CONSERVATION FRAMEWORK AND ASSESSMENT

Prepared for:

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Value All the Pieces

“To keep every cog and wheel is the first precaution of intelligent tinkering.”
Aldo Leopold

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ACRONYMS AND ABBREVIATIONS

BBS	North American Breeding Bird Survey
CalFire	California Department of Forestry and Fire Protection
Caltrans	California Department of Transportation
CBC	Christmas Bird Count
CDFW	California Department of Fish and Wildlife
CHAP	Combined Habitat Assessment Protocols
CNDDB	California Natural Diversity Data Base
CWHR	California Wildlife Habitat Relationships
EDEN	Environmentally Distributed Ecological Networks
GAP	Gap Analysis Program
GHG	greenhouse gas
GIS	geographic information system
GPS	geographic position system
HAB	Habitat and Biodiversity
HCP	Habitat Conservation Plan
HUC	hydrologic unit code
IBIS	Integrated Habitat and Biodiversity Information System
IUCN	International Union for the Conservation of Nature
KEC	key environmental correlates
KEF	key ecological functions
MFRI	Mean Functional Redundancy Index
NCCP	Natural Community Conservation Plan
NHD	National Hydrography Dataset
NHI	Northwest Habitat Institute
PAD-US	Protected Areas Database of the United States
RTP/SCS	Regional Transportation Plan/Sustainable Communities Strategy
SCAG	Southern California Association of Governments
SCMP	South Coast Monitoring Plan
U.S.	United States
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

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EXECUTIVE SUMMARY

The biodiversity of Southern California is considered one of the most highly threatened in the United States (U.S.), with habitat conversion and urbanization the most cited causes of species extirpation (Regan et al. 2007, Tennant et al. 2001). The Southern California Association of Governments (SCAG) is offered this conservation framework and assessment as an approach that will account for impacts and improvements in a consistent manner across all habitats and landscapes. Further, this assessment shows that information is scalable and that looking at one scale provides some insight at another scale. An example of this is provided using the regional information and comparing it to a site in Prado Basin. A key purpose of the strategy is to create a comprehensive database for the SCAG Region as well as develop planning resources for wildlife and open spaces (natural areas) that county transportation commissions and local jurisdictions could use to support their own planning endeavors

The conservation assessment for SCAG differs from most in that it does not prioritize specific lands for conservation, but instead follows a more holistic approach to conservation that gives value to all parts of the landscape. Additionally, it keeps all possible options on the table, rather than precluding them as some prioritization methods can. This assessment also includes a multi-species habitat evaluation method, Combined Habitat Assessment Protocols or CHAP. This method can assess habitat value(s) for regional and site-specific projects, evaluate and can track credits from impacts to mitigation (including advance mitigation), and serve as a foundation for assessing carbon trading. Thus, CHAP has the ability to support the conservation strategy goals and objectives. Finally, this conservation approach advocates citizen science and the use of the outdoors as a learning environment under the structure of Environmentally Distributed Ecological Networks (EDENs).

Forty-three species, or 8% of the total vertebrate, non-fish species in the SCAG region, have a state or federal listing status of threatened or endangered. Additionally, 9 fish and 8 invertebrate threatened or endangered species occur in the region, bringing the total number of listed animal species potentially occurring in the region to 60. Currently, the number of protected areas within the six counties consists of about 3,606 sites, which cover about 35% of the entire SCAG area. But the majority of the protected sites occur in remote, desert areas, and they are not distributed equally among basins or habitat types. For example, only 7% of the total area of the Santa Ana Basin is protected, with less than 3% of valley foothill riparian habitat and only 4% of coastal scrub habitat protected in that basin. Excluding the non-natural land cover types (urban, agriculture, and eucalyptus), the habitat types with the lowest amount of protection in the SCAG region are valley foothill riparian, valley oak woodland, and coastal scrub, all of which have less than 10% of their total area in a U.S. Geological Survey Gap Analysis Program (GAP) 1 or 2 protected status. These habitat types also tend to have high per-acre habitat values and might serve as focal habitats for conservation action.

Lastly, acquiring data and conducting ongoing monitoring are essential pieces to SCAG's framework and to maintaining a viable and up-to-date conservation strategy. There are about 18 million people within the SCAG region; SCAG can embrace this resource to help meet their conservation goals and objectives. An excellent way to obtain additional insight about local resources is to use EDENs and citizen science. Establishing EDENs in Southern California can facilitate the evaluation of ecological processes and species along an environmental gradient. They lend themselves to simple observations or experimental inquiries and can focus on populations or ecosystem mechanisms. Thus, EDENs can serve as a platform for SCAG to link scientists with interested volunteers and community groups to explore a host of various questions. The California Ocean Science Trust provides an excellent example of engaging citizen science using protected areas.

INTRODUCTION

The Southern California Association of Governments (SCAG) is the Metropolitan Planning Organization in the United States (U.S.) serving six counties: Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura. SCAG's area of influence reaches over 18 million people covering more than 38,000 square miles. Acting as a Metropolitan Planning Organization, SCAG is responsible for developing a Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) that provides a long-term blueprint for a sustainable transportation system that integrates land use strategies to achieve targets for reductions in greenhouse gas (GHG) emissions.

Part of the RTP/SCS is a commitment to develop an open space conservation strategy to help mitigate planned activities. Within the RTP/SCS is a Conservation Policy that provides guiding steps to developing a conservation strategy:

- Engage in a strategic planning process to determine the critical components and implementation steps for identifying and addressing open space resources;
- Identify and map regional priority conservation areas based on most recent land use data for future consideration and potential inclusion in future plans;
- Engage with various partners, including county transportation commissions, and build from existing local efforts to identify priority conservation areas and develop an implementable plan; and
- Develop regional mitigation policies or approaches for the 2016 RTP/SCS.

A key purpose of the strategy is to create a comprehensive database for the SCAG Region as well as develop planning resources for wildlife and open spaces (natural areas) that county transportation commissions and local jurisdictions could use to support their own planning endeavors. Further, the conservation strategy would also encourage and support a regional open-space conservation program and/or a regional advance mitigation plan. The strategy is flexible in that it could build off existing local plans and also could be designed to meet the needs of individual stakeholders.

In developing a regional conservation strategy, the first step is to create a regional habitat conservation assessment and database. This report addresses the conservation assessment while the regional database was completed by Leidos earlier this year (in *Existing Information and Data Gaps for Natural Resources in the SCAG Region*, January 2014). Key components of the conservation assessment address biodiversity, water resources, ecosystem services, and climate change resilience through:

- Protection of sensitive, rare, threatened, and endangered species and essential, critical, rare, and unique habitats, including wetlands, riparian areas, oak woodlands, coastal sage scrub, and others;
- Ensuring that the full range of habitat types are identified and represented as important areas for conservation;
- Enhancing natural lands contiguity and maintaining critical landscape inkages;

- Ensuring watershed integrity and protecting groundwater and surface water sources;
- Protecting key habitats and landscapes that provide resilience to climate change; and
- Documenting the wide range of ecosystem services provided by open space lands.

This document is the conservation assessment component of SCAG's conservation strategy process, conducted using the Combined Habitat Assessment Protocols (CHAP) method developed by the Northwest Habitat Institute (NHI). CHAP interprets publicly available information to determine its findings; however, calculating habitat value is a patented process. CHAP provides an assessment of conservation potential at coarse and fine scales and depicts them in a spatial format. This report hallmarks a conservation strategy that incorporates CHAP, a habitat evaluation approach, to demonstrate a coarse-scale assessment for the entire SCAG region. Additionally, it includes an assessment at the fine scale using the Prado Basin, which is the largest riparian woodland in the SCAG region (Faber et al. 1989). The use of CHAP to conduct the conservation assessment is different from other approaches in that it incorporates a habitat and biodiversity accounting system that allows a consistent evaluation of species, habitats, and functions to be applied at various hierarchical scales. This report illustrates the findings and differences that occur between coarse- and fine-scale levels of evaluation. The purpose is to allow SCAG and its stakeholders to have a comparative idea of how information changes from one scale to the next.

REGIONAL CONSERVATION PLANNING: COARSE VS. FINE FILTER APPROACHES

Conservation strategies are designed to address land use issues at multiple scales. For example, a regional conservation program can incorporate actions to recover individual threatened and endangered species while also looking at a landscape level to maintain the diversity of more secure native plant and animal communities. These two complementary approaches have been described as "fine-filter" and "coarse-filter" strategies.

The coarse-filter approach typically employs an assessment of biodiversity based on species and their habitats (NHI 2004). The fine-filter approach is exemplified in actions taken in support of the Endangered Species Act and usually occurs at the local level and applies local information. Biodiversity assessments can occur in both approaches; *biodiversity* is the variability among living organisms within and between structures at the genetic, species, and ecosystem (or habitat) levels. Biodiversity is also the underpinning of a functioning ecosystem and ensures the delivery of ecosystem services (Reyers et al. 2012, World Economic Forum 2010).

The concept behind the coarse-filter approach is to conserve vegetation/habitat types while also protecting the plant, invertebrate, and vertebrate species associated with them. This premise implies that vegetation serves as a satisfactory indicator of the environmental variables that interact on a particular site (Specht 1975, Thomas 1979) and, as such, assumes that plant communities can serve as surrogates for ecosystems and the elements of biodiversity (Noss and Copperrider 1994). However, delineating and assessing any conservation goal relies solely on the quality of the underlining data and information that support the program.

Several recent conservation efforts have demonstrated this broader focus. These efforts do so by 1) identifying and mapping locations of habitats, species, and areas; 2) identifying lands currently managed for biodiversity values and then developing methods to identify and conserve areas that will complement that existing conservation network on private and public lands; and 3) developing easily accessible information sources that can be used as tools by natural resource managers and the public to increase awareness and understanding of a) habitats at risk; b) function, distribution, and abundance of habitats; and c) effects of land management activities (Washington Dept. of Fish and Wildlife 1996, Colorado Div. of Wildlife 1998).

