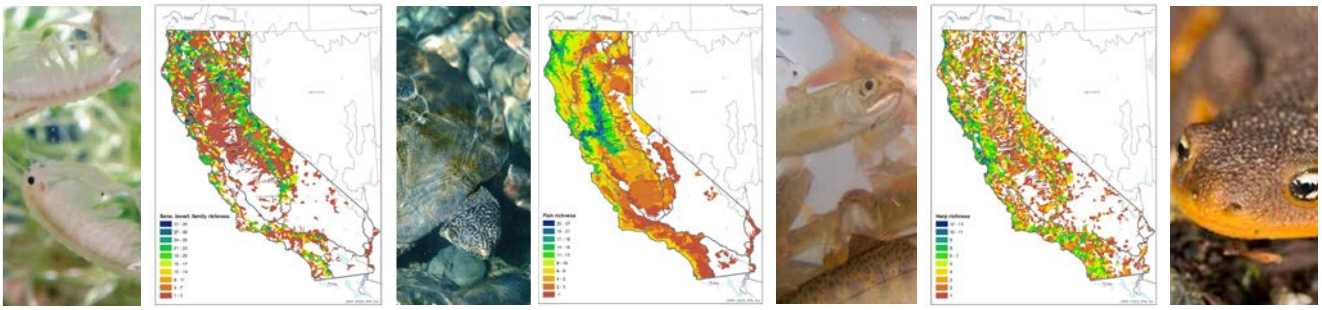

California Freshwater Blueprint

Phase I Overview

October 2015

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Contents

Figures

Tables

Appendices

Purpose

California is renowned as one of the world's most hydrologically altered landscapes. A growing population and transformation of California into one of the most productive agricultural and urban landscapes in the world have reduced aquatic and wetland habitats to a small fraction of their historic extent. Freshwater-dependent ecosystems have been degraded across the entire state, with associated dramatic population declines of aquatic species and reduced ecological functions. For example, 80% of California's fishes are considered at risk of extinction in the next 100 years (Moyle et al. 2011). Despite our declining freshwater systems, there is currently no statewide conservation plan for preserving California's rich freshwater diversity. This collaborative effort[1] attempts to fill that gap.

The objective of this project is to develop a conservation plan (Freshwater Conservation Blueprint) for California's freshwater systems. Such a statewide conservation blueprint is designed to develop conservation strategies to enhance and protect habitats of freshwater fishes and other aquatic organisms. The purpose of this effort is to provide a clear depiction of the taxa and systems in California and to set priorities concerning what freshwater systems to safeguard, where to protect them, what problems to tackle and where to tackle them. Our hope is that the Freshwater Conservation Blueprint will provide a strong vision of how to best conserve and protect California's rich freshwater diversity.

Specific goals of the project are to:

1) Identify priority areas for freshwater ecosystem conservation, accounting for spatial patterns of freshwater biodiversity, threats, and opportunities;

2) Develop regional- and watershed-specific conservation strategies; and
3) Institutionalize the California Freshwater Conservation Blueprint in appropriate management agencies

Project Phases

The project has been developed in two phases (Figure 1). The first phase focused on mapping California's native freshwater taxa (fishes, herpetofauna, invertebrates, plants and birds), and identifying high conservation value areas (CVA). The resulting map (Appendix A), a product of Phase 1 described in this report, identified over 1,000 HUC12 subwatersheds as high conservation value areas based on species groups.

Phase 2 will focus on mapping freshwater systems, and developing an action plan within priority CVAs based on threats, land tenure and opportunity.

This report focuses only on the methods and results of our Phase 1 effort.

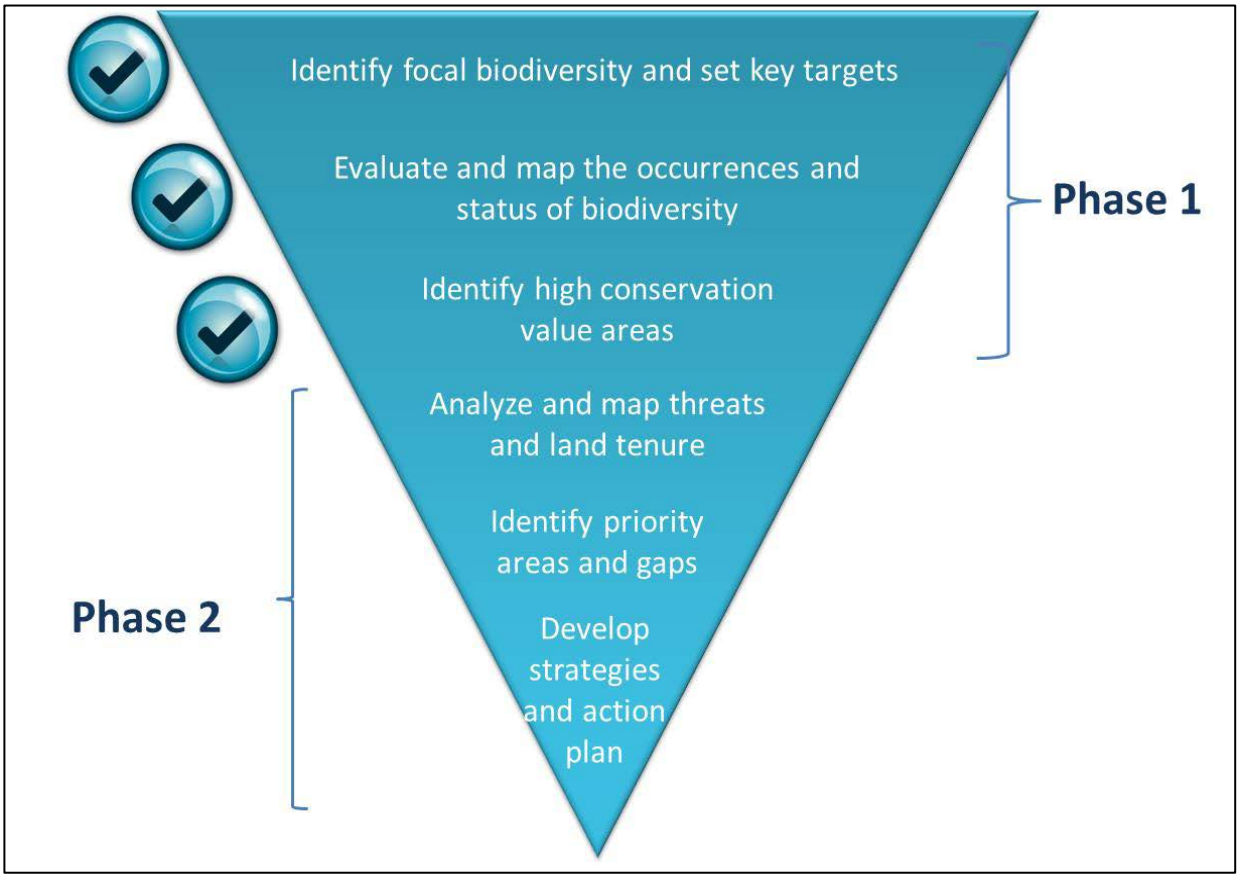
[1] The Nature Conservancy, Trout Unlimited, UC Davis, CA Department of Fish and Wildlife, US Forest Service, Chico State, State Water Resources Control Board, Point Blue Bird Observatory

Phase I Methods and Results

1. Identify focal biodiversity and set key targets

All species rely on water, but not all species are freshwater species. Therefore, to assemble a list of native freshwater taxa in the state, we first needed to define what freshwater taxa are. Criteria for categorizing taxa as freshwater dependent varied by taxonomic group (see Appendix B). For example, fishes were included as freshwater taxa if they regularly occur in freshwater habitats. Herpetofauna were included if: 1) they rely on fresh water or freshwater-dependent vegetation communities to complete one or more life stage (e.g., all anurans and most caudates) or forage within fresh water as obligates (e.g., western pond turtle, *Actinemys marmorata*) or non-obligates (e.g., western terrestrial garter snake, *Thamnophis elegans*) at some stage of development; or, 2) they would not persist without freshwater microhabitats (e.g. Inyo mountain salamander, *Batrachoseps campi*); or, 3) they are found within splash zones of freshwater springs and creeks (e.g., Dunn's salamander, *Plethodon dunni*). See Appendix B for criteria for birds, plants and invertebrates.

Figure 1: Project phases

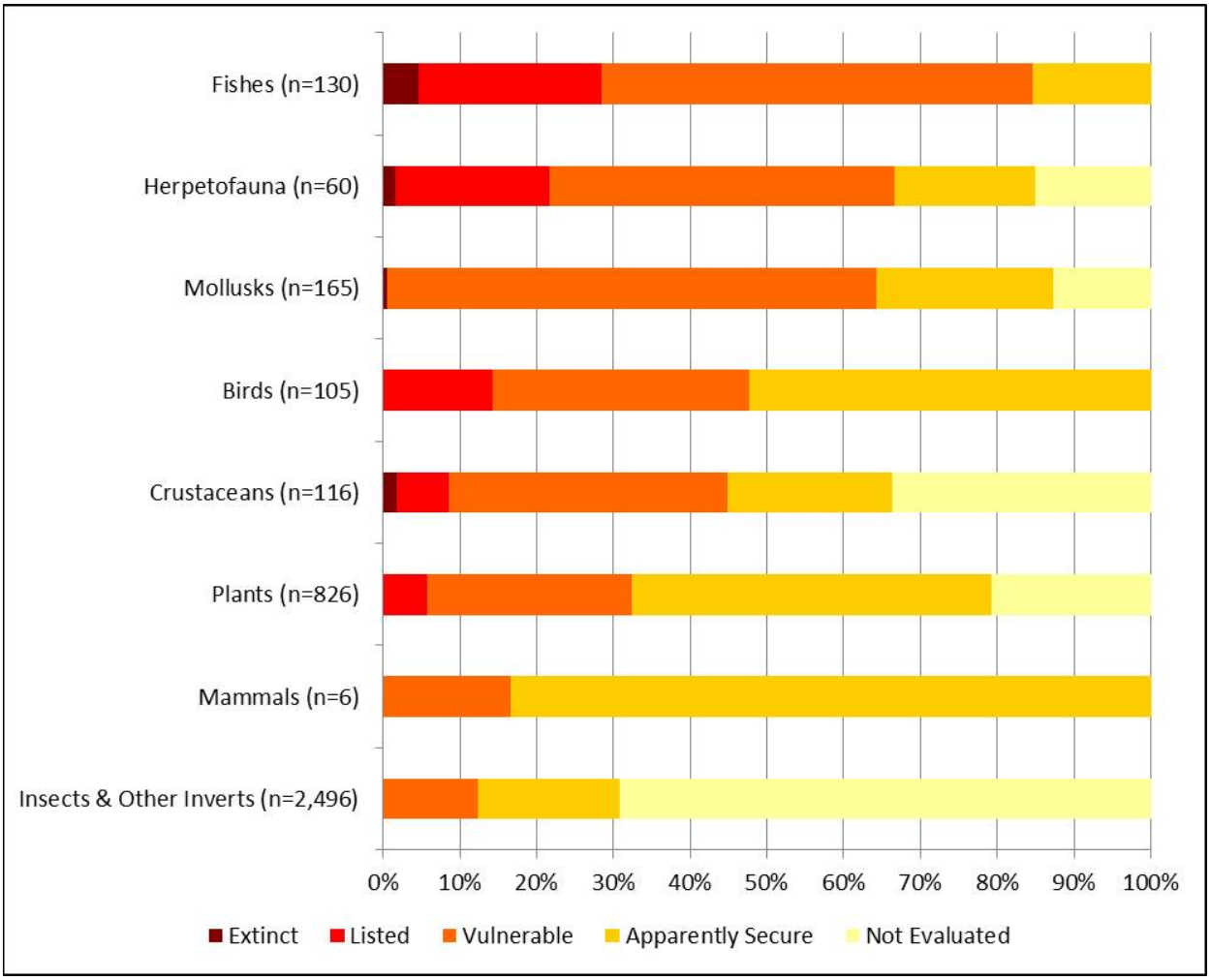


Using a variety of taxonomic review sources and expert guidance, we compiled a list of 3,904 freshwater taxa (species, subspecies, and evolutionary significant units and distinct population segments for salmonids) that occur in California representing plants, mammals, birds, fishes, amphibians, reptiles,

mollusks, crustaceans, and insects, arachnids, branchiopods and polychaetes. Results of this effort can be found in a paper published in PLOSONE in 2015 (See Howard et al. 2015: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710).

Non-vascular plants such as algae and mosses, planktonic microcrustacea (members of the orders Copepoda and Cladocera), segmented worms (Annelida), and water mites (Acari) were not included in our species compilation.

Figure 2: Taxonomic grouping and conservation status of freshwater taxa (species, subspecies and evolutionary significant units) native to California. Percentage of freshwater species by taxonomic groups that are considered vulnerable (at risk of extinction) in watersheds of California. Insects and other invertebrates" includes the classes Arachnida, Branchiopoda, Insecta and Polychaeta.

