlands	Sig Pop Risk from Disease/Toxin
Mammal	Tamias speciosus callipeplus	Mount Pinos lodgepole chipmunk	III	1	3.0	4.5	0	0	1	1	1	2	No	Yes	No	No
Mammal	Tamias speciosus speciosus	San Bernardino Mountains lodgepole chipmunk	III	1	3.0	4.5	0	0	1	1	1	2	No	Yes	No	No
Mammal	Taxidea taxus	American badger	III	1	1.2	1.8	0	0	1	2	3	2	No	No	No	No
Mammal	Taxidea taxus berlandieri		III	1	1.2	1.8	0	0	1	2	3	2	No	No	No	No
Mammal	Taxidea taxus jeffersonii		III	1	1.2	1.8	0	0	1	2	3	2	No	No	No	No
Mammal	Thomomys bottae operarius	Owens Lake pocket gopher	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Urocitellus mollis	Piute ground squirrel	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Urocitellus mollis mollis		III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Urocyon littoralis	Island fox	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Urocyon littoralis catalinae	Santa Catalina Island fox	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Urocyon littoralis clementae	San Clemente Island fox	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Urocyon littoralis dickeyi	San Nicolas Island fox	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Urocyon littoralis littoralis	San Miguel Island fox	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Urocyon littoralis santacruzae	Santa Cruz Island fox	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Urocyon littoralis santarosae	Santa Rosa island fox	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Vulpes macrotis mutica	San Joaquin kit fox	III	1	1.5	2.3	0	0	1	2	2	2	No	No	No	No
Mammal	Vulpes vulpes necator	Sierra Nevada red fox	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Mammal	Vulpes vulpes patwin	Sacramento Valley red fox	III	1	2.0	3.0	0	0	1	1	2	2	No	No	No	No
Mammal	Xerospermophilus mohavensis	Mohave ground squirrel	III	2	3.0	4.5	0	1	1	2	2	2	No	No	No	No
Mammal	Xerospermophilus tereticaudus chlorus	Palm Springs round-tailed ground squirrel	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Mammal	Zapus trinotatus orarius	Point Reyes jumping mouse	III	1	2.0	6.0	0	0	1	2	1	1	No	No	No	No
Mammal	Antilocapra americana sonoriensis	Sonoran pronghorn	NS													No
Mammal	Canis lupus	Gray wolf	NS													No
Mammal	Canis lupus fuscus		NS													No
Mammal	Canis lupus youngi		NS													No
Mammal	Gulo gulo	Wolverine	NS													No
Mammal	Gulo gulo luscus		NS													No
Mammal	Panthera onca	Jaguar	NS													No
Mammal	Panthera onca arizonensis	Arizona jaguar	NS													No
Mammal	Ursus arctos	Grizzly bear	NS													No
Mammal	Ursus arctos californicus	California grizzly bear	NS													No
Mammal	Vulpes macrotis macrotis	San Jacinto kit fox	NS													No
Reptile	Emys marmorata marmorata	northwestern pond turtle	I	4	4.8	4.8	2	0	2	3	2	3	Yes	No	No	Yes
Reptile	Emys marmorata pallida	southwestern pond turtle	I	4	6.0	6.0	2	0	2	2	2	3	Yes	No	No	Yes
Reptile	Thamnophis gigas (Sacramento Valley/Delta)	giant garter snake	I	4	8.0	12.0	2	0	2	2	1	2	Yes	No	Yes	No
Reptile	Thamnophis gigas (San Joaquin Valley)	giant garter snake	I	4	12.0	18.0	2	0	2	1	1	2	Yes	No	Yes	No
Reptile	Thamnophis hammondi	two-striped garter snake	I	4	6.0	9.0	2	0	2	2	2	2	No	Yes	No	No
Reptile	Thamnophis sirtalis ssp.	south coast garter snake	I	4	12.0	18.0	2	0	2	1	1	2	No	Yes	No	No
Reptile	Thamnophis sirtalis tetrataenia	San Francisco garter snake	I	4	12.0	18.0	2	0	2	1	1	2	No	No	No	No
Reptile	Anniella pulchra	California legless lizard	III	1	1.2	1.8	0	0	1	3	2	2	No	No	No	No