This report demonstrates a quantitative approach to valuing landscapes and how the valuations can change over time based on management actions. Generally, to achieve the desired conservation goal, most processes rely on both subjective and quantitative techniques, with the latter often used to aid in the decision-making process (Colorado Division of Wildlife 1998). Important components of quantitative approaches include well-defined goals, an appropriate spatial scale for the analyses, analyses conducted at several scales (e.g., local, watershed, basin, and/or state), an understanding of the limitations of the maps that are used (e.g., resolution, accuracy, and habitats and habitat elements that may be excluded), appropriate units for the analyses, and indices of viability and threat.

Critical to most conservation planning efforts is the ability to: 1) map habitats and species distributions, 2) identify the habitat associations of species, 3) identify levels of protection within a landscape, and 4) understand the changes that have occurred in the landscape over time. Therefore, several types of maps and digital information are useful to conservation efforts, including maps of current and historical vegetation and habitat types, species distribution, critical habitat, and protected areas. Coarse-level maps provide a good source of information about some of the vegetation, habitat, and landforms currently existing on the landscape. They can also provide a general idea of the range of habitat types that are represented in protected areas. Generally, these maps do not adequately represent small features or linear features such as wetlands, riparian areas, and small areas of specific vegetation or habitat types. In addition, many fine-scale features such as structure, habitat elements, and presence of individual plant species generally are not included (Scott et al. 1993, Short and Hesbeck 1995).

At issue with developing a prioritization of the landscape is the attempt to label the entire landscape from “good to bad” and/or “best to worst.” This schema gives the impression that lesser valued landscapes have a lower degree of importance and are only considered in conservation process as an afterthought or as something that can be traded away. But such an approach removes options (current and future) for the conservation planner, whose principal premise is to keep all the pieces because they all have value. This premise stems from the work of renowned environmentalist Aldo Leopold, who stated, “To keep every cog and wheel is the first precaution of intelligent tinkering.”

While prioritizing management actions based on available funding is appropriate, labeling the landscape with a broad-brush qualitative judgment can be misleading. Prioritizing landscape values locks the landscape in time based on current conditions, giving the impression it is stagnant and gives no consideration for ecosystem functions or the services they can provide. In addition, restoration efforts are largely ignored. Furthermore, prioritizing landscape values confounds the public by giving the impression that, once high-value habitats/areas are addressed or protected, conservation is complete. As a result, ecosystem tradeoffs are largely not discussed, adjacency issues are often not captured or considered, and backcasting strategies are usually not applied. The landscape is a system of parts, and these parts can be reassessed and restored or enhanced, thus raising the value of lesser or degraded land to meet a conservation goal or objective.

Therefore, most past and present conservation schemas come from the perspective of the “here and now.” They look at the present landscape as it is and then try to fit or develop a conservation strategy to what they have. The approach is to give the end user a current idea of what might be possible in the present environment. In short, the desire is to use it as an ecological infrastructure from which to build upon. This kind of an approach is valid but also holds some shortcomings. Principally, at the coarse-level assessment it is driven by: 1) lack of detailed spatial data, 2) lack of flexibility to the notion that the landscape is continually changing, 3) lack of ability to scale downward to the finer or local level, 4) lack of ability to account for local environmental improvements and to account for them in a consistent manner, and 5) lack of ability to account for impacts to the land in a consistent manner. Thus, resource planners are often awash in data but in reality lack information. At issue is that the resource planners actually seek just the opposite approach, one that can transcend down to the local level to ascertain baseline condition and also serve as a reality check. Though there is a keen desire for finer resolution information, it clearly comes with increased costs.

BUILDING A FRAMEWORK

In constructing a conservation framework for Southern California, it is important to consider that the regional landscape has a large anthropogenic imprint that influences the inherent value of its ecosystems. As such, we offer a conservation approach that allows for maintaining redundancy and diversity and looks at connectivity to allow species adaptability. The proposed conservation planning framework is built on scientific principles that can help guide the conservation strategy (Box 1). The scientific principles are rooted in the literature and are broad enough to provide a constant basis for the conservation program. While a vision statement is a policy choice about what the conservation program could accomplish, the guiding principles help frame a common understanding of the biological realities that will direct how the program is accomplished.

Box 1. Guiding Principles for a Conservation Framework[1]

1. The abundance, productivity, and diversity of organisms are integrally linked to the characteristics of their ecosystems.
2. Ecosystems are dynamic, resilient, and develop over time.
3. Biological systems are organized hierarchically.
4. Environments and habitats develop, and are maintained, by processes related to climate, geology, and hydrology.
5. Species play key roles in maintaining ecological conditions.
6. Biological diversity allows species to accommodate environmental variation.
7. Ecosystem function, habitat structure, and biological performance are affected by human actions.
8. Ecological management is adaptive and experimental.
9. Citizens are capable of making a valuable contribution to science if they are trained in a structured format.

[1] The guiding principles 1 to 8 are from work in which NHI participated in 2001 and can be found in *A Multi-Species Framework Approach that Integrates Fish, Wildlife, and Ecological Functions* (Northwest Power Planning Council 2002). Principal 9 has been added here to reflect the recent rise and interest in including citizen participation in science.

Overall Approach

In this conservation strategy development process, an approach is offered that will account for impacts and improvements in a consistent manner across all habitats and landscapes. Further, it shows that information is scalable and that looking at one scale provides some insight at another scale.

Other considerations in developing a conservation strategy can include capturing the dynamics of the landscapes, such as tracking climate change and other environmental impacts, and monitoring projects as well as assessing cumulative impacts. A principal outcome of a conservation strategy is to depict a series of subjective ratings consistently across the landscape. To date, there has been no attempt to depict quantitative ratings consistently across the landscape and then step the quantitative rating down to the local level. This assessment does so using CHAP and also shows the overall functions that appear limiting within the region.

Benefits of Using Combined Habitat Assessment Protocols (CHAP)

CHAP has been applied as a framework for conservation planning across the western US. Its methodology establishes a habitat value based on assessment of species, habitat, and functions. It determines habitat quality by using common definitions, mapping standards, and a consistent and comprehensive inventory of an area at the fine scale. The CHAP approach can account and track the triad of components (species, habitat, and functions) to establish an appraised habitat value. The habitat value produced by CHAP is a major improvement over older methods (e.g., Marxan [Ball et al. 2009]) because it is the first approach that relies on a biological accounting system rather than "black box" models. CHAP, which is fundamentally a spatial approach, can integrate other inventory data with geographic information system (GIS) data along with other datasets, as well as include steps to verify or validate these datasets. It focuses on wildlife habitat and its biodiversity and can also complement other resource evaluations. CHAP also uses components that are easy to understand, like developing a species list and mapping habitat types. These components along with incorporating the basic ecology of a species, what habitat features it uses and their principal ecological roles they perform, serve as a basis for evaluation.

CHAP uses a variety of in-office and/or on-the-ground metrics to measure habitat quality by evaluating biodiversity within a habitat type and/or structural condition. The outcome of this evaluation is a Habitat and Biodiversity (HAB) metric that gives a per-acre value for each homogeneous polygon delineated. This HAB metric accounts for species, habitats, and functions at a site that are joined to a peer-reviewed Integrated Habitat and Biodiversity Information System (IBIS) to create appraised "values" between different areas, as well as areas under different management activities. Originally developed for the Pacific Northwest, IBIS is a relational database containing extensive information on vertebrate species and their habitats. More recently, California species and habitat information have been integrated into IBIS using information from the California Wildlife Habitat Relationships (CWHR) data, so it can serve as a standard for the entire west coast.

Since its inception in 2005, CHAP has continued to evolve to work in more applications and new areas as additional peer-reviewed datasets and range maps are added. Between 2007 and 2009, it has been endorsed and used by a wide range of federal and state agencies. CHAP was endorsed by the Oregon Governor's Office for assessing mitigation and was used by the Los Angeles District of U.S. Army Corps of Engineers (USACE) for the Los Angeles River Ecosystem Restoration Study. In addition, CHAP is being used for the San Francisco Bay South Shoreline Study that is investigating sea level rise. It has undergone several independent scientific reviews, and the CHAP concept was published in the National Academies of Science Transportation Research Record (O'Neil et al. 2008, USACE 2014).

Following are the top 10 advantages and benefits of CHAP:

1. CHAP is more than a model; it is a biological resources accounting system and can, therefore, be used specifically for conservation and mitigation planning.

2. CHAP addresses functionality of natural communities and ecosystems rather than simply tallying pre-entered priorities.

3. CHAP is scalable from regional to project level analysis (can "tunnel down" from landscape to project site level). Using its comprehensive landscape approach can inform more effective conservation and restoration at the site or project level.

4. CHAP can be used for watershed evaluations with the U.S. Geological Survey (USGS) hydrologic unit code (HUC) system.
5. CHAP is polygon-based, using a watershed unit system, rather than hexagon-based; thus, CHAP allows use with more types of natural resources datasets and better reflects on-the-ground conditions.
6. CHAP can develop functional assessment profiles and total functional diversity values of natural communities and ecosystems, as well as functional specialist, and can be used to assess habitat for all wildlife species, tied to the Integrated Habitat and Biodiversity Information System, a peer-reviewed dataset linked to the CWHR data.
7. CHAP can be used to develop carbon assessment values to address climate change considerations where appropriate GHG generation/sequestration data are available.
8. CHAP allows scenario building and the incorporation of historical information, such as fire history and other catastrophic event histories.
9. CHAP uses existing software (i.e., ESRI's Arc/GIS) that SCAG already has and uses and has a participatory GIS function that may be used to include stakeholders in the process.
10. CHAP can evaluate impacts (including cumulative impacts) and mitigation at the finer scale, hence a more comprehensive assessment of development throughout the area can be achieved and monitored and can be used for advanced mitigation.

The CHAP tool can be used at all scales/resolutions, a feature that makes it stand apart from other conservation planning tools. Figure 1 provides an example of habitats mapped at coarse-, intermediate-, and fine-scale levels. Examples of CHAP capabilities are presented in the following sections.

COMPARISON OF COARSE- TO FINE-SCALE ANALYSES

For the first time in a conservation strategy, we will show the differences that exist between coarse- to fine-scale assessments. Reviewing information at multiple scales allows one level to inform the other. The multi-scale assessment includes a discussion on species occurrence, change in habitat values, and differences between mapping at the regional level versus a project site.