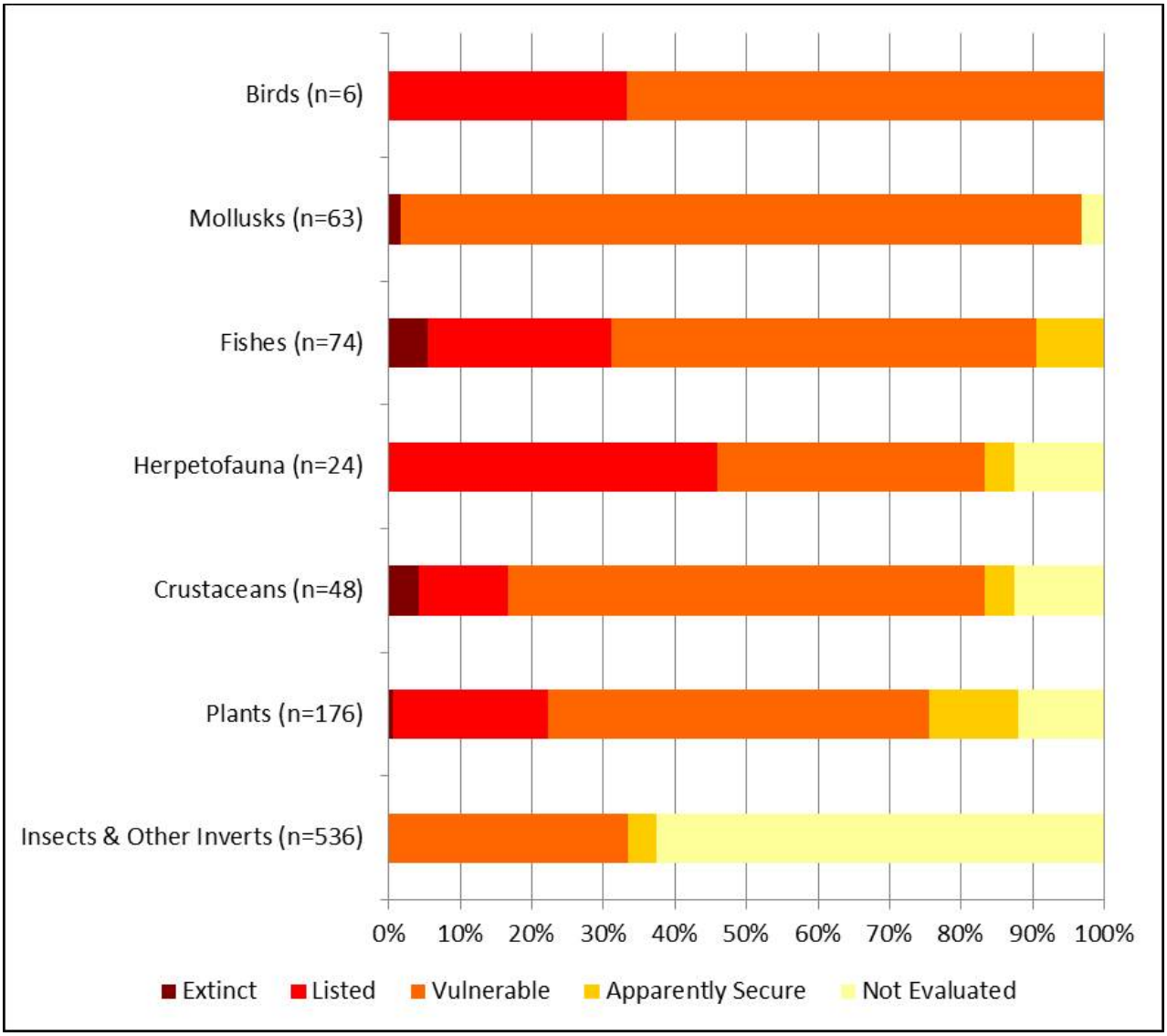


Insects, arachnids, branchiopods, and polychaetes comprise over two-thirds (63.9%) of the freshwater taxa in the study area, with 2,496 taxa (Figure 2). The next largest group is plants (n=826, 21.2%), followed by mollusks (n=165, 4.2%), fish (n=130, 3.3%), crustaceans (n=116, 3%) birds (n=105, 2.7%), herpetofauna (n=60, 1.5%), and mammals (n=6 , 0.2%). Eleven freshwater taxa that were once found in the study area are now considered extinct, including one plant, two crustaceans, one mollusk, one frog,

and six fishes. An additional 12 taxa are considered possibly extinct including eight insects or other invertebrates, two mollusks, and two plants.

Nearly a quarter of the 3,904 native freshwater taxa found in California are endemic (n=927), including 536 Insects, arachnids, branchiopods, and polychaetes, 176 plants, 74 fishes, 63 mollusks, 48 crustaceans, 24 herpetofauna, and six birds (Figure 3). Taxa were classified as endemic to California if they are known to be restricted to our study area based on available data from NatureServe and other sources.

Figure 3: Taxonomic grouping and conservation rank of freshwater taxa endemic to California. Percentage of freshwater endemic species by taxonomic groups that are considered vulnerable (at risk of extinction) in watersheds of California. ”"Insects and other invertebrates” includes the classes Arachnida, Branchiopoda, Insecta and Polychaeta.



From the freshwater species database compilation efforts, we identified key freshwater conservation targets on which to base conservation planning. Our key focal conservation targets are a limited suite of taxa chosen to represent and encompass the freshwater biodiversity found in the state. The targets provide the basis for setting conservation goals, carrying out conservation actions, and measuring conservation effectiveness. In theory, conservation of these focal targets will ensure the conservation of additional native, sensitive and rare biodiversity. Key conservation targets for our efforts included native freshwater fish, sensitive reptile and amphibian taxa and sensitive insect, mollusk and crustacean families (Table 1). Invertebrate families were included if they are considered sensitive to disturbance (U.S. EPA 2006, Ode 2003). We selected this suite of targets as they represent a full suite of freshwater habitats including seeps and springs, headwater streams, mainstem rivers and wetlands. Bird and plant taxa were not considered key conservation targets for this initial set of analyses.

2. Evaluate and map the occurrences of key freshwater targets

The basic mapping unit for this assessment is the subwatershed or 12-digit hydrologic unit code (HUC12), which averages ~20,000 acres or ~ 30 square miles within California. A total of 4,464 HUC12s are located within California (the study area). We used observations or current range information for freshwater target taxa within HUC12s to represent distribution within the assessment.

We relied on the PISCES database for fish taxa. PISCES is the most comprehensive, quality-controlled dataset of extant ranges of California's freshwater fish taxa (Santos et al. 2014). For herpetofauna we relied on observations at the taxon level compiled for UC-Davis' Amphibian and Reptile Species of Special Concern (ARSSC) effort (http://arssc.ucdavis.edu/index.html). We used the ARSSC data because it had been inspected for quality to remove spurious observations. For target invertebrate families, we relied primarily on benthic macroinvertebrate and bioassessment sampling datasets (e.g. SWAMP and Utah State Buglab) supplemented with CDFW and museum records and range information gathered for the California Freshwater Species database (Howard et al. 2015). While this represents the most comprehensive compilation of invertebrate data in the state, we acknowledge that there are limitations to the data quality. For example, most invertebrate data come from bioassessment monitoring efforts which under samples certain habitats such as non-perennial streams, large rivers, springs, high altitude streams and wet meadows.

Patterns of key freshwater targets chosen for this analysis are shown in Figures 4A, 4B, 4C.

3. Identify high conservation value areas (CVAs)

Figure 4A: Pattern of richness of key fish species used in Zonation runs

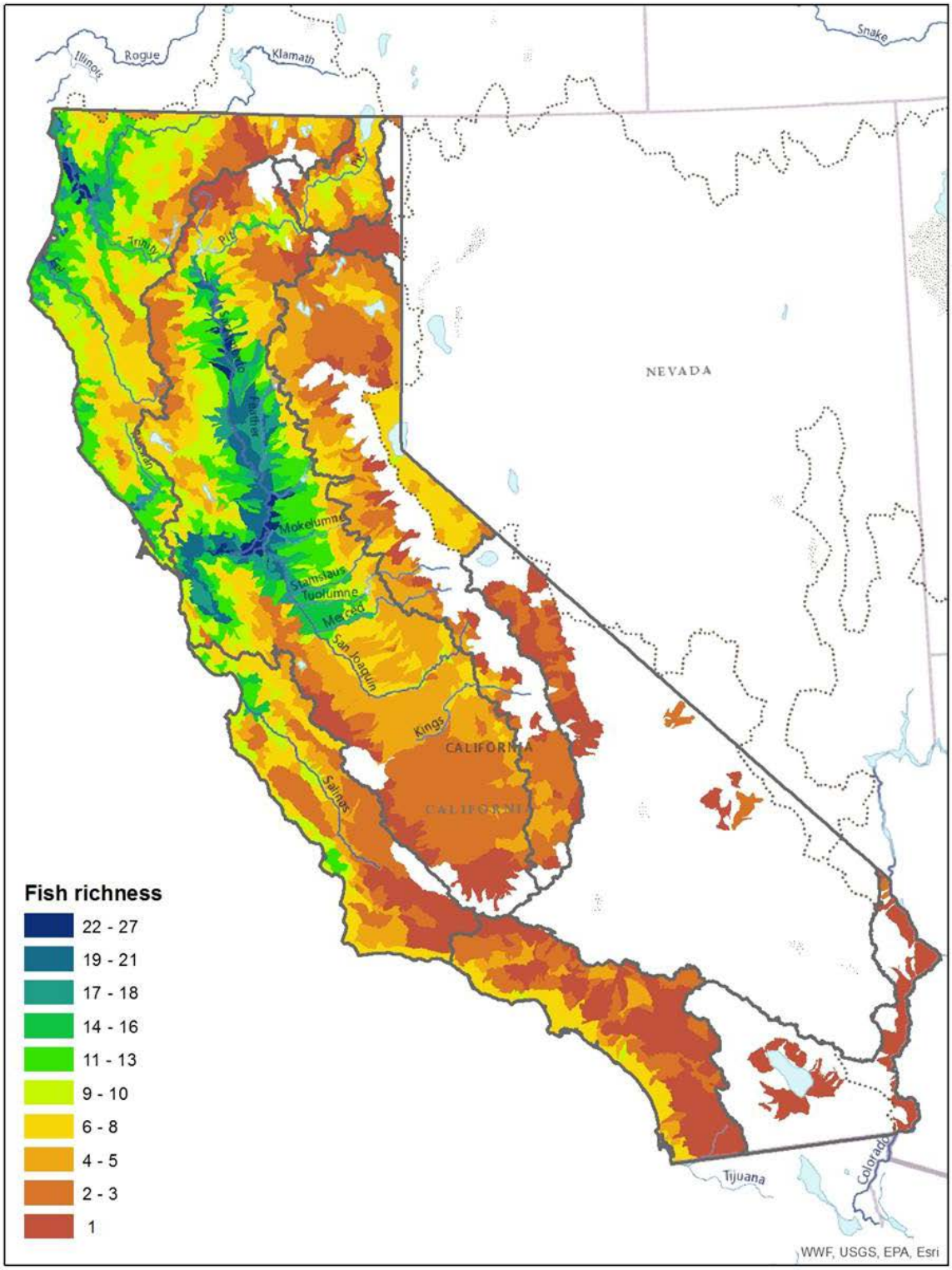


Figure 4B: Pattern of richness of key amphibian and reptile species used in Zonation runs

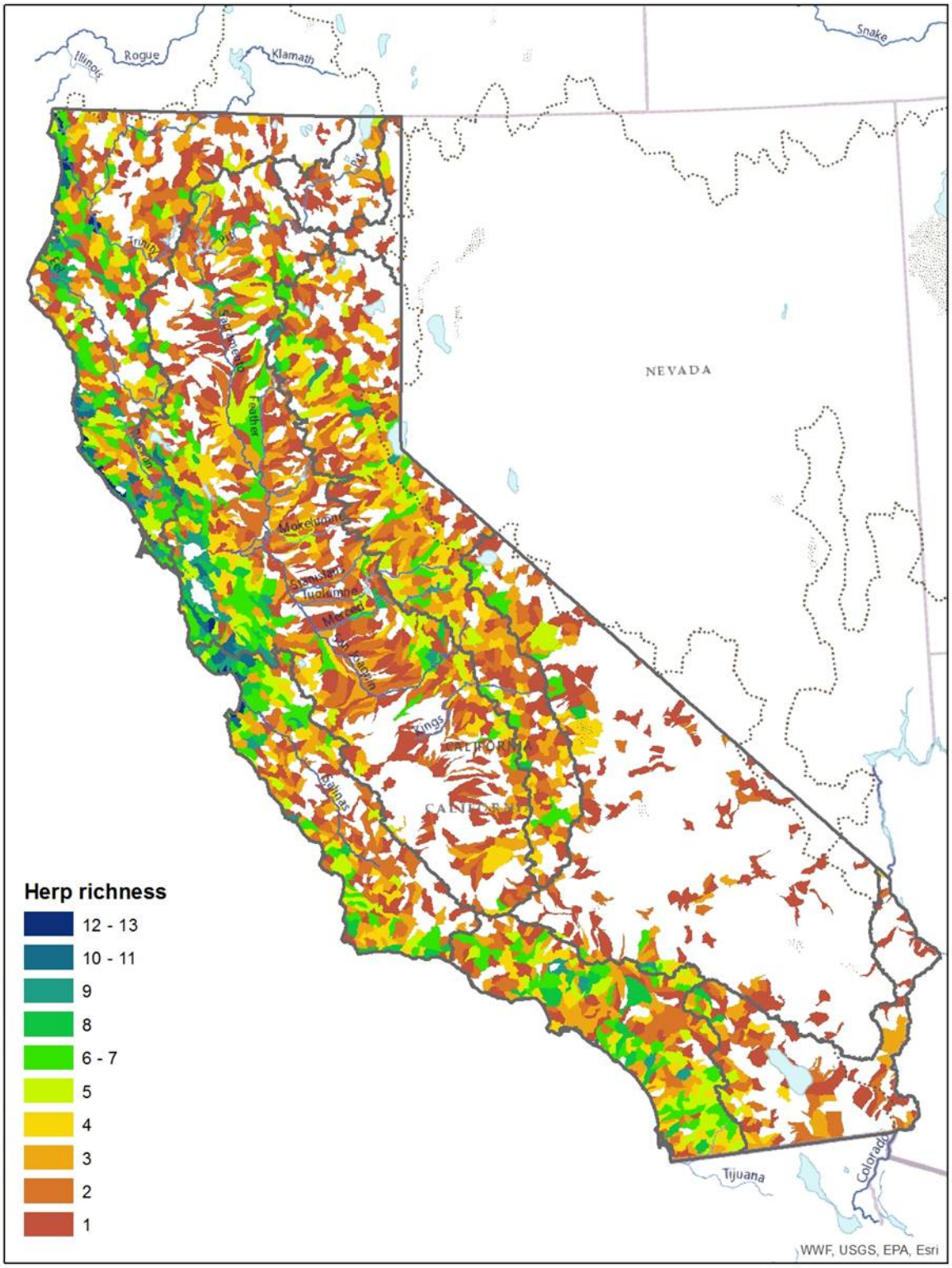
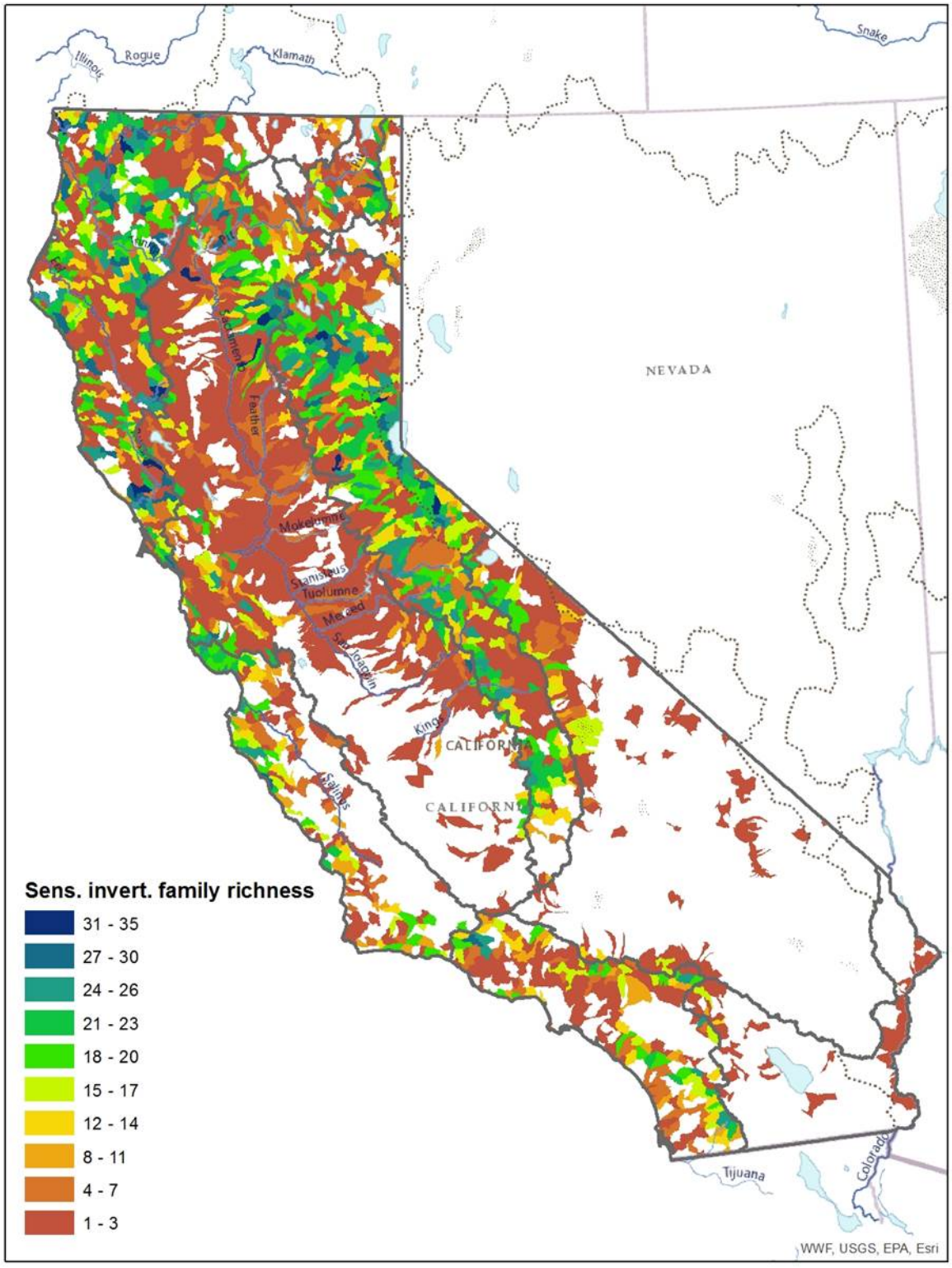