Reptile	Arizona elegans occidentalis	California glossy snake	III	0	0.0	0.0	0	0	0	2	2	3	No	Yes	No	No
Reptile	Aspidoscelis hyperythra	orange-throated whiptail	III	1	2.0	3.0	0	0	1	2	1	2	No	Yes	No	No
Reptile	Aspidoscelis tigris stejnegeri	Coastal whiptail	III	1	2.0	3.0	0	0	1	2	1	2	No	Yes	No	No
Reptile	Charina umbratica	southern rubber boa	III	1	2.0	2.0	1	0	0	2	1	3	No	Yes	No	No
Reptile	Coleonyx switaki	barefoot gecko	III	0	0.0	0.0	0	0	0	2	1	2	No	Yes	No	No
Reptile	Coleonyx variegatus abbotti	San Diego banded gecko	III	0	0.0	0.0	0	0	0	2	1	2	No	Yes	No	No
Reptile	Contia longicauda	forest sharp-tailed snake	III	2	3.0	4.5	1	0	1	3	1	2	No	Yes	No	No
Reptile	Crotalus ruber	red-diamond rattlesnake	III	0	0.0	0.0	0	0	0	3	1	3	No	Yes	No	No
Reptile	Diadophis punctatus regalis	regal ring-necked snake	III	1	2.0	3.0	1	0	0	2	1	2	No	No	No	No
Reptile	Elgaria panamintina	Panamint alligator lizard	III	1	3.0	4.5	1	0	0	1	1	2	No	No	No	No
Reptile	Gambelia copeii	Cope's leopard lizard	III	1	3.0	4.5	0	0	1	1	1	2	No	Yes	No	No
Reptile	Gambelia sila	blunt-nosed leopard lizard	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Reptile	Gopherus agassizii	desert tortoise	III	2	2.4	2.4	0	0	2	3	2	3	No	Yes	No	Yes
Reptile	Heloderma suspectum	Gila monster	III	0	0.0	0.0	0	0	0	1	1	3	No	No	No	No
Reptile	Lampropeltis zonata (parvirubra)	California mountain kingsnake (San Bernardino population)	III	0	0.0	0.0	0	0	0	2	1	2	No	Yes	No	No
Reptile	Lampropeltis zonata (pulchra)	California mountain kingsnake (San Diego population)	III	0	0.0	0.0	0	0	0	2	1	2	No	Yes	No	No
Reptile	Masticophis flagellum ruddocki	San Joaquin whipsnake	III	0	0.0	0.0	0	0	0	2	2	2	No	Yes	No	No
Reptile	Masticophis fuliginosus	Baja California coachwhip	III	0	0.0	0.0	0	0	0	1	1	2	No	Yes	No	No
Reptile	Masticophis lateralis euryxanthus	Alameda whipsnake	III	0	0.0	0.0	0	0	0	2	1	2	No	Yes	No	No
Reptile	Phrynosoma blainvillii	Blainville's horned lizard	III	1	1.0	1.5	0	0	1	3	3	2	No	Yes	No	No
Reptile	Phrynosoma mcallii	flat-tailed horned lizard	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No

APPENDIX A
A Rapid Assessment of the Vulnerability of Sensitive Wildlife to Extreme Drought- Resulting Scores

Class	Scientific Name	Common Name	Drought Concern Priority	Drought Risk (sum)	Drought Risk (index)	Protracted Drought Risk	Annual Survival	Reproduction	Food Production	Pop. Size (1-3)	Range Size (1-3)	Life Span (1-3)	Sig Pop Risk from Ag Water Reduction	Sig Pop Risk from Increased Wildfire	Sig Reliant on Managed Wetlands	Sig Pop Risk from Disease/Toxin
Reptile	Pituophis catenifer pumilis	Santa Cruz Island gopher snake	III	0	0.0	0.0	0	0	0	1	1	3	No	Yes	No	No
Reptile	Plestiodon skiltonianus interparietalis	Coronado skink	III	1	2.0	3.0	1	0	0	2	1	2	No	Yes	No	No
Reptile	Salvadora hexalepis virgultea	coast patch-nosed snake	III	0	0.0	0.0	0	0	0	2	2	2	No	Yes	No	No
Reptile	Uma inornata	Coachella Valley fringe-toed lizard	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Reptile	Uma notata	Colorado Desert fringe-toed lizard	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Reptile	Uma scoparia	Mohave fringe-toed lizard	III	1	2.0	3.0	0	0	1	2	1	2	No	No	No	No
Reptile	Xantusia gracilis	sandstone night lizard	III	1	3.0	4.5	0	0	1	1	1	2	No	No	No	No
Reptile	Xantusia riversiana	Island night lizard	III	1	2.0	2.0	0	0	1	2	1	3	No	Yes	No	No
Reptile	Xantusia sierrae	Sierra night lizard	III	1	3.0	4.5	0	0	1	1	1	2	No	Yes	No	No
Reptile	Bogertophis rosaliae	Baja California rat snake	NS													No
Reptile	Kinosternon sonoriense	Sonora mud turtle	NS													No