Species Lists

Initially, both the regional and the local analyses begin with a species list that is generated using CWHR range maps. The coarse-scale species list (Appendix C) that also includes feral and non-native species is based simply on species' potential presence or absence in a given basin. The fine-scale species list (Appendix D, Table D-1) is adjusted using expert knowledge of local conditions and species distribution. The habitat evaluation team for the project reviews the list and refines it based on site-specific knowledge. As a result, the site-specific list tends to be smaller than the initial list as species not known to occur at the site are removed. However, as was done with the Prado Basin assessment, sometimes species are added to the fine-scale species list, such as invasive fish or rare species known to occur locally at the site but outside of their mapped CWHR range.

Habitat Value

When moving from the coarse scale to the fine scale, the per-acre habitat values for a given area change for several reasons. First, there are differences in species lists, as explained above. Second, the habitat delineation is based on aerial and field mapping and includes smaller patches of habitat that likely would not be apparent on a coarse-scale habitat map. Third, the calculation of the per-acre value at the fine scale accounts for structural conditions, key environmental correlates (KECs) present at the site, and presence of invasive plant species. Thus, habitat types are further broken down at the fine scale so that polygons of the same habitat type at a site may have different per-acre values based on structural conditions, KECs, and invasive species (see Appendix F, Maps F-5 – F-10). At the coarse scale, all habitat patches of the same habitat type within the evaluation unit (e.g., basin) have the same habitat value, regardless of invasive species, structural condition, and KECs.

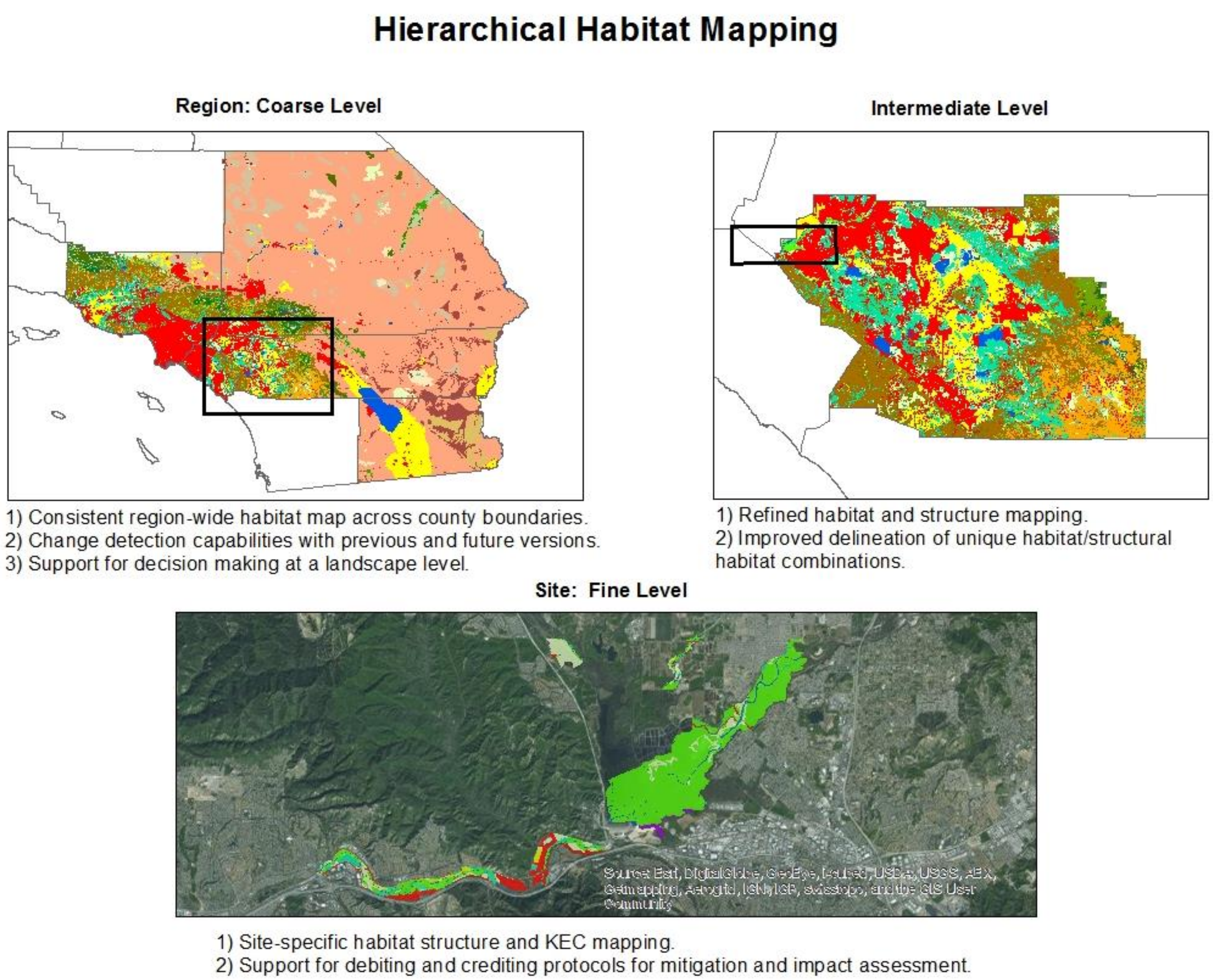

Figure 1. Example of Habitat Mapped at Different Hierarchical Scales, All of Which the CHAP Tool Can Address

MITIGATION

A mitigation method is included that can be viewed as a means to fund and/or implement the goals of this conservation strategy. CHAP can provide and track species, functions and habitat quality for habitat assessment, impact evaluation (debiting), and mitigation (crediting) when impacts are unavoidable. CHAP is primarily a multi-species approach that can assess hundreds of species concurrently, as well as address single-species evaluations. CHAP establishes ecological criteria for assessing habitat quality, and its products support mitigation, conservation planning, and conservation banking. Species-habitat-function relationship information is stored in the IBIS accounting system, which is integrated into CHAP's inventory and evaluates site "values." Because of this innovative approach and applying consistent protocols, a site's baseline and future conditions, as well as different management activities, can also be determined.

Because the CHAP approach is a biological accounting system, it is also capable of evaluating debits and credits. Figure 2 shows a conceptual diagram for assessing baseline conditions for impact (debits) and mitigation (credits) at a site. To get a complete accounting, the CHAP approach needs to be applied to both sites at the same level of evaluation so that a comparison can be done. A step-by-step general discussion of the CHAP method follows that outlines the principles employed and outcomes generated. For a specific example of developing baseline condition values, please see Appendix E, *Pilot Fine-Scale Assessment: Prado Basin*.

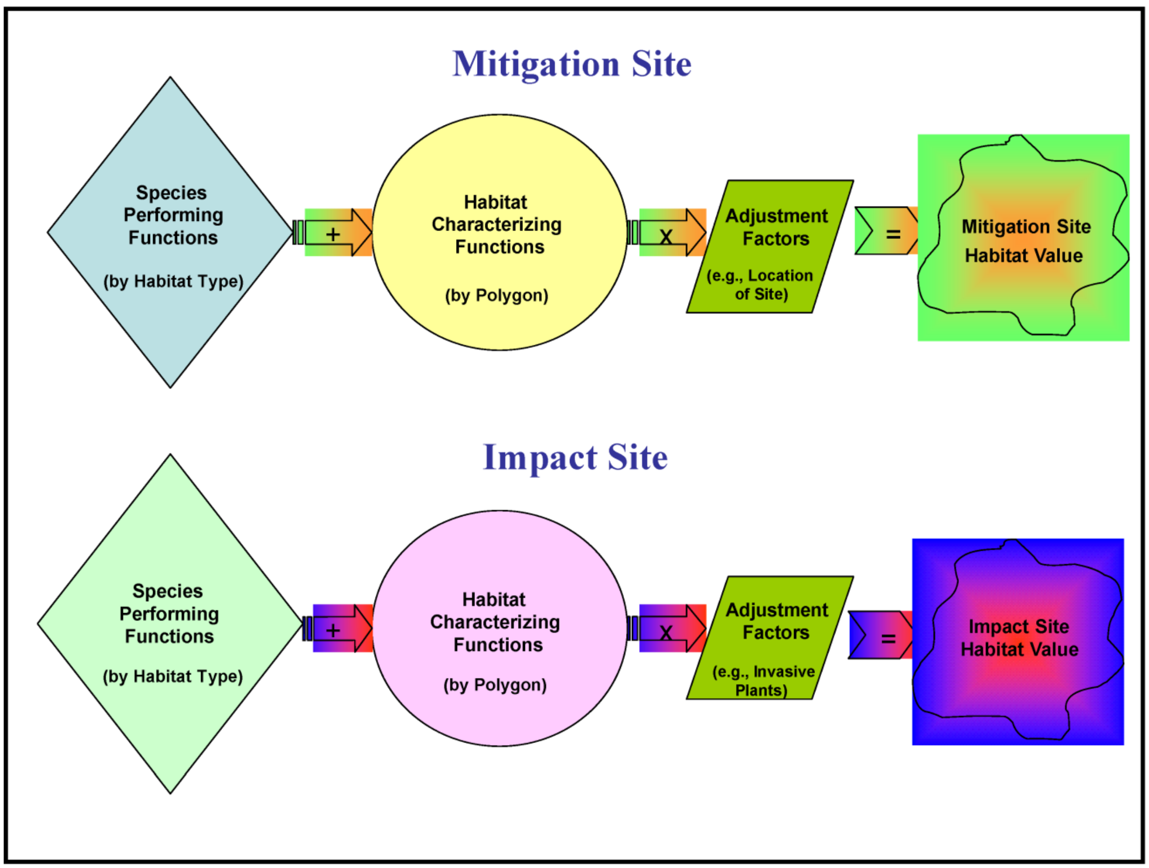

Figure 2. Conceptual Approach for Evaluating Baseline Conditions of an Impacted and Mitigation Site

STEPS PERFORMED AT THE IMPACT & MITIGATION SITE(S):

Step 1 – Initial Preparation Field Data Collection

The coarse scale information for mitigation comes into play when determining where to site a mitigation bank or create a service area for where off-site mitigation for impacts can occur. But as mentioned earlier, if the goal is to require mitigation at the site level then CHAP's fine scale approach is needed. The first step when implementing a fine scale assessment is to focus on determining a project or site's boundaries. Often the soliciting agency or party will have paper or a digitally spatial GIS file already available. But this information often requires refinements that require further registration information to digitally reference the site, like historical records, tax lot information, and/or local knowledge of resource managers. Once the project boundaries have been established, high-resolution aerial photography is obtained to establish a geographic control and base to begin delineating the ground features present at the site. A good source for this information is the National Agriculture Imagery Program or NAIP. Analysts use the photography and GIS software to interactively parse up the landscape within a site's boundary into discrete polygons representing homogenous groupings of fish and wildlife and fish habitat types and structural conditions visible in aerial imagery. For aquatic groups, like lakes or rivers, this can depict littoral zones or areas of aquatic vegetation. While this step is not necessarily the final base map of a project, it does provide field crews with a good starting point as to what and where to conduct their field data collection.