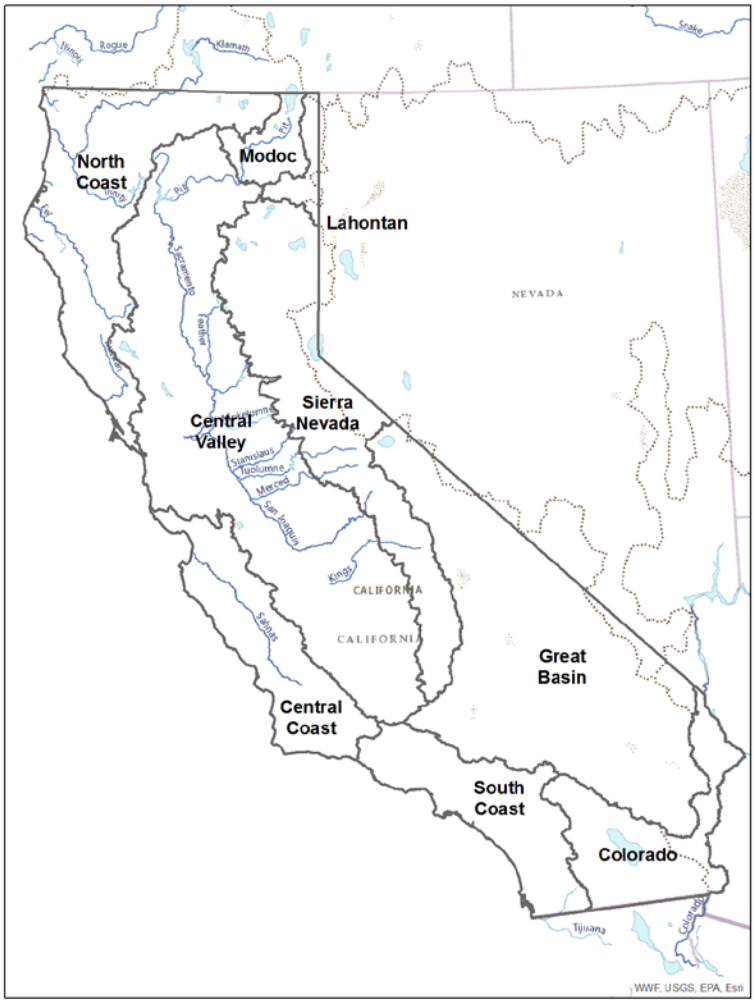
Figure 4C: Pattern of richness of sensitive invertebrate families used in Zonation runs



Methods

We identified high conservation value areas using Zonation conservation planning software and expert opinion. Zonation is a publically available decision-support system designed for use in systematic conservation planning that applies a complementarity-based algorithm to species occurrence data to produce a ranking of conservation priority areas across the landscape. The Zonation software ranks the importance of each planning unit (HUC12s in our case) according to a reserve design algorithm. We used Zonation to rank HUC12 watersheds within nine freshwater conservation planning regions in California, which were defined according to DWR hydrologic region boundaries and Moyle's (2002) zoogeographic regions for freshwater fish (Figure 5). Each region represents relatively homogenous biogeographic conditions and generally corresponds to existing state water management/planning units.

Figure 5: Planning regions



Freshwater fish, reptile and amphibian taxa were included in Zonation optimization runs as were sensitive invertebrate families (Table 1). For fishes, three subgroups were considered for optimization runs: anadromous, range restricted taxa (occurring in ≤25 HUC12 watersheds), and wide-ranging taxa (occurring >25 HUC12s). For herpetofauna three subgroups were run: lotic, lentic and generalists. We used family-level observations for invertebrates because of the unequal spatial distribution of observations and the challenges of identifying many invertebrates at the species and genus level. Mollusk, crustacean and insect invertebrate families defined as sensitive were included in the zonation runs.

The Zonation-based ranking of HUC12 watersheds within each region was used to identify CVAs. First, we used the Added Benefit Function algorithm within Zonation to identify the top 10% of ranked subwatersheds for each group of fish and herpetofauna taxa and sensitive invertebrate families for each region. Within the Added Benefit Function, subwatershed rank is determined by how much of the proportional distribution of all taxa/families is present in a subwatershed: it can be thought of as prioritizing for richness while considering rarity. When the top 10% of locations did not capture all taxa or families present in a region, we selected the top-ranked watersheds identified using the Core Area

Zonation algorithm which contained the missing taxa. In this way we were able to ensure that all taxa found within a planning region were represented in the high value conservation areas.

For fishes, potential CVAs represented in the top 10% HUC12s were examined by Peter Moyle and Rebecca Quinones and modified based on the following criteria:

- Watersheds were added that are known to provide habitat essential to persistence of fish populations (e.g., Lassen foothill streams)
- Watersheds were added to include key tributary or headwater streams flowing into a contiguous CVA (e.g., Smith River, Navarro River, Eel River, Clear Lake, etc.)
- Watersheds were removed that were known to be of extremely poor habitat quality for the native taxa potentially present (e.g., Tule Lake, Rubicon River)
- Watersheds were removed if the species assemblage was well-represented in other CVAs within the region (e.g., Mad River, South Fork Pit River, headwaters of Santa Clara River)
- CVAs were removed or modified if target taxa were widely distributed in adjacent regions (e.g., South Fork American River in Sierra Nevada Region)

For herpetofauna and invertebrates, we added HUCs to the CVA network that included taxa or family occurrences that were not included in the top 10% of Zonation-ranked HUCs in the region. This occurred infrequently and only when rare taxa occurred in HUCs with low species/family richness, due to the Zonation algorithm prioritization of richness. For herpetofauna, potential CVAs were also supplemented by HUC12s that expert reviewers identified as important for herpetofauna conservation, but missing from the top 10% Zonation results. These additions were included to capture the core of a species' range vs. the periphery (e.g. highest elevation zones of the Sierra Nevada for Yosemite toad). For insects, potential CVAs represented in the top 10% HUCs were supplemented by watersheds that occurred in the top 20% of Zonation ranked HUCs and occurred in the top 40% of family richness for the region. These HUCs were only added if they fell outside of an existing CVA.

Results

A total of 1,082 HUC12 subwatersheds (20% of the HUC12s within the state) were identified as high conservation value areas (Table 2). These subwatersheds total 26 million acres or 40,000 square miles which is approximately 25% of California. The selection of CVAs was intentionally generous, and will be likely be winnowed in Phase 2 when threats and opportunities are considered.

By taxonomic group, 584 subwatersheds (18,353,768 acres) were identified as high value areas for fish, 377 subwatersheds (19,117,283 acres) for herpetofauna, and 401 subwatersheds for invertebrates (20,360,113 acres).

High conservation value areas by planning region are shown in Figures 6-14 and listed in Table 2. Area within a planning region identified as high conservation value areas ranged from a low of 8.6% in the Great Basin planning region to a high of 49.2% in the North Coast planning region (Figures 6-14). Planning regions with the greatest number of high conservation value areas are the Central Valley and North coast both with 279 HUC12s identified as CVAs totally 6.8 million and 6.2 million acres respectively. A statewide map of high conservation value areas can be found in Appendix 1 and can be downloaded here:
http://scienceforconservation.org/map_gallery/CA_freshwater_conservation_blueprint.

The greatest number of fish CVAs was identified in the North Coast region with 218 HUC12s, followed by the Central Valley with 127. The Central Valley planning region had the greatest number of CVAs for herpetofauna with 122 high CVA HUC12s, followed by the Sierra Nevada with 73 high CVA HUC12s. The greatest number of invertebrate CVAs were identified in the Sierra Nevada and Central Valley regions with 114 and 113 high CVA HUC12s, respectively.

High CVAs for fish, herpetofauna and invertebrate overlap in 100 HUC12 subwatersheds totaling 11,815,290 acres (Figure 15). These 100 high CVA subwatersheds where fish, herpetofauna and invertebrates overlap are located within the following basins:

- Antelope/Mill/Deer/Butte Creek
- Battle Creek
- Clear Lake
- Eagle Lake
- East Walker River
- Garcia River
- Goose Lake
- Santa Ana River headwaters
- Kings River
- Lagunitas Creek
- Lake Tahoe/Truckee R.
- Lower and Middle Klamath River
- Monterey Bay
- Napa/Sonoma/Petaluma
- Pit and Fall Rivers
- Redwood Creek and Mad River
- Russian River
- Salmon River
- Santa Clara River
- Santa Maria River
- Scott River
- Smith River
- South San Francisco Bay
- Upper Kings River
- Upper Owens River

Figure 6: High conservation value areas for Central Coast planning region.
F = fish CVA, H = herpetofauna CVA, I = invertebrate CVA

Figure 7: High conservation value areas for Central Valley planning region. F = fish CVA, H = herpetofauna CVA, I = invertebrate CVA.

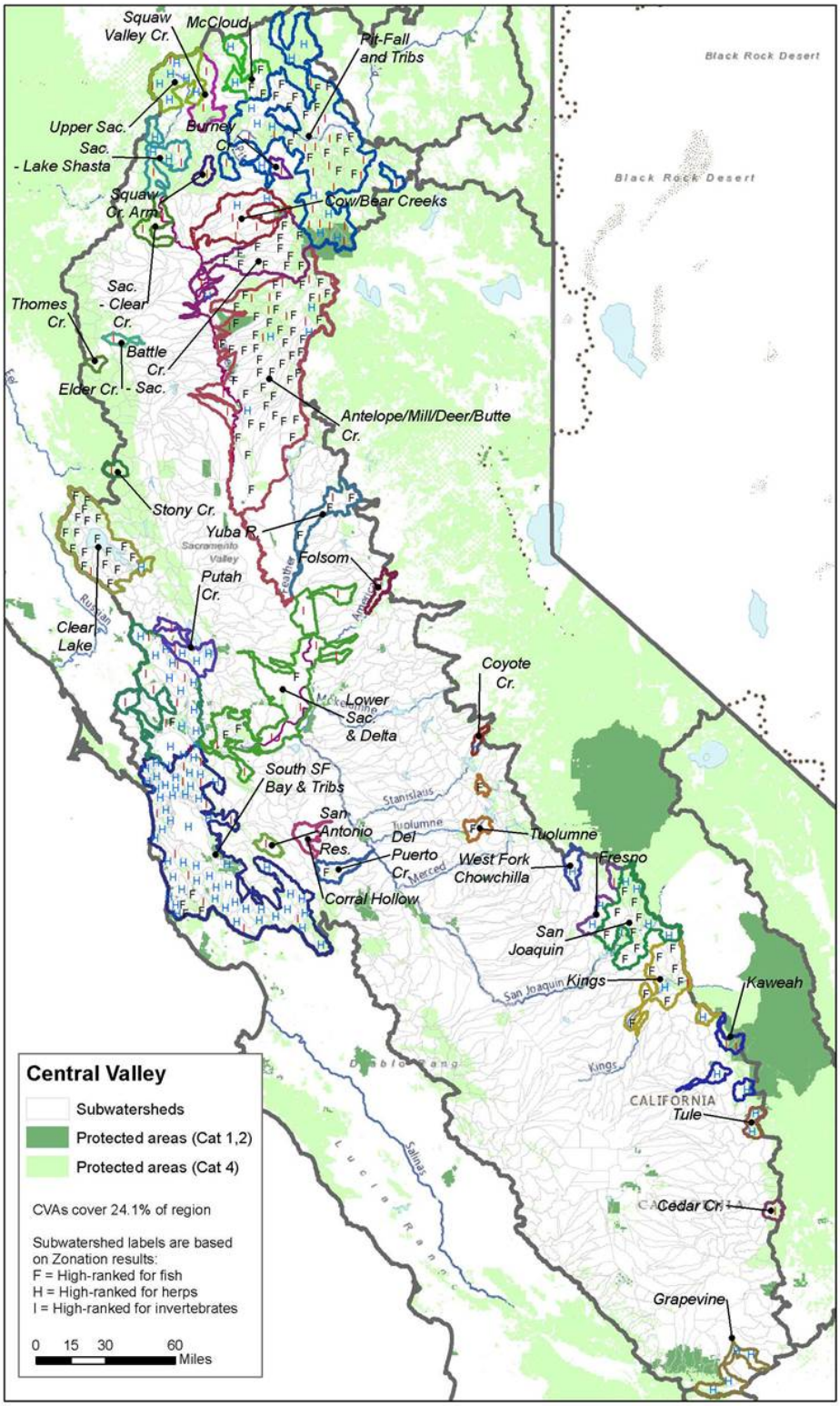


Figure 8: High conservation value areas for Colorado planning region.
F = fish CVA, H = herpetofauna CVA, I = invertebrate CVA.