Step 2 – Field Data Collection

With the delineated aerial photo in hand, field crews then move onto the site to complete their surveys. Data pertaining to the fish and wildlife habitat type and structural condition that were developed in the office are reviewed and finalized in the field. Additionally, the field crew collects key environmental correlates or KECs, which are the fine feature elements, in a consistent manner. They also collect the type and amount of invasive plant species presence and other pertinent information for each of the polygons identified on the aerial photo. The survey crew can modify the delineated polygons to capture a true representation based on the observed conditions on the ground. Polygons sometimes need to be added, removed, or otherwise altered to support field crew observations. This iterative process between field data collection and the office GIS-based analysis provides for several checks and measures that help eliminate errors and discrepancies in the datasets. Maps showing the derived information from habitat type, structural conditions, KECs, and invasive species field data are included for the Prado Basin pilot (Appendix F, Maps F-4 – F-10).

During this step, verification transects can also be run (Ashley 2010). These transects should be run concurrent with field surveys to familiar the surveyors with the local vegetation and calibrate their ocular acuity to obtain site measurements. The data collected by these transects are used to help verify the findings of the CHAP method as well as provide specific vegetation characteristics that can be used for management purposes. Transect locations should be established via Geographic Position System (GPS) to establish future reference points that can be used for status and trend monitoring, if desired at a future date.

Step 3 – Develop a Species List

An initial multi-species list is generated from the CWHR species range data. As part of NHI's deliverables, this information can be easily generated from the species list generated for each basin. Species legal and conservation status has also been included. This information then needs to be reviewed by local experts so the list is most applicable to the sites (impact and mitigation). Once this and the other two above steps are accomplished, then habitat value calculations can be developed.

Step 4 – Data Compilation

For a description of this step, please see Steps 4 and 5 under the methods section of Prado Basin pilot study assessment (Appendix E). The outcomes of these data compilations are to produce a per-acre value by habitat type and an overall site value. For example, determining baseline conditions for an impact site may have an overall site value of 212. If the entire site is impacted, then CHAP would require that the habitat value of 212 would need to be mitigated. Next, the baseline habitat value of the mitigation site needs to be determined, and say it has a value of 254. To compensate for the loss value of the impacted area, the mitigation site needs to be enhanced an equivalent of 212. That is, restoration or enhancement activities must increase the habitat value by 212 so that the future value of the baseline condition would be 467.

Currently, some agencies employ mitigation ratios in an effort to replace loss value; for example, ratios can be 1 for 2, or for every acre loss 2 acres must be acquired. In some instances, the ratio can even be higher. However, relying on ratios will not guarantee the impact site has been adequately compensated. Mitigation ratios have no basis in science; rather, their use is a policy decision. Using ratios assumes that a mitigation site directly compares in relative value with the impact site and makes this assumption without accounting for a site's capability to be enhanced and the functionality that needs to be replaced. Selecting a mitigation site is key but can also present some unknowns. For example, can compensation for loss habitat value be achieved in ½ acre, 1 acre, or 10 acres? To address this issue, a number of organizations are moving toward using "conservation banks." CHAP has the ability to generate per-acre values for conservation banks, thereby trading directly impact loss value for mitigation value and moving away from acre-for-acre replacement.

The CHAP approach can account for the uplift created by restoration or enhancement activities and, therefore, can eliminate the need for mitigation ratios. Additionally, CHAP is spatially explicit and its results are easily understandable to resource agency staff and the public. Finally, as a real-world example, in 2010 CHAP became the procuring method to settle a 25-year-old wildlife habitat loss. In this instance, the Bonneville Power Administration settled with the State of Oregon for $150 million dollars to acquire and enhance about 17,000 acres in the Willamette Valley. The CHAP analysis was done at the fine scale and involved 10 separate project evaluations.

Advance Mitigation

Because SCAG works in concert with transportation partners, such as California Department of Transportation (Caltrans) and the six county transportation commissions, there is interest from a planning perspective to identify advance mitigation for transportation projects. CHAP and IBIS have been used in support of transportation projects (Cushing and Wilson 2005). So to address this interest, the coarse-scale CHAP per-acre values developed by basin can be incorporated into the planning process (see Table 2 for values). For instance, freshwater emergent wetlands, which require mandatory compensation, have a range of per-acre values from 15.1 to 18.3, depending on the basin that has this habitat type mapped. Five basins within the SCAG region do not have a freshwater emergent wetland habitat value, because this habitat type is not mapped for these basins in the California Department of Forestry and Fire Protection (CalFire) statewide land cover map database. This is an example of the limitation of using information that is developed for another purpose. Nonetheless, the per-acre values that are shown can be used to give planners a relative idea of the natural value of the habitat type. This is done by multiplying the per-acre value by area, which can give a coarse value for a site. The coarse-scale value is for planning purposes only (e.g., rapid and efficient screening of potential mitigation opportunities); if mitigation is required, then the fine-scale approach needs to be applied. This is because the coarse-scale values give a relative index or estimation of value without accounting for other influences, like adjacency or amount of invasive species. Thereby, the coarse scale may over- or underestimates a site's value and, thus, to obtain a more precise value, a fine-scale CHAP analysis is needed. CHAP can also track multi-species valuations along with single-species appraisals to avoid double counting the same values within a landscape.

Another approach to mitigation can be found in the US Fish and Wildlife Services's Habitat Conservation Plans and in the state of California's Natural Community Conservation Plans. Both the federal and state conservation approaches are directed towards developing these plans in return for securing federal and state permits that affect threatened and endangered species.

VALUING NATURE'S FUNCTIONS (ECOSYSTEM FUNCTIONS)

In conservation planning there has been recent dialogue and suggestions that an approach to valuing nature's functions and its services should be developed and implemented, commonly referred to as "ecosystem services".[1] Regarding an approach, there are two camps. One has the view that nature should serve the needs of humans over other species, or human-centered science. The other reflects a more nature-centered science and finds that prioritizing human needs above all the other species is an inimical approach. The intent of both camps is to raise the awareness and value of our natural resources' contributions to earth's ecosystems, but they differ in approach.

The first view, valuing services that benefit humankind, centers on the establishment of a "market" so that payments and services can be bought and sold. An example would be establishing a carbon market to help reduce GHGs. Farmers and businessmen point to other similar, government-supported programs like the Department of Agriculture's Conservation Reserve Program. The Conservation Reserve Program provides payments to farmers and ranchers in the form of an annual rent or cost share to reduce soil erosion, improve water quality, create wildlife habitat, and other services.

The nature-centered approach suggests nature has benefits in its own right and, therefore, should be valued for that. People in this camp believe humans should learn to live in harmony with nature and be aware of the services it provides for them. In addition, natural resources should be

1 The term "ecosystem services" does not resonate with the public according to a national survey (Mertz 2010).

maintained so that these benefits will continue to support humanity. Examples of this approach would include national and state parks, wildlife refuges, and nature reserves.

This conservation assessment does not espouse either approach but rather suggests that the two approaches move in tandem, if there is a desire to value nature's services. Therefore, some guidelines are offered when considering assessment of nature services (Box 2). These guidelines come from Ervin et al. (2013) and are slightly modified for SCAG's consideration. Their purpose is to offer a framework to guide the development of nature's ecological, social, and economic assessments that can produce more informed resource management decisions. The guidelines would also help decision makers and society to be more informed about and aware of the significance of functioning ecosystems and their contributions to the region's current and future sustainability. Without a set of guiding principles, there is a tendency to avoid comprehensive assessments and refocus back on single species issues or projects that engage a limited number of groups. Thus, the following guidelines call for an integrated approach.

Box 2. Guiding Principles for Assessing and Valuing Nature's Services

1. Articulate a clear purpose for the assessment and a rationale for the methods used.
2. Reflect a fair and honest effort to represent ecosystems and all of the benefits they provide without intent to produce a predetermined outcome.
3. Identify and engage all interested and affected stakeholders in a transparent, inclusive manner.
4. Use interdisciplinary approaches to address the landscape attributes, ecological functions.
5. Assess the full suite of ecological, social, and economic costs and benefits.
6. Consider resilience and the ability to maintain biodiversity and sustain ecosystems for current and future generations.
7. Use the best scientific information available while disclosing uncertainties and potential effects that bear on the decision.
8. Apply robust methodologies and approaches that strive to be consistent, repeatable, and transparent.
9. Provide a rationale for the exclusion of any social, ecological, or economic attributes relevant to the management decision that were not included in the assessment.
10. Use language that is relevant to the intended audience to make valuation results understandable for non-technical stakeholders (see Appendix A, *Conservation Terminology Dos and Don'ts*).

The CHAP approach meets several of these guiding principles. For instance, it can characterize ecological functions and resilience and creates a metric to do so. CHAP also applies a method that is consistent, repeatable, and transparent and can complement other interdisciplinary approaches. In addition, it provides the best scientific information for evaluating a habitat and its biodiversity.