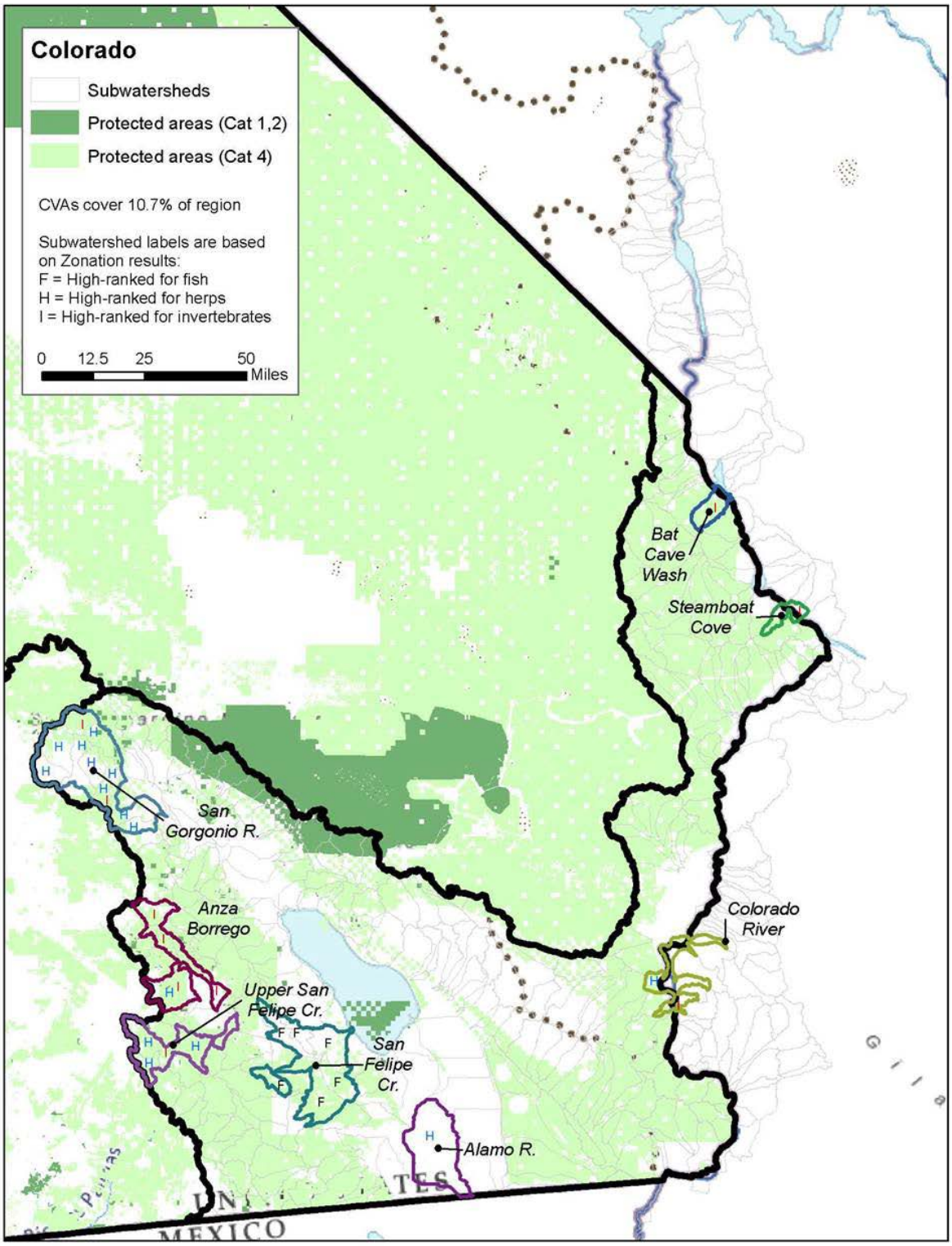


Figure 9: High conservation value areas for Great Basin planning region.
F = fish CVA, H = herpetofauna CVA, I = invertebrate CVA.

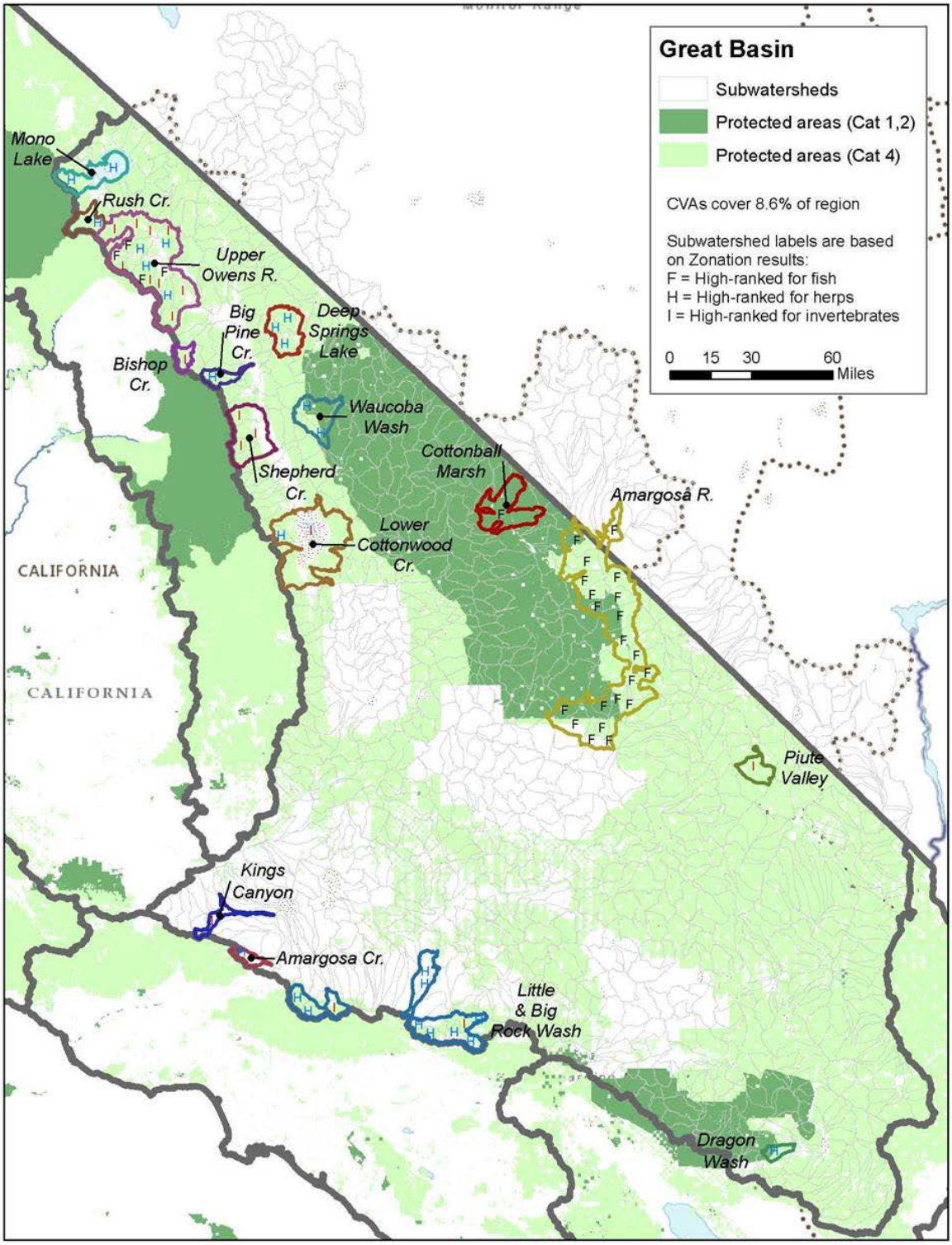


Figure 10: High conservation value areas for Lahonton planning region.
F = fish CVA, H = herpetofauna CVA, I = invertebrate CVA

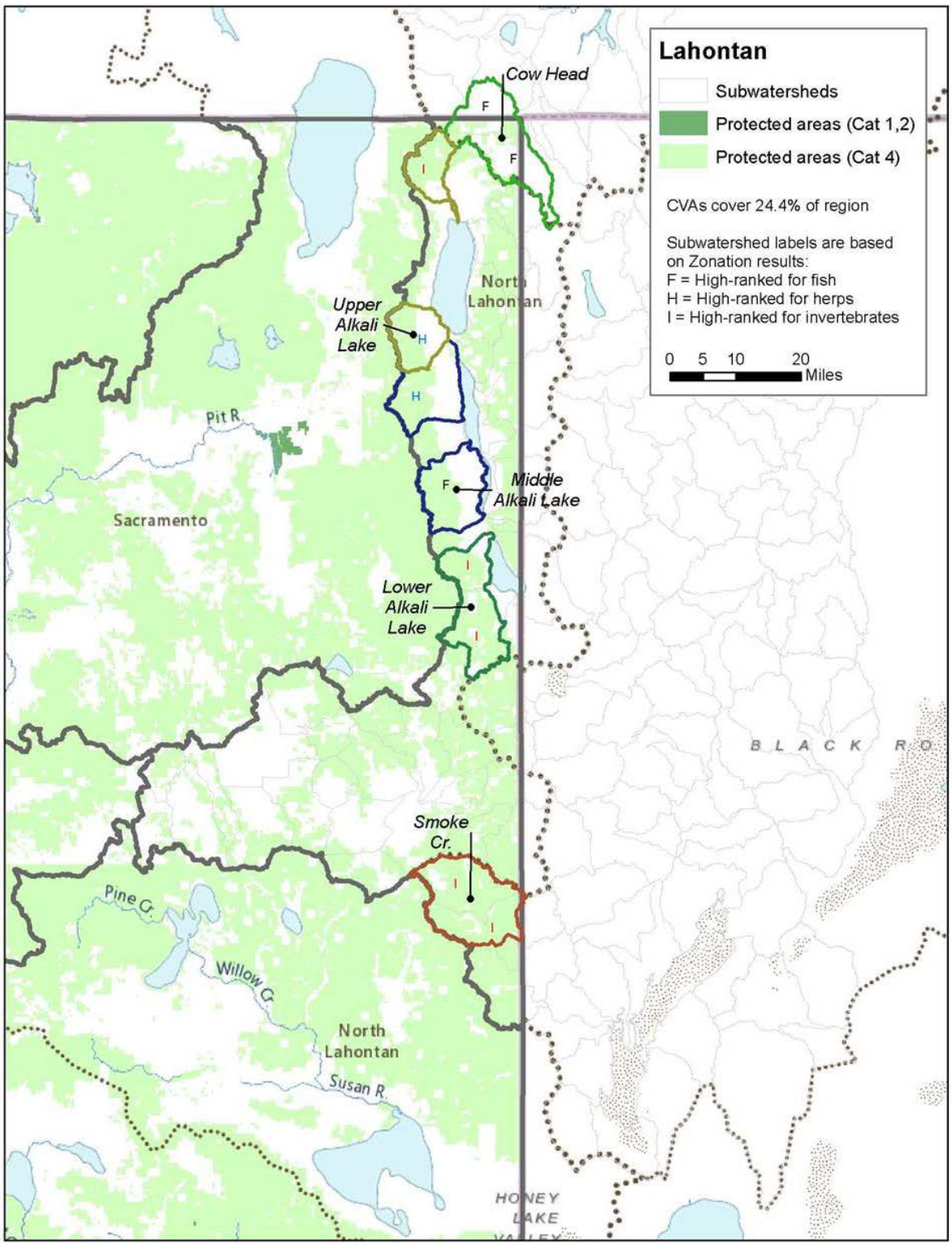


Figure 11: High conservation value areas for Modoc planning region.
F = fish CVA, H = herpetofauna CVA, I = invertebrate CVA.

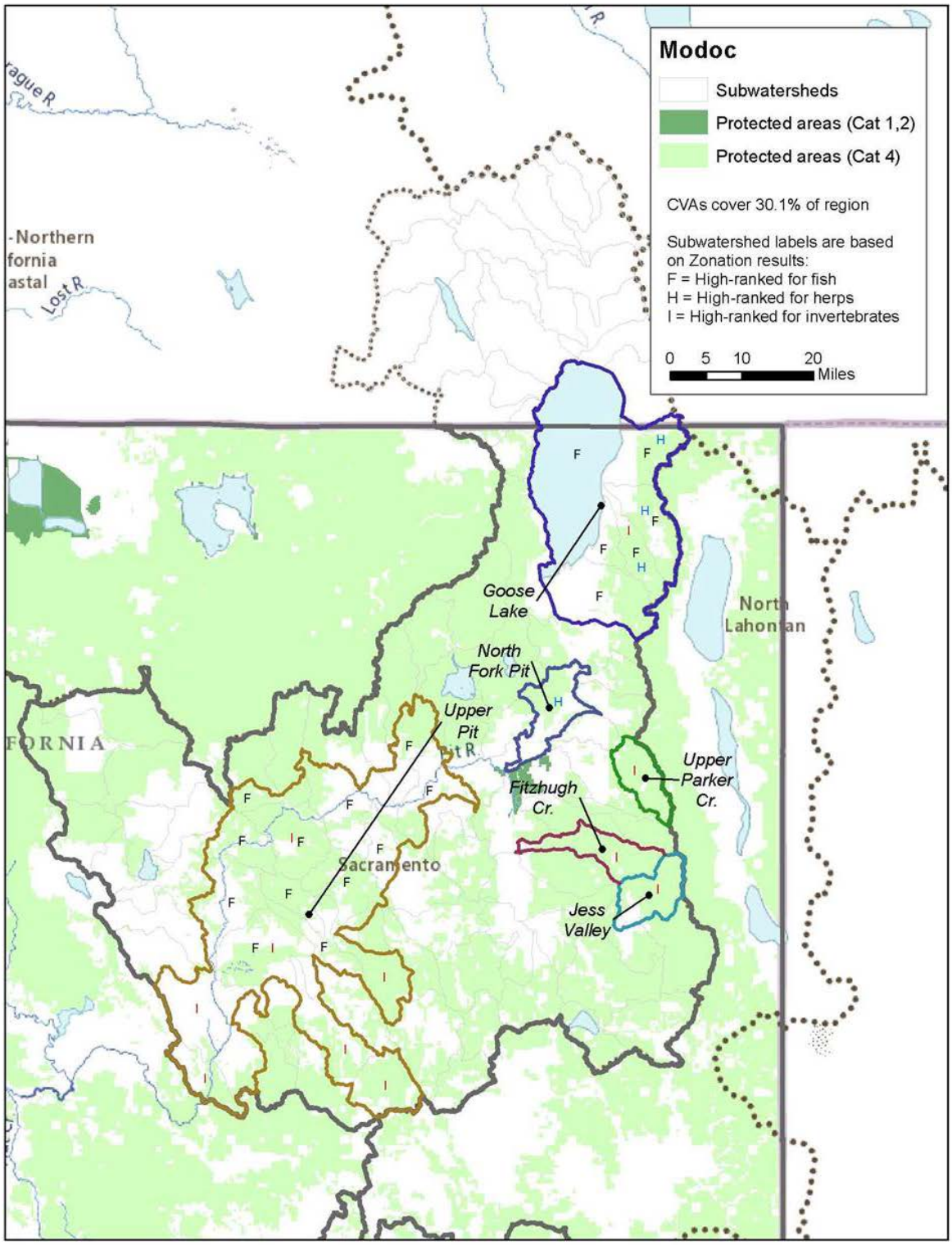


Figure 12: High conservation value areas for North Coast planning region.
F = fish CVA, H = herpetofauna CVA, I = invertebrate CVA.

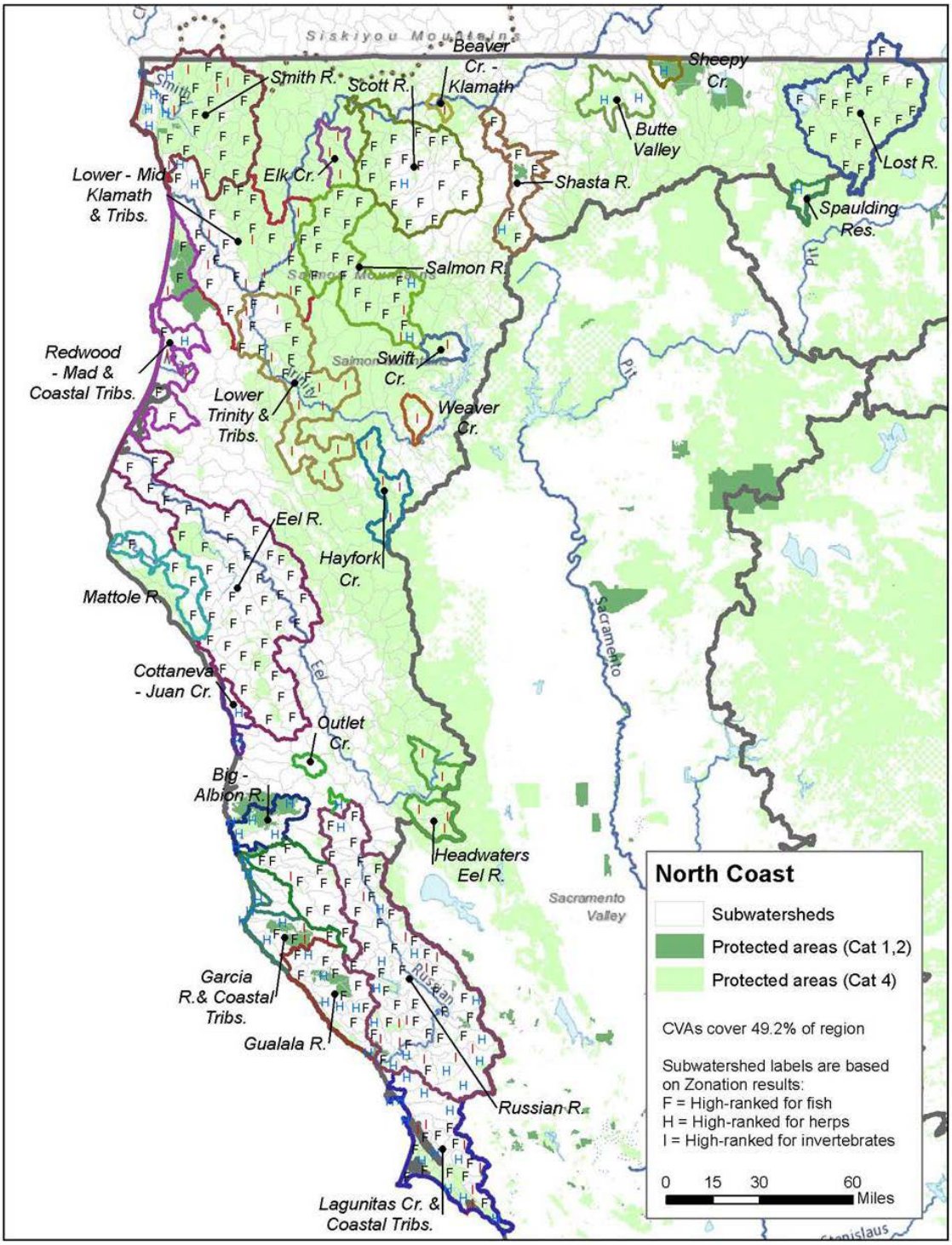


Figure 13: High conservation value areas for Sierra Nevada planning region. F = fish CVA, H = herpetofauna CVA, I = invertebrate CVA.

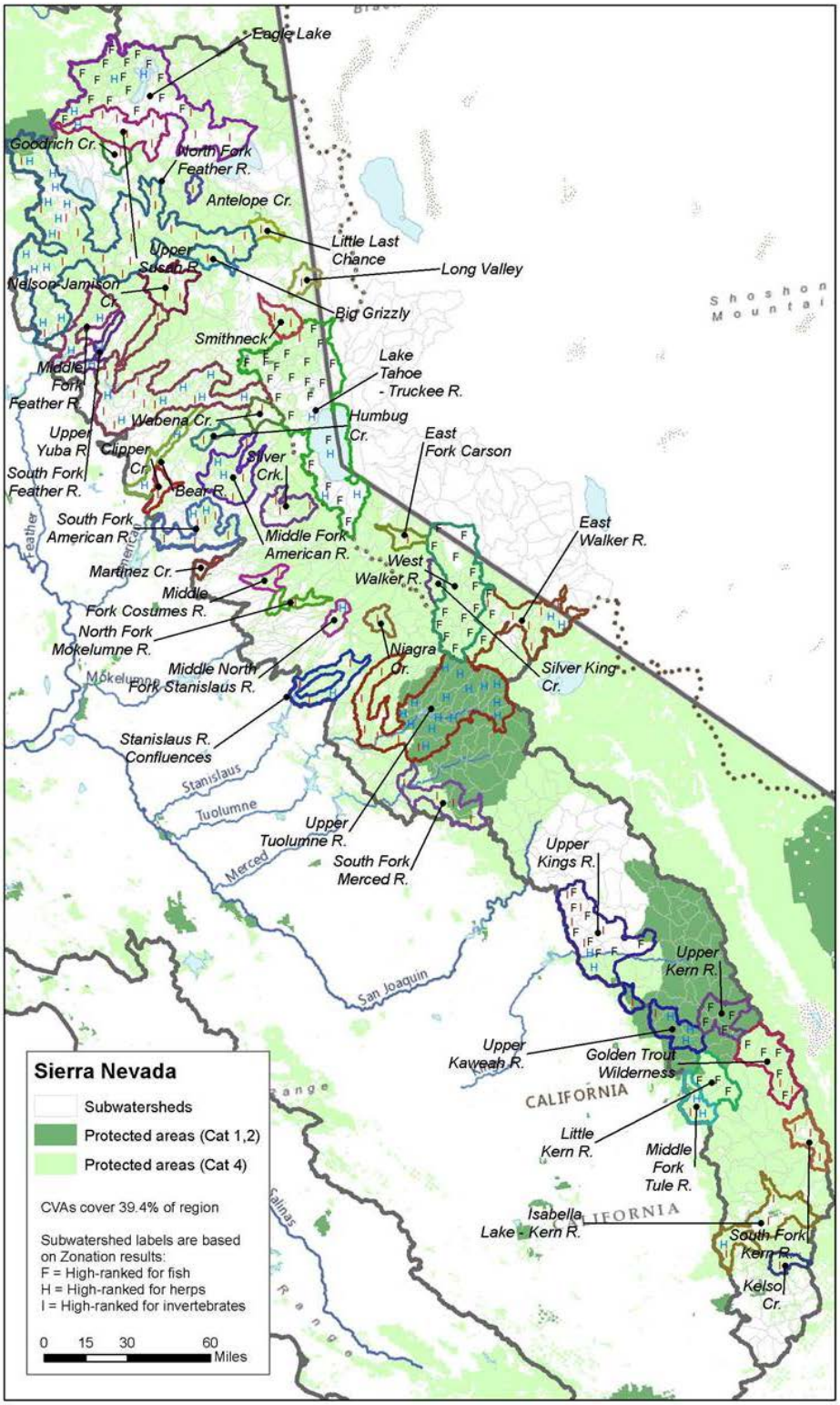


Figure 14: High conservation value areas for South Coast planning region.
F = fish CVA, H = herpetofauna CVA, I = invertebrate CVA.

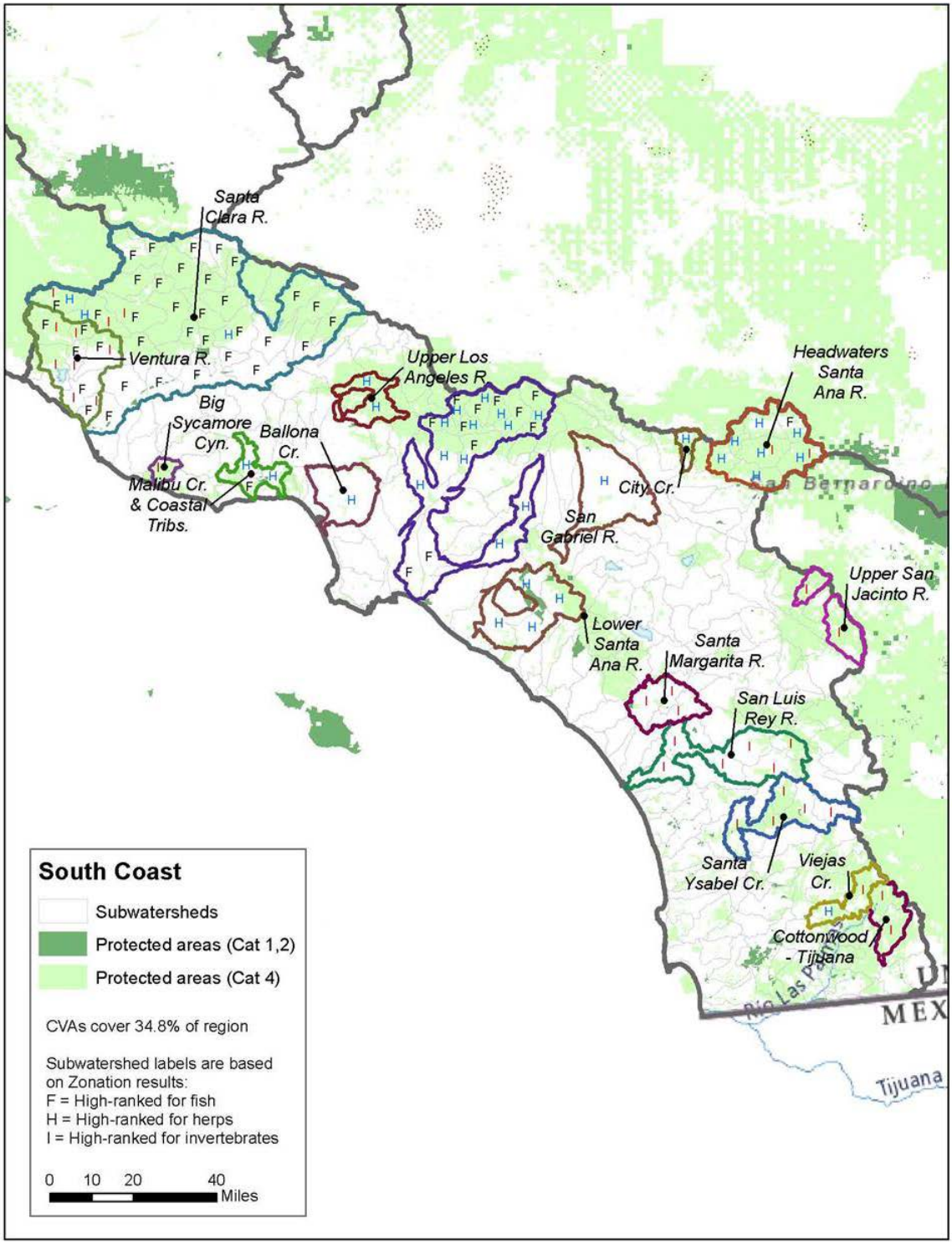
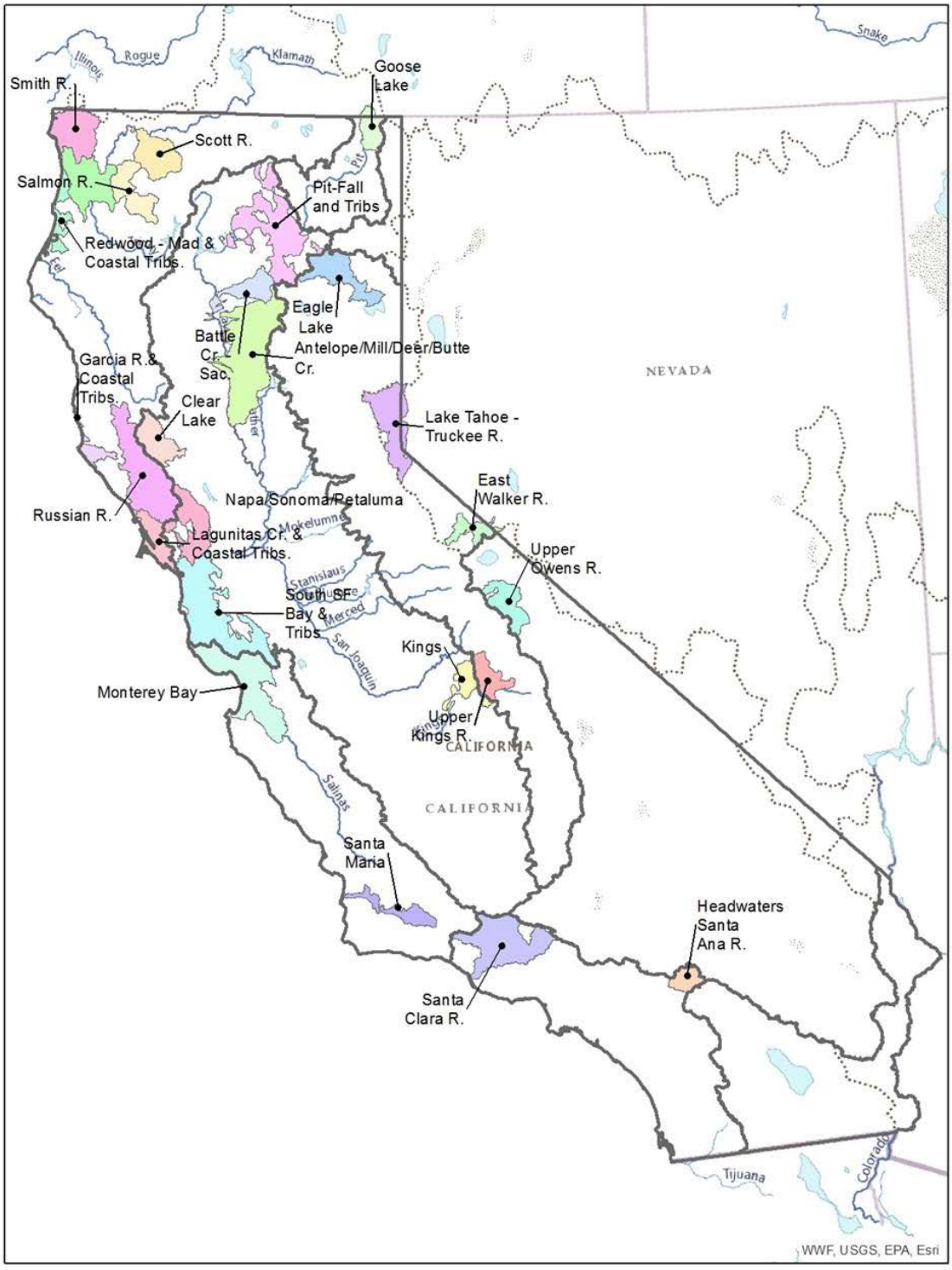