Example CHAP Application: Carbon Registry

With the CHAP methodology, a carbon registry is an example of a program that follows the above principles and addresses both approaches to conservation. A carbon registry is a program where landowners can sell carbon credit developed on their land to offset other GHG-emitting practices. Such programs clearly fall within the human-centered approach. However, to incorporate the nature-centered view, a comprehensive evaluation of the habitat and biodiversity at the landowner site would be performed prior to selling any credits. The idea here is to determine a land value by evaluating its biodiversity based on its species, habitats, and functions. The CHAP approach would convert the assessment into a per-acre value by habitat type that incorporates ecological functions, resilience, and biodiversity. It would also generate a spatial depiction. For example, Figure 3 illustrates a site where high per-acre values are shown to be dark and light blue while lower values are colored red and gold. The blue areas depict a higher level of biodiversity and functionality.

A map similar to Figure 3 can communicate that biodiversity at the site is important and that the landowner could be rewarded for taking additional steps to enhance or maintain the land, thereby increasing the per-acre value. The areas in dark blue could receive a greater carbon value on a registry because the higher biodiversity would equate to a higher likelihood of meeting carbon sequestration goals in the long-term. Therefore, a site with a higher likelihood of meeting carbon goals would convert to a higher carbon value.

Another issue to consider is the bundling of credits versus keeping the parts separate and selling credits individually. Both options can be used. In the case of carbon, since 2012 the State of California has embarked on a cap-and-trade program where metric tons of carbon are traded by large electric power plants and industrial plants. The purpose of the program is to set clear limits on GHG emissions and minimize the total costs to the emitters while achieving these limits. Companies must hold enough emission allowances to cover their emissions (one allowance is equal to one metric ton of carbon dioxide or its equivalent) but are free to buy and sell extra allowances on the open market [http://www.c2es.org/us-states-regions/key-legislation/california-cap-trade#Basics].

However, if natural habitats are used to mitigate carbon emissions, it should be recognized that ecological systems are interconnected and that carbon and biodiversity are not interchangeable. The fundamental basis for this is to acknowledge that ecological system benefits come from ecological processes that are interlinked at a site or area. Recognizing this basic premise also avoids the double selling of credits for the same piece of land. CHAP can compute a score for an individual polygon based on its biodiversity and allows for adjustment factors, incorporating other key components at a site that affect a land's valuation. The CHAP per-acre value can then be amended to account for the carbon value.

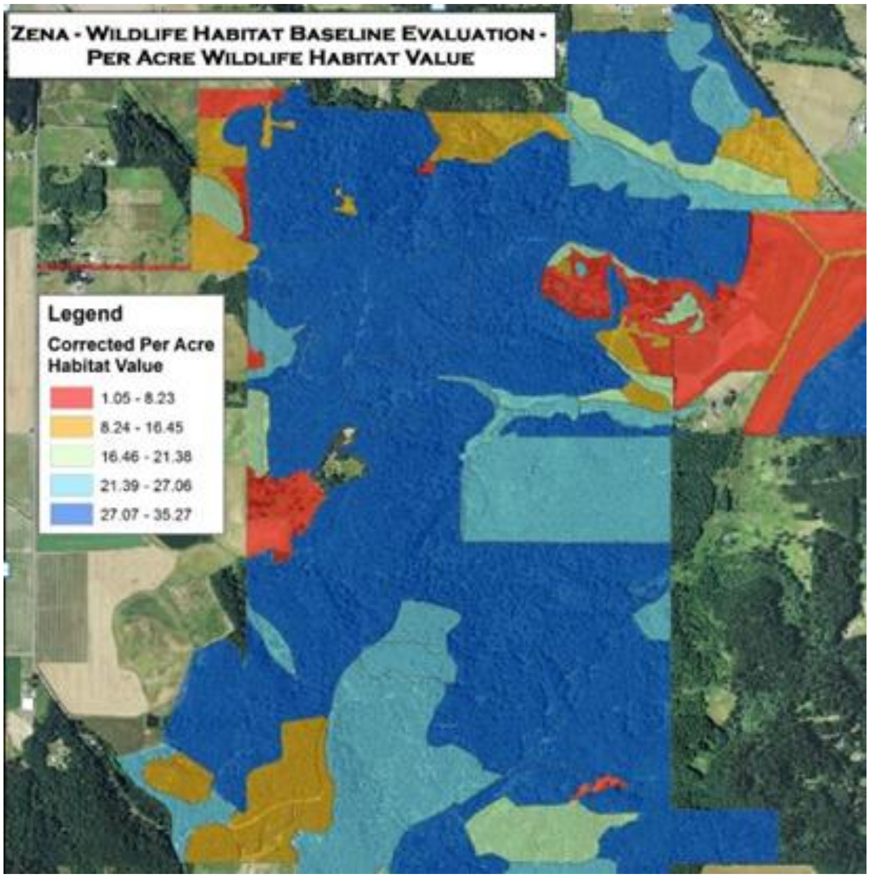

Figure 3. An Example of a Map Depicting Per-acre Values Based on a Site's Habitat Types and Biodiversity With the Habitat Value Corrected Based on Amount of Invasive Species Present

There is a segment within the resource management community that wants to set up a separate biodiversity market whereby credits can be bought and sold. The idea of setting up a market is new, but the idea of selling biodiversity credits is not. Conservation banks and other methods used to assess impacts and mitigations have been around for more than 30 years [http://water.epa.gov/lawsregs/guidance/wetlands/mitbanking.cfm].

SCAG REGION CHAP ASSESSMENT

COARSE-SCALE ASSESSMENT

For the coarse-scale assessment of the SCAG region, maps were developed identifying the wildlife habitat types located within the regional boundary by basin (see Appendix F, Map F-3). The habitat type classifications are based on the scheme derived from CWHR. Wildlife species associated with these habitat types are linked to NHI's IBIS data system (Johnson and O'Neil, 2001).

Originally developed for the Pacific Northwest, IBIS is a relational database containing extensive information on vertebrate species and their habitats. More recently, California species and habitat information have been integrated into IBIS using information from CWHR, which is based on current biological information and professional judgment by recognized experts on California's wildlife. Information in IBIS includes species' ecological functions, life histories, habitat relationships, habitat structural conditions, potential impacts of management activities, and KECs, which are fine feature habitat elements, such as snags or down wood.

The coarse-scale CHAP assessment does not require a field inventory but instead relies on existing GIS datasets and the IBIS database. The foundational blocks of the assessment are watershed boundaries, rather than political boundaries or hexagons that have little relevance to biological systems. The watershed-based approach is appropriate in regional planning because of common issues and solutions that flow through the watershed.

Methods

A coarse-scale assessment requires several steps. It starts with identifying regional basins within the SCAG region, and then implementing the following process.

1. Develop a species list. For the coarse-scale approach, the CWHR species range maps were intersected with the watershed boundaries to create a potential species list for each basin within the SCAG region. The watershed boundaries used for this assessment correspond to the third-level HUC (basin) in the USGS National Hydrography Dataset (NHD) (Appendix F, Map F-1). Because the CWHR species range maps do not include fish species, the species list is limited to terrestrial vertebrates (birds, mammals, reptiles, and amphibians).[2]

2. Identify CWHR habitats. The CalFire multi-source land cover map was used to link species to habitats present in each basin (Appendix F, Map F-2). The CalFire map combines several data sources to capture wildlife habitat, farmland, wetlands, and developed areas in a coarse (100-meter raster) statewide land cover map. The two Channel Islands within the boundaries of the SCAG regions were excluded from the analysis because they were not part of the CalFire land cover map.

   Data Incompatibility: Other higher resolution vegetation maps were not used because they did not cover the entire SCAG region (e.g., California Department of Fish and Wildlife (CDFW's) Western Riverside County vegetation) or they were in a different classification system that could not be easily cross-referenced to CWHR habitat types (e.g., California GAP vegetation, USGS Landfire Existing Vegetation Type).

3. Develop a species-function matrix. Once the potential species list and habitat types were identified for each basin, species' key ecological functions (KEFs) were incorporated using information in the IBIS database to generate the species-function matrices (Appendix B, Matrix 1). KEFs are the principal ecological roles performed by a species in its ecosystem. A species usually has multiple KEFs, and KEFs can be shared among different species. The species-function matrix is used to calculate the species Mean Functional Redundancy Index (MFRI) for each habitat type. Functional redundancy is defined as the number of species performing the same ecological function in a community. A high redundancy

[2] The CHAP approach does allow for other sources of fish information to be included and evaluated. Other CHAP assessments have included US Fish and Wildlife Service biologists local knowledge as well as other state data systems like the New Mexico's BISON-M.

imparts greater resistance of the community to changes in its overall functional integrity. Conversely, the loss of species and functional diversity decreases ecological resilience to disturbance or disruption (Peterson et al. 1998). The functions are derived by cross-referencing the species list to the KEFs that each species performs. A "functional specialist" is a species that serves only one or very few ecological roles and, thus, may be particularly vulnerable to changes in its environment. Likewise, some KEFs are performed by only one or few species. A "critical functional link" is a species that is the only one in a particular habitat that provides a particular ecological role. Identifying functional specialists and critical functional links can be important, because the loss of these species results in the immediate loss of a function within an area. Functional profiles can also provide a graphical representation of functional redundancy in an area (see Figures 4 and 5).

Results

Species List

Using the CWHR species ranges, a species list with 550 vertebrate species that could potentially occur in the SCAG region was developed (Appendix C). Forty-three species, or 8% of the total vertebrate, non-fish species in the region, have a state or federal listing status of threatened or endangered (Table 1). Because fish species are not included in the CWHR database, they were not included in the coarse-scale assessment. However, using the California Natural Diversity Database (CNDDB), we found records for 15 fish species and 78 invertebrate species in the SCAG region (Appendix D). We excluded records classified as extirpated (i.e., no longer occurring in an area). The fish and invertebrate species list is far from complete, but it should be noted that 9 of the fish species and 8 of the invertebrate species found in the SCAG region have a state or federal listing status of threatened or endangered, bringing the total number of listed animal species potentially occurring in the SCAG region to 60.