Figure 15: The 100 HUC12 subwatersheds were high conservation value areas overlap for fish, herpetofauna, and invertebrates.



Summary and Next Step

Phase 1 of the California Freshwater Blueprint project fills a gap in our knowledge of freshwater taxa in California including a better understanding of what are freshwater taxa in the state and where those taxa currently occur, and attempts to identify high conservation value areas based on the occurrence of fishes, amphibians, reptiles and invertebrates. We are optimistic that the high value freshwater conservation areas identified represent the best knowledge currently available regarding the occurrence of freshwater targets. However, there are limitations to our knowledge. Specifically we don't have enough systematically collected information about the distribution of most taxa in California, let alone population status.

In addition, most of the invertebrate data comes from bioassessment monitoring, which undersamples certain habitats (non-perennial streams, large rivers, springs, high altitude streams and wet meadows, etc.), many of which are known to have high levels of endemism and might reasonably be expected to be vulnerable to factors like climate change. With that in mind, we acknowledged that these CVAs are based solely on the estimated ranges of the target taxa, and do not consider a suite of factors that may influence the conservation value of a particular area, including habitat quality, taxa life history requirements, and anthropogenic stressors. To the extent possible, that information will be incorporated in Phase 2, where Conservation Priority Areas and conservation strategies will be identified.

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Table 1: List of fish, amphibian and reptile taxa and sensitive invertebrate families considered key conservation targets

Key Target Group	Scientific name	Common name
Fishes - anadromous	*Acipenser medirostris*	Northern green sturgeon
Fishes - anadromous	*Acipenser medirostris*	Southern green sturgeon
Fishes - anadromous	*Acipenser transmontanus*	White sturgeon
Fishes - anadromous	*Entosphenus tridentata*	Pacific lamprey
Fishes - anadromous	*Oncorhynchus clarki clarki*	Coastal cutthroat trout
Fishes - anadromous	*Oncorhynchus gorbuscha*	Pink salmon
Fishes - anadromous	*Oncorhynchus kisutch*	Central Coast coho salmon
Fishes - anadromous	*Oncorhynchus kisutch*	Southern Oregon Northern California coast coho salmon
Fishes - anadromous	*Oncorhynchus keta*	Chum salmon
Fishes - anadromous	*Oncorhynchus mykiss*	Northern California coast winter steelhead
Fishes - anadromous	*Oncorhynchus mykiss*	Northern California coast summer steelhead
Fishes - anadromous	*Oncorhynchus mykiss*	Klamath Mountains Province winter steelhead
Fishes - anadromous	*Oncorhynchus mykiss*	Klamath Mountains Province summer steelhead
Fishes - anadromous	*Oncorhynchus mykiss*	Central California coast winter steelhead
Fishes - anadromous	*Oncorhynchus mykiss*	Central Valley steelhead
Fishes - anadromous	*Oncorhynchus mykiss*	South Central California coast steelhead
Fishes - anadromous	*Oncorhynchus tshawytscha*	Upper Klamath-Trinity fall Chinook salmon
Fishes - anadromous	*Oncorhynchus tshawytscha*	Upper Klamath-Trinity spring Chinook salmon
Fishes - anadromous	*Oncorhynchus tshawytscha*	Southern Oregon Northern California coast fall Chinook salmon
Fishes - anadromous	*Oncorhynchus tshawytscha*	California Coast fall Chinook salmon
Fishes - anadromous	*Oncorhynchus tshawytscha*	Central Valley winter Chinook salmon
Fishes - anadromous	*Oncorhynchus tshawytscha*	Central Valley spring Chinook salmon
Fishes - anadromous	*Oncorhynchus tshawytscha*	Central Valley late fall Chinook salmon
Fishes - anadromous	*Oncorhynchus tshawytscha*	Central Valley fall Chinook salmon
Fishes - range restricted	*Cottus asperrimus*	Rough sculpin
Fishes - range restricted	*Cottus asper subspecies*	Clear Lake prickly sculpin
Fishes - range restricted	*Cottus klamathensis macrops*	Bigeye marbled sculpin
Fishes - range restricted	*Cottus klamathensis klamathensis*	Upper Klamath marbled sculpin
Fishes - range restricted	*Catostomus microps*	Modoc sucker

Fishes - range restricted	*Cyprinodon nevadensis nevadensis*	Saratoga Springs pupfish
Fishes - range restricted	*Cyprinodon nevadensis amargosae*	Amargosa River pupfish
Fishes - range restricted	*Cyprinodon nevadensis shoshone*	Shoshone pupfish
Fishes - range restricted	*Catostomus occidentalis lacusanserinus*	Goose Lake sucker
Fishes - range restricted	*Cottus perplexus*	Reticulate sculpin
Fishes - range restricted	*Cyprinodon radiosus*	Owens pupfish
Fishes - range restricted	*Cyprinodon salinus salinus*	Salt Creek pupfish
Fishes - range restricted	*Cyprinodon salinus milleri*	Cottonball Marsh pupfish
Fishes - range restricted	*Gila coerulea*	Blue chub
Fishes - range restricted	*Lavinia exilicauda chi*	Clear Lake hitch
Fishes - range restricted	*Lavinia parvipinnus*	Gualala roach
Fishes - range restricted	*Lavinia symmetricus subspecies*	Red Hills roach
Fishes - range restricted	*Lavinia symmetricus subspecies*	Clear Lake roach
Fishes - range restricted	*Lavinia symmetricus navarroensis*	Navarro roach
Fishes - range restricted	*Lavinia symmetricus subspecies*	Tomales roach
Fishes - range restricted	*Lavinia mitrulus*	Northern (Pit) roach
Fishes - range restricted	*Rhinichthys osculus subspecies*	Owens speckled dace
Fishes - range restricted	*Rhinichthys osculus subspecies*	Long Valley speckled dace
Fishes - range restricted	*Rhinichthys osculus nevadensis*	Amargosa Canyon speckled dace
Fishes - range restricted	*Rhinichthys osculus subspecies*	Santa Ana speckled dace
Fishes - range restricted	*Siphatales bicolor bicolor*	Klamath tui chub
Fishes - range restricted	*Siphatales bicolor pectinifer*	Lahontan lake tui chub
Fishes - range restricted	*Siphatales bicolor subspecies*	Eagle Lake tui chub
Fishes - range restricted	*Siphatales bicolor snyderi*	Owens tui chub
Fishes - range restricted	*Siphatales mohavensis*	Mojave tui chub
Fishes - range restricted	*Siphatales thalassinus thalassinus*	Goose Lake tui chub
Fishes - range restricted	*Siphatales thalassinus vaccaceps*	Cow Head tui chub
Fishes - range restricted	*Hysterocarpus traskii pomo*	Russian River tule perch
Fishes - range restricted	*Hysterocarpus traskii lagunae*	Clear Lake tule perch
Fishes - range restricted	*Gasterosteus aculeatus williamsoni*	Unarmored threespine stickleback
Fishes - range restricted	*Gasterosteus aculeatus subspecies*	Shay Creek stickleback
Fishes - range restricted	*Spirinchus thaleichthys*	Longfin smelt
Fishes - range restricted	*Thaleichthys pacificus*	Eulachon
Fishes - range restricted	*Entosphenus folletti*	Northern California brook lamprey
Fishes - range restricted	*Entosphenus tridentata*	Goose Lake lamprey
Fishes - range restricted	*Oncorhynchus clarki seleneris*	Paiute cutthroat trout
Fishes - range restricted	*Oncorhynchus mykiss stonei*	McCloud River redband trout
Fishes - range restricted	*Oncorhynchus mykiss subspecies*	Goose Lake redband trout
Fishes - range restricted	*Oncorhynchus mykiss aquilarum*	Eagle Lake rainbow trout
Fishes - range restricted	*Oncorhynchus mykiss gilberti*	Kern River rainbow trout

Fishes - range restricted	*Oncorhynchus mykiss aguabonita*	California golden trout
Fishes - range restricted	*Oncorhynchus mykiss whitei*	Little Kern golden trout
Fishes - wide ranging	*Archoplites interruptus*	Sacramento perch
Fishes - wide ranging	*Cottus asper subspecies*	Prickly sculpin
Fishes - wide ranging	*Cottus aleuticus*	Coastrange sculpin
Fishes - wide ranging	*Chasmistes brevirostris*	Shortnose sucker
Fishes - wide ranging	*Cottus beldingi*	Paiute sculpin
Fishes - wide ranging	*Catostomus fumeiventris*	Owens sucker
Fishes - wide ranging	*Cottus gulosus*	Riffle sculpin
Fishes - wide ranging	*Cottus klamathensis polyporus*	Lower Klamath marbled sculpin
Fishes - wide ranging	*Catostomus luxatus*	Lost River sucker
Fishes - wide ranging	*Cyprinodon macularius*	Desert pupfish
Fishes - wide ranging	*Catostomus occidentalis occidentalis*	Sacramento sucker
Fishes - wide ranging	*Catostomus occidentalis mnioltiltus*	Monterey sucker
Fishes - wide ranging	*Catostomus occidentalis humboldtianus*	Humboldt sucker
Fishes - wide ranging	*Catostomus platyrhynchus*	Lahontan mountain sucker
Fishes - wide ranging	*Cottus pitensis*	Pit sculpin
Fishes - wide ranging	*Catostomus rimiculus*	Klamath smallscale sucker
Fishes - wide ranging	*Catostomus snyderi*	Klamath largescale sucker
Fishes - wide ranging	*Catostomus santaanae*	Santa Ana sucker
Fishes - wide ranging	*Catostomus tahoensis*	Tahoe sucker
Fishes - wide ranging	*Fundulus parvipinnis*	California killifish
Fishes - wide ranging	*Gila orcutti*	Arroyo chub
Fishes - wide ranging	*Leptocottus armatus*	Staghorn sculpin
Fishes - wide ranging	*Lavinia exilicauda exilicauda*	Sacramento hitch
Fishes - wide ranging	*Lavinia exilicauda harengeus*	Monterey hitch
Fishes - wide ranging	*Lavinia symmetricus symmetricus*	Central California roach
Fishes - wide ranging	*Lavinia symmetricus subspecies*	Russian River roach
Fishes - wide ranging	*Lavinia symmetricus subditus*	Monterey roach
Fishes - wide ranging	*Mylopharodon conocephalus*	Hardhead
Fishes - wide ranging	*Orthodon microlepidotus*	Sacramento blackfish
Fishes - wide ranging	*Ptychocheilus grandis*	Sacramento pikeminnow
Fishes - wide ranging	*Pogonichthys macrolepidotus*	Sacramento splittail
Fishes - wide ranging	*Richardsonius egregius*	Lahontan redside
Fishes - wide ranging	*Rhinichthys osculus subspecies*	Sacramento speckled dace
Fishes - wide ranging	*Rhinichthys osculus robustus*	Lahontan speckled dace
Fishes - wide ranging	*Rhinichthys osculus klamathensis*	Klamath speckled dace
Fishes - wide ranging	*Siphatales bicolor obesus*	Lahontan stream tui chub
Fishes - wide ranging	*Siphatales thalassinus subspecies*	Pit River tui chub
Fishes - wide ranging	*Xyrauchen texanus*	Razorback sucker
Fishes - wide ranging	*Hysterocarpus traskii traskii*	Sacramento tule perch

Fishes - wide ranging	*Eucyclogobius newberryi*	Tidewater goby
Fishes - wide ranging	*Gasterosteus aculeatus aculeatus*	Coastal threespine stickleback
Fishes - wide ranging	*Gasterosteus aculeatus microcephalus*	Inland threespine stickleback
Fishes - wide ranging	*Mugil cephalus*	Striped mullet
Fishes - wide ranging	*Hypomesus pacificus*	Delta smelt
Fishes - wide ranging	*Entosphenus similis*	Klamath River lamprey
Fishes - wide ranging	*Lampetra ayersi*	River lamprey
Fishes - wide ranging	*Lampetra hubbsi*	Kern brook lamprey
Fishes - wide ranging	*Lampetra lethophaga*	Pit-Klamath brook lamprey
Fishes - wide ranging	*Lampetra richardsoni*	Western brook lamprey
Fishes - wide ranging	*Platichthys stellatus*	Starry flounder
Fishes - wide ranging	*Oncorhynchus clarki henshawi*	Lahontan cutthroat trout
Fishes - wide ranging	*Oncorhynchus mykiss*	Southern California steelhead
Fishes - wide ranging	*Oncorhynchus mykiss irideus*	Coastal rainbow trout
Fishes - wide ranging	*Prosopium williamsoni*	Mountain whitefish
Herps - generalists	*Thamnophis atratus*	Aquatic gartersnake
Herps - generalists	*Taricha torosa*	California newt
Herps - generalists	*Rana draytonii*	California red-legged frog
Herps - generalists	*Pseudacris cadaverina*	California tree frog
Herps - generalists	*Rana cascadae*	Cascades frog
Herps - generalists	*Thamnophis marcianus*	Checkered gartersnake
Herps - generalists	*Thamnophis sirtalis*	Common gartersnake
Herps - generalists	*Scaphiopus couchii*	Couch's spadefoot toad
Herps - generalists	*Thamnophis gigas*	Giant gartersnake
Herps - generalists	*Spea intermontana*	Great Basin spadefoot
Herps - generalists	*Anaxyrus cognatus*	Great Plains toad
Herps - generalists	*Rana pipiens*	Northern leopard frog
Herps - generalists	*Rana aurora*	Northern red-legged frog
Herps - generalists	*Thamnophis ordinoides*	Northwestern gartersnake
Herps - generalists	*Pseudacris regilla*	Pacific chorus frog
Herps - generalists	*Anaxyrus punctatus*	Red-spotted toad
Herps - generalists	*Taricha granulosa*	Rough-skinned newt
Herps - generalists	*Rana muscosa*	Sierra Madre yellow-legged frog
Herps - generalists	*Rana sierrae*	Sierra Nevada yellow-legged frog
Herps - generalists	*Taricha sierrae*	Sierra newt
Herps - generalists	*Emys marmorata*	Western pond turtle
Herps - generalists	*Spea hammondii*	Western spadefoot toad
Herps - generalists	*Thamnophis elegans*	Western terrestrial gartersnake
Herps - generalists	*Anaxyrus boreas*	Western toad
Herps - generalists	*Anaxyrus woodhousii*	Woodhouse's toad
Herps - generalists	*Anaxyrus canorus*	Yosemite Toad

Herps - lotic	*Anaxyrus californicus*	Arroyo Toad
Herps - lotic	*Dicamptodon ensatus*	California giant salamander
Herps - lotic	*Dicamptodon tenebrosus*	Coastal giant salamander
Herps - lotic	*Ascaphus truei*	Coastal tailed frog
Herps - lotic	*Rana boylii*	Foothill yellow-legged frog
Herps - lotic	*Taricha rivularis*	Red-bellied newt
Herps - lotic	*Thamnophis couchii*	Sierra gartersnake
Herps - lotic	*Rhyacotriton variegatus*	Southern torrent salamander
Herps - lotic	*Thamnophis hammondii*	Two-striped gartersnake
Herps - lentic	*Anaxyrus exsul*	Black toad
Herps - lentic	*Ambystoma californiense*	California tiger salamander
Herps - lentic	*Plethodon dunni*	Dunn's salamander
Herps - lentic	*Batrachoseps campi*	Inyo Mountains salamander
Herps - lentic	*Ambystoma macrodactylum*	Long-toed Salamander
Herps - lentic	*Ambystoma gracile*	Northwestern salamander
Herps - lentic	*Rana pretiosa*	Oregon spotted frog
Inverts - Sensitive mollusk family	*Unionidae*	
Inverts - Sensitive mollusk family	*Margaritiferidae*	
Inverts - Sensitive mollusk family	*Sphaeriidae*	
Inverts - Sensitive mollusk family	*Pleuroceridae*	
Inverts - Sensitive mollusk family	*Hydrobiidae*	
Inverts - Sensitive mollusk family	*Lymnaeidae*	
Inverts - Sensitive arthropod family	*Ameletidae*	
Inverts - Sensitive arthropod family	*Amphizoidae*	
Inverts - Sensitive arthropod family	*Apataniidae*	
Inverts - Sensitive arthropod family	*Athericidae*	
Inverts - Sensitive arthropod family	*Blephariceridae*	
Inverts - Sensitive arthropod family	*Brachycentridae*	
Inverts - Sensitive arthropod family	*Calamoceratidae*	
Inverts - Sensitive arthropod family	*Capniidae*	
Inverts - Sensitive arthropod family	*Chloroperlidae*	
Inverts - Sensitive arthropod family	*Cordulegastridae*	
Inverts - Sensitive arthropod family	*Corduliidae*	
Inverts - Sensitive arthropod family	*Corydalidae*	
Inverts - Sensitive arthropod family	*Deuterophlebiidae*	
Inverts - Sensitive arthropod family	*Dixidae*	
Inverts - Sensitive arthropod family	*Elmidae*	
Inverts - Sensitive arthropod family	*Ephemerellidae*	
Inverts - Sensitive arthropod family	*Eulichadidae*	
Inverts - Sensitive arthropod family	*Glossosomatidae*	
Inverts - Sensitive arthropod family	*Goeridae*	

Inverts - Sensitive arthropod family	*Helicopsychidae*	
Inverts - Sensitive arthropod family	*Heptageniidae*	
Inverts - Sensitive arthropod family	*Isonychiidae*	
Inverts - Sensitive arthropod family	*Lepidostomatidae*	
Inverts - Sensitive arthropod family	*Leuctridae*	
Inverts - Sensitive arthropod family	*Limnephilidae*	
Inverts - Sensitive arthropod family	*Lutrochidae*	
Inverts - Sensitive arthropod family	*Macromiidae*	
Inverts - Sensitive arthropod family	*Nemouridae*	
Inverts - Sensitive arthropod family	*Odontoceridae*	
Inverts - Sensitive arthropod family	*Peltoperlidae*	
Inverts - Sensitive arthropod family	*Perlidae*	
Inverts - Sensitive arthropod family	*Perlodidae*	
Inverts - Sensitive arthropod family	*Petaluridae*	
Inverts - Sensitive arthropod family	*Philopotamidae*	
Inverts - Sensitive arthropod family	*Phryganeidae*	
Inverts - Sensitive arthropod family	*Psychomyiidae*	
Inverts - Sensitive arthropod family	*Pteronarcyidae*	
Inverts - Sensitive arthropod family	*Ptilodactylidae*	
Inverts - Sensitive arthropod family	*Rhyacophilidae*	
Inverts - Sensitive arthropod family	*Scirtidae*	
Inverts - Sensitive arthropod family	*Sericostomatidae*	
Inverts - Sensitive arthropod family	*Taeniopterygidae*	
Inverts - Sensitive arthropod family	*Tanyderidae*	
Inverts - Sensitive arthropod family	*Uenoidae*	
Inverts - Sensitive crustacean family	*Anisogammaridae*	
Inverts - Sensitive crustacean family	*Asellidae*	
Inverts - Sensitive crustacean family	*Astacidae*	
Inverts - Sensitive crustacean family	*Atyidae*	
Inverts - Sensitive crustacean family	*Chirocephalidae*	
Inverts - Sensitive crustacean family	*Crangonyctidae*	

Table 2: Summary of high conservation value areas by planning region

Central Coast Planning Region					
CVA	**Total # HUC12s**	**Fish CVAs (# HUC12s)**	**Herpetofauna CVAs (#HUC12s)**	**Invertebrate CVAs (#HUC12s)**	**Square Miles**
Arroyo Seco	2	0	0	2	63
Big Sur	1	1	0	1	58
Cuyama River headwaters	1	0	0	1	33
Gaviota Creek	6	4	3	0	228
Lower San Antonio	2	0	2	0	78
Monterey Bay	33	33	16	8	1,347
San Antonio Creek	1	1	0	0	38
San Luis Obispo Creek	2	0	0	2	85
San Simeon Creek	1	0	0	1	32
Santa Margarita Creek	1	0	1	0	36
Santa Maria	10	9	3	1	368
Santa Ynez	15	11	4	0	535
Willow Creek	3	1	0	2	78
TOTAL	**78**	**60**	**29**	**18**	**2,981**
				Percent of Planning Region	**26.4%**

Central Valley Planning Region					
CVA	**Total # HUC12s**	**Fish CVAs (# HUC12s)**	**Herpetofauna CVAs (#HUC12s)**	**Invertebrate CVAs (#HUC12s)**	**Square Miles**
Antelope/Mill/Deer/Butte creeks	49	45	8	19	1,970
Battle Creek	14	12	4	1	437
Burney Creek	1	0	0	1	29
Cedar Creek	1	0	0	1	37
Clear Lake	19	18	2	1	524
Corral Hollow	2	0	2	0	64
Cow/Bear Creeks	9	0	2	8	307
Coyote Creek	1	0	1	0	20
Del Puerto Creek	2	2	0	0	74
Elder Creek	1	0	0	1	29

Folsom	1	0	0	1	46
Fresno	3	0	2	1	98
Grapevine	4	0	4	0	144
Kaweah	4	0	2	2	130
Kings	10	8	3	1	316
Lower Sac. & Delta	10	3	0	8	806
McCloud	5	3	4	0	157
Napa/Sonoma/Petaluma	15	1	11	9	693
Pit-Fall and Tribs	38	18	13	23	1,453
Putah Creek	4	0	3	2	141
Sac. - Clear Creek	2	0	0	2	98
Sac. - Lake Shasta	7	0	4	3	174
San Antonio Res.	1	0	0	1	40
San Joaquin	10	8	5	0	404
South SF Bay & Tribs	44	4	42	19	1,713
Squaw Creek Arm	1	0	0	1	35
Squaw Valley Creek	3	0	0	3	131
Stony Creek	1	0	0	1	32
Thomes Creek	1	0	0	1	21
Tule	2	0	2	0	49
Tuolumne	2	2	0	0	66
Upper Sac.	7	0	7	2	216
West Fork Chowchilla	1	0	1	0	56
Yuba R.	4	3	0	1	159
TOTAL	**279**	**127**	**122**	**113**	**10,668**
				Percent of Planning Region	**24.1%**

Colorado Planning Region					
CVA	**Total # HUC12s**	**Fish CVAs (# HUC12s)**	**Herpetofauna CVAs (#HUC12s)**	**Invertebrate CVAs (#HUC12s)**	**Square Miles**
Alamo R.	1	0	1	0	158
Anza Borrego	4	0	1	4	142
Bat Cave Wash	1	0	0	1	35
Colorado River	1	0	1	1	84
San Felipe Creek	6	6	0	0	241
San Gorgonio R.	9	0	9	3	299
Steamboat Cove	1	0	0	1	25
Upper San Felipe Creek	3	0	3	1	120
TOTAL	**26**	**6**	**15**	**11**	**1,104**
				Percent of Planning Region	**10.7%**

Great Basin Planning Region					
CVA	**Total # HUC12s**	**Fish CVAs (# HUC12s)**	**Herpetofauna CVAs (#HUC12s)**	**Invertebrate CVAs (#HUC12s)**	**Square Miles**
Amargosa Creek	1	0	1	0	30
Amargosa R.	21	21	0	0	892
Big Pine Creek	1	0	1	0	41
Bishop Creek	1	0	0	1	33
Cottonball Marsh	1	1	0	0	159
Deep Springs Lake	3	0	3	0	118
Dragon Wash	1	0	1	0	30
Kings Canyon	1	0	0	1	40
Little & Big Rock Wash	10	0	9	3	342
Lower Cottonwood Creek	2	0	1	1	394
Mono Lake	2	0	2	0	117
Piute Valley	1	0	0	1	61
Rush Creek	1	0	1	0	58
Shepherd Creek	3	0	0	3	173
Upper Owens R.	11	4	6	10	497
Waucoba Wash	3	0	3	0	118
TOTAL	**63**	**26**	**28**	**20**	**3,104**
				Percent of Planning Region	**8.6%**

Lahontan Planning Region					
CVA	**Total # HUC12s**	**Fish CVAs (# HUC12s)**	**Herpetofauna CVAs (#HUC12s)**	**Invertebrate CVAs (#HUC12s)**	**Square Miles**
Cow Head	2	2	0	0	82
Lower Alkali Lake	2	0	0	2	71
Middle Alkali Lake	2	1	1	0	111
Smoke Creek	2	0	0	2	90
Upper Alkali Lake	2	0	1	1	67
TOTAL	**10**	**3**	**2**	**5**	**422**
				Percent of Planning Region	**24.4%**

Modoc Planning Region					
CVA	**Total # HUC12s**	**Fish CVAs (# HUC12s)**	**Herpetofauna CVAs (#HUC12s)**	**Invertebrate CVAs (#HUC12s)**	**Square Miles**
Fitzhugh Creek	1	0	0	1	38
Goose Lake	6	6	3	1	327
Jess Valley	1	0	0	1	36
North Fork Pit	1	0	1	0	41
Upper Parker Creek	1	0	0	1	30
Upper Pit	17	12	0	7	664
TOTAL	**27**	**18**	**4**	**11**	**1,135**
				Percent of Planning Region	**30.1%**