Table 1. Number, Type, and Listing Status (Federal or State Endangered or Threatened) of Vertebrate, Non-fish Species Potentially Occurring Within the SCAG Region

Animal Type	# of Species	# Listed	% Listed
Amphibian	25	5	20
Bird	338	21	6
Mammal	113	12	11
Reptile	74	5	7
Total	**550**	**43**	**8**

Habitat Value

The MFRI for each habitat type per basin is shown in Table 2 and in Appendix F, Map F-3. This value represents the per-acre habitat value for the coarse-scale evaluation. Species-habitat associations for most habitat types were taken directly from the CWHR data. The exceptions were species associations for urban, agriculture, and water cover types. The CHAP methodology only includes species that breed in and have a close association with urban and agricultural areas to avoid overestimating the habitat value of these highly-modified land cover types. Because "water" is not a CWHR habitat type, the species associated with riverine and lacustrine habitats were used to calculate the MFRI for water.

In each of the 10 hydrological basins (Figure 4), agricultural and urban habitat types have the lowest per-acre values, while riparian, oak woodland, and mixed chaparral habitat types tended to have relatively high per-acre values. The per-acre values for lacustrine, riverine, and water habitat types would be higher if fish species were included in the analysis.

While these values provide a consistent look across the region and are indicators of the functional redundancy and, thus, resiliency of each habitat type, they should not be used to prioritize one habitat type or basin over another. The exceptions for this are the non-native land cover types such as urban, agriculture, and eucalyptus. These types are dominated by introduced species or human-built structures that have replaced native plants and wildlife that depended on them. In these cases, restoration to native habitat types is preferable to maintaining the existing habitat and restored habitats should result in higher habitat values and greater protection of native biodiversity.

Habitat types such as grasslands typically have a lower per-acre value than riparian habitat, but grasslands support a unique assemblage of species such as butterflies and forbs not found in other habitat types. Protecting these habitats is vitally important to conserving the overall biodiversity of a site or region. This concept in conservation planning is referred to as "complementarity," which is the number of unrepresented species or other biodiversity features that a new area adds (Margules and Pressey 2000). Thus, an area with a low per-acre value may have a very high complementarity value if it contributes features that are not widely represented in the landscape. Additionally, lower diversity habitats, such as grasslands, can also serve as movement corridors to and among higher diversity habitats. This connectivity allows for genetic exchange and the ability for species dispersal without which higher diverse habitats may become vulnerable to reduced species diversity over time.

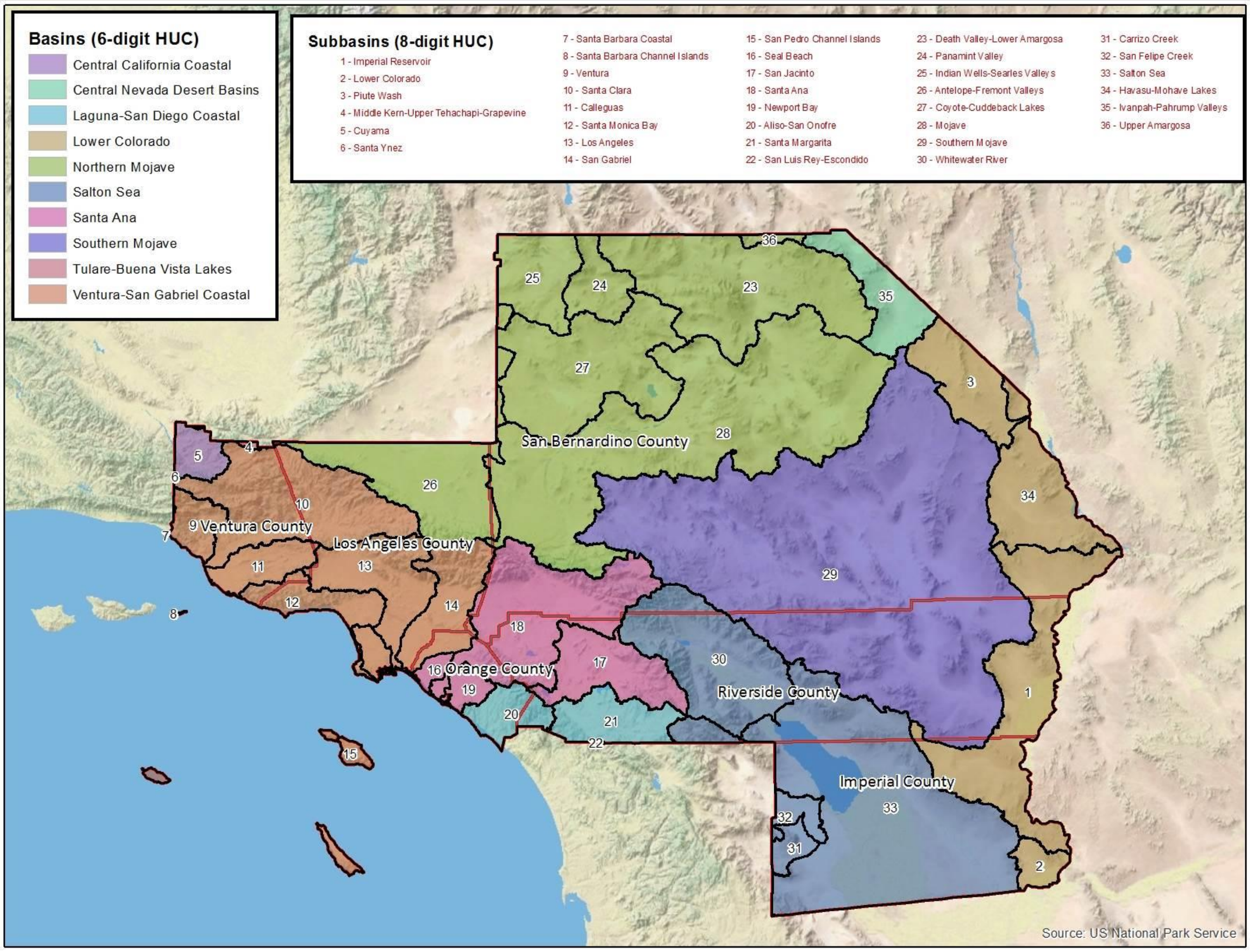

Figure 4. Basins and Subbasins in the SCAG Region

Table 2. Coarse-scale Mean Functional Redundancy Index (MFRI) for Each Basin within the SCAG Region

Habitat Type	Central California Coastal	Central Nevada Desert Basins	Laguna San Diego Coastal	Lower Colorado	Northern Mojave	Salton Sea	Santa Ana	Southern Mojave	Tulare Buena Vista Lakes	Ventura San Gabriel Coastal
Agriculture	5.82	3.72	5.95	5.10	5.82	6.43	6.05	5.51	6.00	6.26
Alkali desert scrub	–	11.77	10.03	13.61	13.83	–	12.53	14.66	–	12.33
Alpine dwarf shrub	–	–	–	–	–	5.76	5.96	–	–	–
Annual grassland	19.46	–	19.15	–	19.54	20.75	20.28	18.77	18.58	20.07
Barren	12.45	–	12.90	10.06	11.09	12.47	13.48	10.20	8.33	13.60
Bitterbrush	–	–	–	–	–	–	–	13.95	–	–
Blue oak foothill pine	–	–	–	–	21.85	–	–	–	–	22.16
Blue oak woodland	22.01	–	–	–	21.13	–	–	–	21.08	21.94
Chamise redshank chaparral	18.80	–	19.40	–	19.06	19.21	19.59	–	–	19.36
Closed cone pine cypress	–	–	–	–	14.47	–	14.45	–	–	14.42
Coastal oak woodland	21.54	–	20.81	–	21.38	21.49	21.69	–	–	22.01
Coastal scrub	18.21	–	18.72	–	18.39	18.92	18.91	17.35	17.06	18.51
Desert riparian	–	–	–	20.01	21.70	23.22	20.18	22.35	–	–
Desert scrub	–	13.02	10.32	15.07	14.78	16.28	12.93	15.98	10.05	12.88
Desert succulent shrub	–	–	9.93	13.72	14.20	15.28	–	14.93	–	–
Desert wash	–	–	11.44	15.71	15.50	17.38	13.65	17.02	–	13.63
Eastside pine	–	–	–	–	16.63	16.07	16.54	15.66	–	16.42
Estuarine	–	–	–	–	–	–	–	–	–	16.19
Eucalyptus	–	–	22.48	–	–	22.97	23.30	–	–	23.37
Freshwater emergent wetland	–	–	15.98	–	15.10	18.30	16.90	–	–	16.67
Jeffrey pine	15.39	–	–	–	16.29	15.80	16.33	–	15.06	15.94
Joshua tree	–	–	–	–	15.24	14.69	13.88	15.41	–	13.84
Juniper	15.35	11.70	–	13.26	18.02	16.52	16.75	16.63	15.48	16.43
Lacustrine	–	–	–	13.87	12.75	17.05	–	–	–	16.59
Lodgepole pine	–	–	–	–	–	11.71	12.15	–	–	–

Habitat Type	Central California Coastal	Central Nevada Desert Basins	Laguna San Diego Coastal	Lower Colorado	Northern Mojave	Salton Sea	Santa Ana	Southern Mojave	Tulare Buena Vista Lakes	Ventura San Gabriel Coastal

Table 2. Coarse- scale Mean Functional Redundancy Index (MFRI) for Each Basin within the SCAG Region (Continued)

Habitat Type	Central California Coastal	Central Nevada Desert Basins	Laguna San Diego Coastal	Lower Colorado	Northern Mojave	Salton Sea	Santa Ana	Southern Mojave	Tulare Buena Vista Lakes	Ventura San Gabriel Coastal
Mixed chaparral	21.09	–	21.25	–	22.92	22.83	23.18	21.35	19.93	22.69
Montane chaparral	17.08	–	15.57	–	17.48	17.13	17.63	16.01	16.62	17.89
Montane hardwood	19.31	–	18.41	–	19.59	19.16	19.46	18.19	18.16	19.45
Montane hardwood conifer	19.29	–	17.85	–	19.47	18.96	19.51	18.10	–	19.86
Montane riparian	20.84	–	–	–	21.13	20.57	20.90	19.38	–	21.14
Palm oasis	–	–	–	–	–	16.06	–	15.21	–	–
Perennial grassland	–	–	17.59	–	–	19.03	18.81	–	–	–
Pinyon juniper	18.78	15.57	17.69	16.50	22.79	21.40	21.06	21.64	18.38	21.71
Ponderosa pine	–	–	–	–	19.63	19.38	19.77	–	–	19.41
Riverine	–	–	–	–	11.87	–	–	–	–	–
Sagebrush	14.68	13.25	14.07	13.85	17.23	16.57	16.55	16.38	14.90	16.77
Saline emergent wetland	–	–	–	–	–	–	14.17	–	–	13.83
Sierran mixed conifer	17.65	–	16.04	–	18.00	17.51	17.94	16.72	17.00	18.13
Subalpine conifer	–	–	–	–	–	8.71	8.75	8.49	8.17	8.54
Unknown shrub type*	–	–	–	–	0.00	–	–	–	0.00	–
Urban	4.50	2.39	4.41	2.77	3.91	4.31	4.41	3.35	4.28	4.75
Valley foothill riparian	–	–	23.30	–	24.30	24.10	24.14	22.78	–	24.43
Valley oak woodland	–	–	–	–	20.97	–	–	–	–	21.71
Water	16.61	7.03	16.51	14.13	13.06	17.30	17.07	12.92	–	17.80
Wet meadow	–	–	18.77	–	18.60	19.64	19.49	17.03	–	–
White fir	–	–	–	–	16.45	15.97	16.40	–	–	–

*Unknown shrub type not calculated

Functional Profile

A functional profile can be determined by counting the number of functions that can be attributed to wildlife species. Figure 5 shows the 10 functions with the highest redundancy in the SCAG region, while Figure 6 illustrates the functions with the smallest amount of functional redundancy (only 1 -3 species per function). For example, functions that have the highest amount of species redundancy with them (in Figure 5) are species that are prey for primary or secondary consumers or species that eat terrestrial invertebrates. Functions that have the lowest amount of species redundancy include impounding water by creating diversions or dams and dispersing lichen (Figure 6).

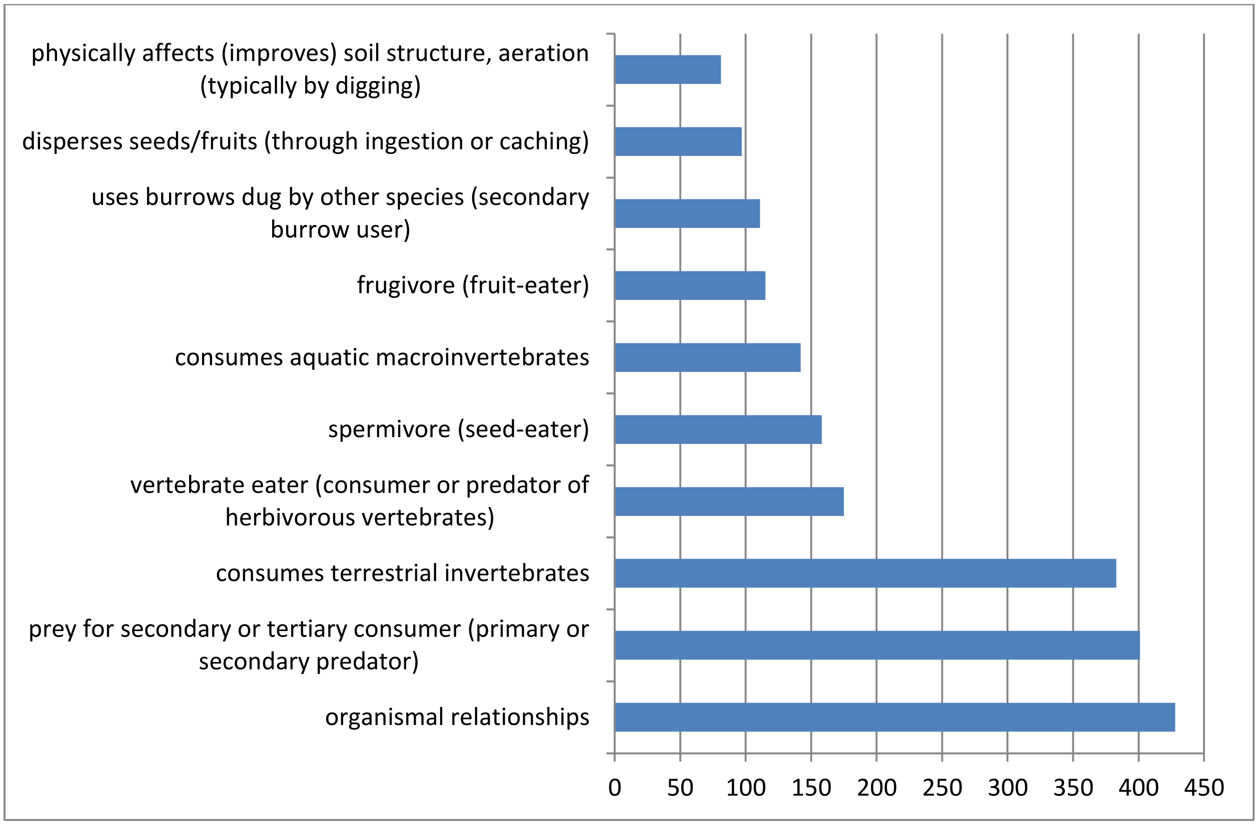

Figure 5. Functions With the Most Redundancy in the SCAG Region

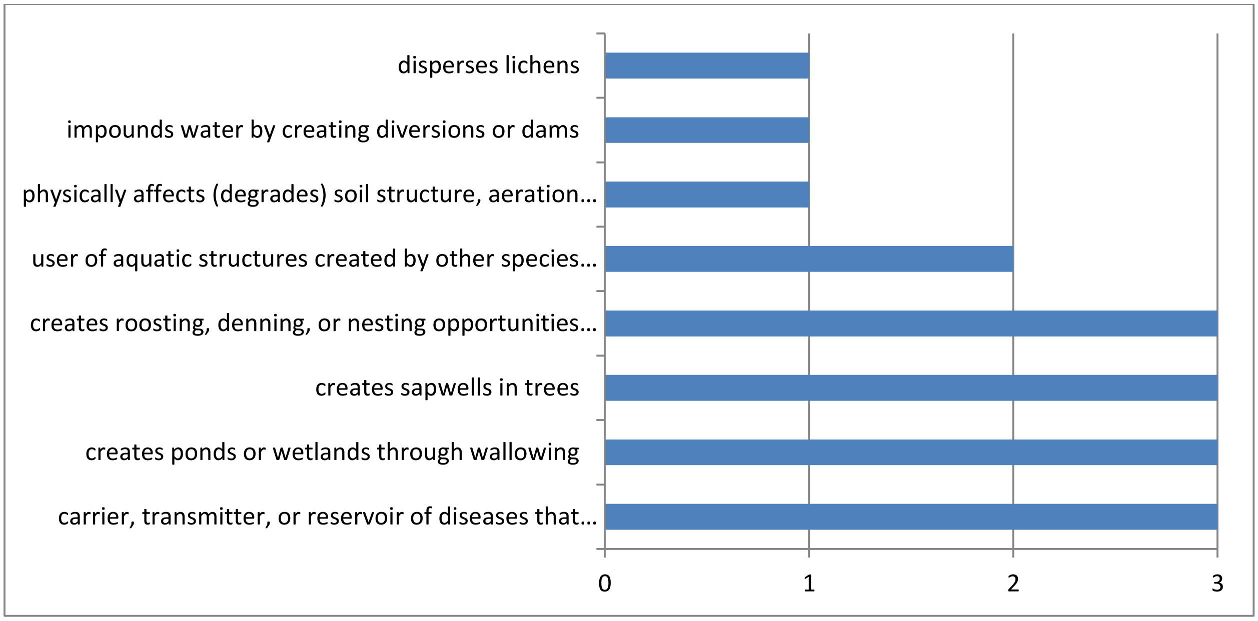

Figure 6. Functions Performed by the Fewest Number of Species in the SCAG Region

SYSTEMATIC CONSERVATION PLANNING – NEXT STEPS

One issue in conservation planning is the "research-implementation gap" between conservation assessments and actions that actually conserve nature (Knight et al. 2008). This is partly due to an overreliance on data-driven conservation planning and the black-box nature of supporting software such as Marxan (Brooks 2010). To overcome this problem, the current trend in conservation is to combine data-driven methods with stakeholder-driven techniques. The CHAP approach provides SCAG with a repeatable, data-driven technique for assessing habitat that provides a consistent look at the region that can also be used for mitigation and restoration actions at the local level. The outcome of this approach is systematic conservation planning that integrates biological assessment, stakeholder engagement, and socioeconomics to develop cost-effective conservation actions. In addition, advance mitigation funding can also address the "research-implementation gap" and give SCAG an early resource to support implementation.

The next step is deciding how to use this and other supporting information to help prioritize conservation actions. Margules and Pressey (2000) propose a framework for systematic conservation planning (Box 3) with the objectives that protected areas represent the biodiversity of a region and promote the long-term survival of species and other elements of biodiversity by maintaining natural processes and viable populations and excluding threats. We provide six recommendations for moving forward with systematic conservation planning: representation, ecological integrity, connectivity, hydrologic connectivity, climate change adaptation, and Environmentally Distributed Ecological Networks (EDENs)/citizen science.

Box 3. Stages in Systematic Conservation Planning (taken from Margules and Pressey 2000)

Systematic conservation planning can be separated into six stages, and some examples of tasks and decisions in each are presented below (Pressey and Logan 1997). Note that the process is not unidirectional; there will be much feedback and reasons for altering decisions (see Margules and Pressey 2000 for examples).