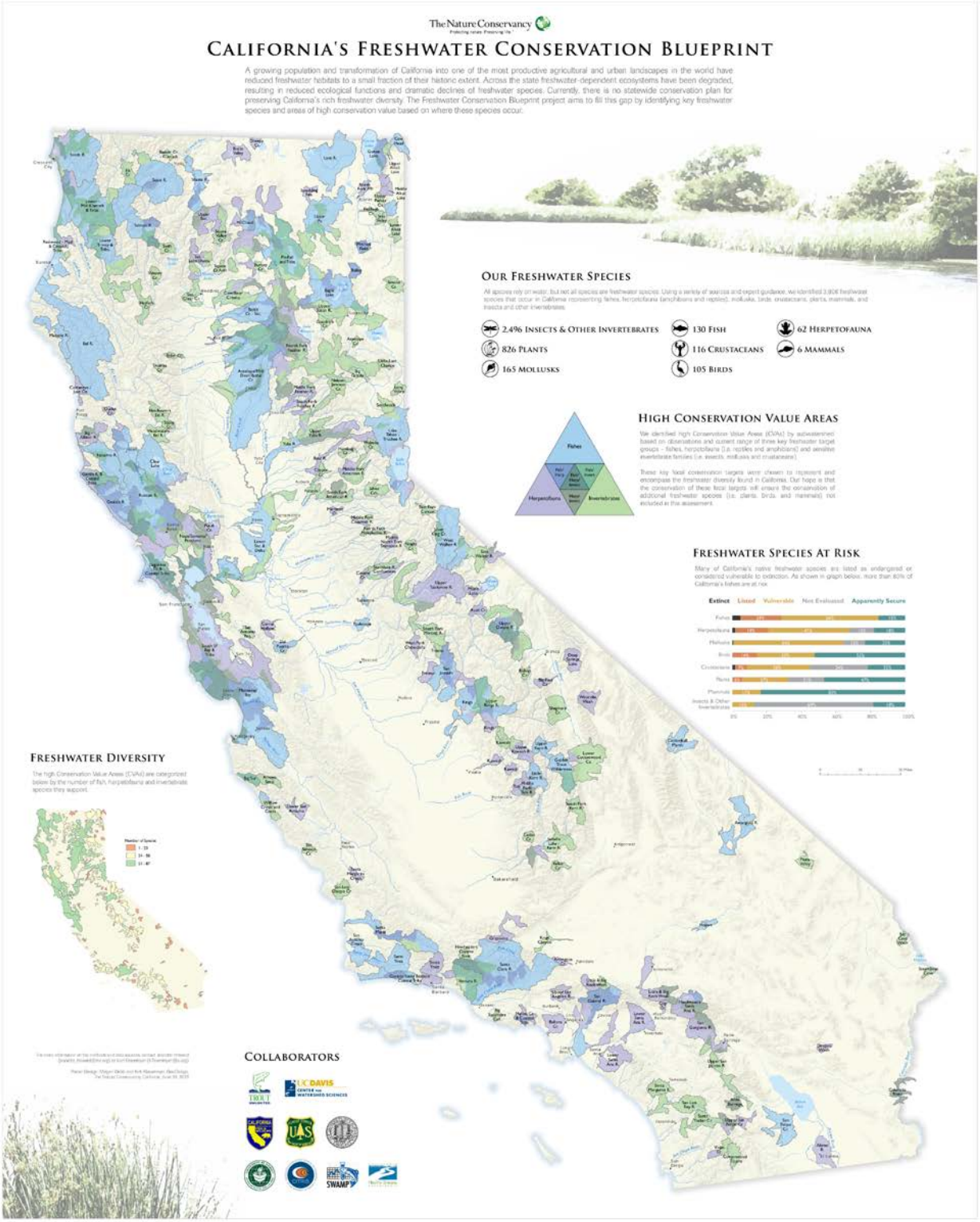
North Coast Planning Region					
CVA	**Total # HUC12s**	**Fish CVAs (# HUC12s)**	**Herpetofauna CVAs (#HUC12s)**	**Invertebrate CVAs (#HUC12s)**	**Square Miles**
Beaver Creek - Klamath	1	0	0	1	19
Big - Albion River	4	0	4	1	150
Butte Valley	2	0	2	0	137
Cottaneva - Juan Creek	2	0	2	0	53
Eel River	38	38	0	0	1,369
Elk Creek	3	0	0	3	95
Garcia River .	6	3	4	3	188
Gualala River	9	8	6	0	347
Hayfork Creek	4	0	0	4	137
Headwaters Eel RIVER	5	0	0	5	181
Lagunitas Creek & Coastal Tribs.	19	11	14	10	471
Lost RIVER	18	18	0	0	630
Lower - Mid Klamath & Tribs.	21	19	3	10	820
Lower Trinity & Tribs.	17	9	0	11	595
Mattole River	4	4	0	0	177
Navarro River	9	9	0	1	315
Outlet Creek	2	0	2	0	45
Redwood - Mad & Coastal Tribs.	7	5	1	2	342
Russian River	40	36	17	13	1,380
Salmon River	17	17	2	2	550
Scott River	19	18	1	1	617
Shasta River	5	5	1	0	208
Sheepy Creek	1	0	1	0	36
Smith River	23	18	5	8	728
Spaulding Res.	1	0	1	0	43
Swift Creek	1	0	0	1	56
Weaver Creek	1	0	0	1	50
TOTAL	**279**	**218**	**66**	**77**	**9,741**
				Percent of Planning Region	**49.2%**

Sierra Nevada Planning Region					
CVA	**Total # HUC12s**	**Fish CVAs (# HUC12s)**	**Herpetofauna CVAs (#HUC12s)**	**Invertebrate CVAs (#HUC12s)**	**Square Miles**
Antelope Creek	1	0	0	1	20
Bear R.	2	0	2	0	81
Big Grizzly	1	0	0	1	52
Clipper Creek	1	0	0	1	42
Eagle Lake	18	16	5	3	674
East Fork Carson	1	0	0	1	43
East Walker River	9	3	2	6	297
Golden Trout Wilderness	5	5	0	2	216
Goodrich Creek	1	0	0	1	44
Humbug Creek	1	0	0	1	36
Isabella Lake - Kern River	5	0	3	3	250
Kelso Creek	1	0	0	1	45
Lake Tahoe - Truckee River	24	21	4	2	882
Little Kern River	3	3	0	0	133
Little Last Chance	1	0	0	1	37
Long Valley	1	0	0	1	46
Martinez Creek	1	0	1	0	20
Middle Fork American River	5	0	2	3	180
Middle Fork Cosumnes River	2	0	1	1	45
Middle Fork Feather River	4	0	3	1	137
Middle Fork Tule River	2	0	2	1	86
Middle North Fork Stanislaus R.	1	0	1	0	41
Nelson-Jamison Creek	4	0	0	4	125
Niagra Creek	1	0	0	1	43
North Fork Feather River	32	0	13	26	1,123
North Fork Mokelumne River	1	0	0	1	49
Silver Creek	3	0	0	3	108
Silver King Creek	1	1	0	1	43
Smithneck	2	0	0	2	69
South Fork American River	6	0	2	6	186
South Fork Feather River	2	0	2	0	48

South Fork Kern River	3	0	0	3	105
South Fork Merced River	4	0	0	4	169
Stanislaus R. Confluences	4	0	1	3	125
Upper Kaweah River	5	0	3	2	157
Upper Kern River	4	4	0	0	114
Upper Kings River	10	8	2	5	375
Upper Susan River	6	0	1	6	198
Upper Tuolumne River	20	0	15	6	728
Upper Yuba River	13	0	8	9	527
Wabena Creek	1	0	0	1	54
West Walker River	15	15	0	0	435
TOTAL	**227**	**76**	**73**	**114**	**8,190**
				Percent of Planning Region	**39.4%**

South Coast Planning Region					
CVA	**Total # HUC12s**	**Fish CVAs (# HUC12s)**	**Herpetofauna CVAs (#HUC12s)**	**Invertebrate CVAs (#HUC12s)**	**Square Miles**
Ballona Creek	1	0	1	0	128
Big Sycamore Creek	1	0	0	1	21
City Creek	1	0	1	0	23
Cottonwood - Tijuana	2	0	0	2	83
Headwaters Santa Ana River	7	1	7	2	251
Lower Santa Ana River	5	0	5	0	413
Malibu Creek	3	1	3	0	71
San Gabriel River	15	11	12	0	564
San Luis Rey River	6	0	0	6	244
Santa Clara River	31	31	6	3	1,241
Santa Margarita River	3	0	0	3	112
Santa Ysabel Creek	5	0	0	5	176
Upper Los Angeles River	2	0	2	0	78
Upper San Jacinto River	2	0	0	2	90
Ventura River	7	6	0	7	244
Viejas Creek	2	0	1	1	72
TOTAL	**93**	**50**	**38**	**32**	**3,812**
				Percent of Planning Region	**34.8%**

Appendix A: California's Freshwater Conservation Blueprint



Download available at
http://scienceforconservation.org/map_gallery/CA_freshwater_conservation_blueprint

Appendix B: Criteria used to define freshwater taxa by taxonomic group

1. FISH

    - Freshwater fishes are defined as those that spawn in freshwater. This also includes several estuarine taxa commonly found in brackish water such as starry flounder, striped mullet and staghorn sculpin.

2. PLANTS

    - Plant taxa that occur exclusively in freshwater and have special adaptations for living submerged in water, or at the water's surface. Includes free-floating aquatic plans and emergent wetland plants rooted beneath the water surface (e.g. *Nuphar polysepala*).
    - Plant taxa that occur primarily in freshwater wetland habitats but are not strictly aquatic (e.g. *Typha angustifolia*).
    - Plant taxa requiring freshwater inundation to complete their life-cycle, such as plants occurring in long-inundated portions of vernal pools (e.g. *Orcuttia californica*).
    - Plant taxa associated with freshwater and aquatic habitats over much of their range or life-cycle as identified by expert botanists.
    - Plant taxa identified in the Jepson Manual of Vascular Plants of California as associated with wetland habitats such as marshes, lakes, vernal pools, fens, springs, and bogs, and dependent on wetland habitat.
    - Plant taxa identified as Wetland Obligates in the U.S. Army Corps of Engineers list of wetland plant taxa.
    - Plant taxa identified as Facultative Wetland plants in the U.S. Army Corps of Engineers list of wetland plant taxa, and identified by expert botanists as dependent on freshwater wetland or aquatic habitats.

3. HERPTEFAUNA

    - Taxa that exclusively rely on freshwater or freshwater-dependent vegetation communities in California in order to complete one or more stages of a reproductive cycle.
    - Taxa that forage within freshwater, either as obligates (e.g., *Actinemys marmorata* and *Thamnophis gigas*), non-obligates (e.g., *T. elegans* and *T. ordinoides*), or as obligates and non-obligates depending on point of ontogeny (i.e., larval and adult amphibian of a single taxa).
    - Relict taxa occurring within mesic microhabitats within xeric landscapes that would not persist in such regions without freshwater springs, such as *Batrachoseps campi* (a plethodontid salamander that does not go through a larval stage).
    - Taxa that do not require freshwater for foraging or any part of their reproductive cycle, but are typically found in California occurring within the splash zone of freshwater springs and creeks, such as *Plethodon dunni* (a plethodontid salamander that does not go through a larval stage).

4. BIRDS

    A) Criteria for Inclusion

- Taxa that exclusively rely on freshwater or freshwater-dependent vegetation communities in California, including taxa strongly associated with riparian vegetation.
- Taxa that breed widely across western North America in freshwater habitats and migrate to California where a substantial portion, but not all, of their wintering habitat consists of freshwater habitats
- Taxa that use coastal waters during winter and migration but rely completely on freshwater for breeding in California (e.g, Harlequin Duck, American White Pelican, Western Grebe)
- Taxa that require freshwater inputs in to saline systems where reductions in freshwater inputs could result in complete habitat loss or substantial changes vegetation and habitat suitability (e.g., taxa that are only found at the Salton Sea , Saltmarsh Common Yellowthroat).
- Taxa that winter or breed in both freshwater and saline wetlands, but have large portions of their California population dependent on inland freshwater habitats, including flooded agriculture.

B) Criteria for Exclusion

- Taxa not dependent on the regular presence of freshwater or freshwater-dependent habitats.
- Taxa that no longer occur in or are not native to the region.
- Taxa were omitted if they are rare and do not contribute in a meaningful way to the avifauna of the region. – i.e., primarily lost "vagrants," even if the occur every year (e.g., Swamp Sparrow, American Redstart).

5. INVERTEBRATES

- Benthic macroinvertebrates (BMIs) are those included on the Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) Standard Taxonomic Effort (STE) list collected as part of freshwater bioassessment in the southwestern United States. The list contains BMI taxa known to occur in streams, lakes, or wetlands, including vernal pools, but special emphasis was placed on stream taxa since freshwater bioassessment is most frequently conducted in that habitat type. The list was compiled from published literature sources and from records in the State Water Board's bioassessment database, the latter being derived from surveys of thousands of stream sites throughout California.
- All taxa in the SAFIT list are benthic in one or more life stages and utilize freshwater habitats in one or more of the following critical life functions: feeding, mating, egg deposition/development, and larval development to maturity.
- The taxa list is more comprehensive for some taxonomic groups than others, reflecting the knowledge base and interests of the authors and other taxonomists at California's Aquatic Bioassessment Lab, availability and regional synoptic coverage of primary taxonomic literature, and likelihood of obtaining properly preserved specimens in typical benthic samples. For example, the list is comprehensive for most aquatic insect groups such as mayflies, stoneflies, dragonflies, caddisflies, beetles, the dipteran suborder Nematocera, etc. The dipteran suborder Brachycera is a notable exception, with most taxa being listed at genus level. The taxa lists also include surface-dwelling groups like Gerridae (water striders, order Hemiptera) and Gyrinidae (whirligig beetles, order Coleoptera), but exclude taxa associated with riparian zones, shore-dwelling taxa, and plant tissue inhabitants in taxonomic groups such as Collembola, Staphylinidae, Heteroceridae, Chrysomelidae, Curculionidae, Saldidae, Isopoda and Amphipoda.

- The list is comprehensive for benthic crustaceans except Ostracoda. The list does not include planktonic microcrustacea (Copepoda and Cladocera). No attempt has been made to provide comprehensive taxa lists for freshwater Annelida (segmented worms) as preservation is typically poor in benthic samples, but generic lists are provided for leeches and polychaetes. Similarly, generic listings are included for Acari (water mites). An extensive taxonomic literature is available for these groups and could support compilation of taxa lists by appropriate experts in future versions. The list also excludes freshwater parasites such as Branchiura and mermithid Nematoda, the Branchiobdella, which are commensals on crayfish, and the Nematomorpha which are parasitic on terrestrial insects but are found in freshwater for part of their life cycle.
- Phylum Mollusca is variably treated: taxa lists are generally comprehensive for taxa that occur in larger streams and rivers, despite improper preservation that prevents taxa-level identifications in typical benthic samples. Pebblesnails (*Fluminicola sp*.) are a diverse group in springs of the southwestern US, but a taxa list has not been included.