1. Compile data on the biodiversity of the planning region.
   - Review existing data and decide which data sets are sufficiently consistent to serve as surrogates for biodiversity across the planning region.
   - If time allows, collect new data to augment or replace some existing datasets.
   - Collect information on the localities of species considered to be rare and/or threatened in the region (these are likely to be missed or underrepresented in conservation areas selected only on the basis of land classes, such as vegetation types).
2. Identify conservation goals for the planning region.
   - Set quantitative conservation targets for species, vegetation types, or other features (for example, at least three occurrences of each species, 1,500 hectares of each vegetation type, or specific targets tailored to the conservation needs of individual features). Despite inevitable subjectivity in their formulation, the value of such goals is their explicitness.
   - Set quantitative targets for minimum size, connectivity, or other design criteria.
   - Identify qualitative targets or preferences (for example, as far as possible, new conservation areas should have minimal previous disturbance from grazing or logging).
3. Review existing conservation areas.
   - Measure the extent to which quantitative targets for representation and design have been achieved by existing conservation areas.
   - Identify the imminence of threat to underrepresented features, such as species or vegetation types, and the threats posed to areas that will be important in securing satisfactory design targets.
4. Select additional conservation areas.
   - Regard established conservation areas as “constraints” or focal points for the design of an expanded system.
   - Identify preliminary sets of new conservation areas for consideration as additions to established areas. Options for doing this include reserve selection algorithms or decision-support software to allow stakeholders to design expanded systems that achieve regional conservation goals subject to constraints such as existing reserves, acquisition budgets, or limits on feasible opportunity costs for other land uses.
5. Implement conservation actions.
   - Decide on the most appropriate or feasible form of management to be applied to individual areas (some management approaches will be fallbacks from the preferred option).
   - If one or more selected areas prove to be unexpectedly degraded or difficult to protect, return to Step 4 and look for alternatives.
   - Decide on the relative timing of conservation management when resources are insufficient to implement the whole system in the short term (usually).
6. Maintain the required values of conservation areas.
   - Set conservation goals at the level of individual conservation areas (for example, maintain seral habitats for one or more species for which the area is important). Ideally, these goals will acknowledge the particular values of the area in the context of the whole system.
   - Implement management actions and zonings in and around each area to achieve the goals.
   - Monitor key indicators that will reflect the success of management actions or zonings in achieving goals. Modify management as required.

Representation and USGS GAP Analysis Program (GAP)

In conservation planning, *representation* refers to the attempt to protect the most species by ensuring the full spectrum of habitat types are represented within a network of protected areas. Protected lands data can be used to identify underrepresented habitats that may need greater protection. Ideally, a fine-scale vegetation/habitat map would be used for this type of analysis, but this is not yet available for the entire SCAG region.

The USGS Gap Analysis Program (GAP) maintains a comprehensive and current inventory of America's protected lands, referred to as the Protected Areas Database of the United States (PAD-US). According to the USGS standards and methods manual (USGS GAP 2012), protected areas are defined as being "Dedicated to the preservation of biological diversity and to other natural, recreation and cultural uses, managed for these purposes through legal or other effective means." A GAP status code, which is the measure of management intent to conserve biodiversity, is assigned to each protected area. The four codes are as follows:

- **Status 1:** An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference or are mimicked through management.
- **Status 2:** An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance.
- **Status 3:** An area having permanent protection from conversion of natural land cover for the majority of the area but subject to extractive uses of either a broad, low-intensity type (e.g., logging, OHV recreation) or localized intense type (e.g., mining). It also confers protection to federally listed endangered and threatened species throughout the area.
- **Status 4:** There are no known public or private institutional mandates or legally recognized easements or deed restrictions held by the managing entity to prevent conversion of natural habitat types to anthropogenic habitat types. The area generally allows conversion to unnatural land cover throughout or management intent is unknown.

The International Union for the Conservation of Nature (IUCN) defines a protected area as "A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values." Only GAP status codes 1 and 2 lands meet this definition of protection.

A map showing the distribution of protected land in the SCAG region is found in Appendix F, Map F-11. The ownership of this land is shown in Appendix F, Map F-12. We analyzed the amount of protected habitat in each SCAG basin for each CWHR habitat type using GAP Statuses 1 and 2 lands and the CalFire land cover map (Appendix E). Excluding the non-natural land cover types (urban, agriculture, and eucalyptus), the habitat types with the lowest amount of protection in the SCAG region are valley foothill riparian, valley oak woodland, and coastal scrub, all of which have less than 10% of their total area in a GAP 1 or 2 protected status. For example, only 7% of the total area of the Santa Ana Basin is protected, with less than 3% of valley foothill riparian habitat and only 4% of coastal scrub habitat protected in that basin. These underrepresented habitat types also tend to have high per-acre habitat values and might serve as focal habitats for conservation action.

One word of caution: while a coarse-scale analysis can help identify ecosystems or habitat in need of greater protection, rare natural communities, wetlands, and riparian areas are likely to be underrepresented and should be factored in using additional data sources and local knowledge. Also, these comparisons of representation are based on current land cover data, but many habitat types such as coastal scrub have already undergone dramatic declines due to development and land conversion. A more stringent criterion of representation would be based on comparisons with potential or historical (pre-Euroamerican) distribution of ecological communities (Hierl et al. 2008, Sprugel 1991).

Surrogate species are often used to represent a group or community of species frequently named umbrella, keystone, or biodiversity indicators as a shortcut in conservation planning. But, this approach has limited utility in preserving regional biota (Andelman and Fagan 2000). For example, unless explicitly incorporated in the analysis, at-risk species, which tend to have small ranges and occur in restricted habitats, are not likely to be included in conservation areas selected on the basis of indicator taxa (Lawler et al. 2003). Furthermore, reserve designs based on vertebrate umbrella species may fail to protect invertebrate biodiversity (Rubinoff 2001). A comprehensive conservation strategy should combine ecosystem-level planning with fine-scale community and species needs using a multiple-species approach.

Locations or occurrences of sensitive plant and animal species and rare natural communities can be found in the CNDBB managed by CDFW. It is important to identify these areas, as they are the most likely to be lost if they are not protected, resulting in a loss of biodiversity. One limitation of species occurrence data is the uneven survey effort across the landscape and among species. This may bias the data toward areas closer to human populations that have been more heavily surveyed, to more accessible public land, or to species that are more visible and easier to document opportunistically. Also, some species that are at the greatest risk may actually receive the least amount of monitoring (Regan et al. 2007). This could result in higher-priority species having fewer data points in regional databases such as the CNDBB. Another data source for sensitive species is the U.S. Fish and Wildlife Service (USFWS) critical habitat data, which can be overlaid with protected lands data to get a sense where gaps in protection may be occurring.

In addition to the representation of species or habitats in the network of protected lands, another important aspect of planning should be the likelihood of long-term persistence of biodiversity. Many species exist in remnant habitat that is surrounded by intensive land uses that may threaten the ecological integrity and, thus, the biodiversity and ecological function of an area.

Ecological Integrity

While there is no universal definition of ecological integrity, it can be broadly defined as an intact and well-functioning ecosystem. The BC Parks Legacy Panel considers an ecosystem to have ecological integrity when "the structure, composition, and function of the ecosystem are unimpaired by stresses from human activity; natural ecological processes are intact and self-sustaining, the ecosystem evolves naturally and its capacity for self-renewal is maintained; and the ecosystem's biodiversity is ensured." The biodiversity of southern California is considered one of the most highly threatened in the USA with habitat conversion and urbanization the most cited causes of species extirpation (Regan et al. 2007, Tennant et al. 2001). Other major threats include invasive species, off-road vehicles, recreation/human disturbance, altered fire regime like an increase in fires at the Wildland-Urban interface, and altered hydrology (Regan et al. 2007).

The Human Footprint in the West Project (USGS) provides a coarse-scale spatial model of anthropogenic influence on the landscape (Appendix F, Map F-12). The map of the human footprint is a composite of seven models that explores how anthropogenic features influence wildlife populations via "bottom up" changes in habitat (road-induced dispersal of invasive plants, oil and gas developments, human-induced fires, and anthropogenic habitat fragmentation) or "top down" predator densities (spatial distribution of domestic and synanthropic avian predators [i.e. feral house cats, feral dogs, corvids]). Not all human disturbances are included in these models, such as mining, all-terrain vehicle use, pollution, and grazing (Leu et al. 2008). The human footprint models can help land managers develop regional priorities and delineate areas for habitat restoration based on proximity to areas that decrease restoration potential as well as identify areas where management actions could lessen the effects of human activity.

This modeling effort suggests that the human footprint disproportionately affects areas of high biodiversity that tend to be low elevation with higher below- and above-ground productivity (Leu et al. 2008). For areas that have a high human footprint, such as the California South Coast Ecoregion that encompasses all of SCAG's coastal region, one of the biggest challenges is how to maintain or restore ecological integrity, particularly as human populations continue to grow.

CONNECTIVITY

Ecological connectivity refers to the flow of organisms and ecological processes across landscapes (Taylor et al. 1993). Connectivity may reduce the risk of species loss by ensuring gene flow among isolated populations and allowing vacant habitat to be recolonized. Conservation corridors (linkages) are thought to increase connectivity by facilitating animal movement between separate but potentially suitable habitat (LaPoint et al. 2013).

The California Essential Habitat Project commissioned by Caltrans and CDFW provides a starting point for the conservation goal of enhancing natural lands contiguity and maintaining critical landscape linkages. The California Essential Habitat Project coarse-scale connectivity map can be used to identify potential threats to connectivity across the landscape as well as conservation opportunities (Rudnick et al. 2012). The finer-scale regional linkage plans such as the South Coast Missing Linkage project (www.scwildlands.org) are designed to meet the needs of a suite of focal species and can help guide site-specific actions. SC Wildlands is also working on a California Desert Connectivity Project with 23 linkage designs using 40 focal species.

Although maintaining animal movement across an increasingly fragmented landscape is crucial, it is important to validate corridor model predictions. There have been few studies that demonstrate corridors are used by mammals as predicted, and in some cases models have performed poorly when tested in the field (LaPoint et al. 2013). Unbaited camera traps are useful for validating model predictions and animal movement data (e.g., www.movebank.org) can be used to identify corridors at the local scale.

Hydrologic Connectivity

Hydrologic connectivity is the water-mediated transfer of matter, energy, and/or organisms within or between elements of the hydrologic cycle (Pringle 2003). The issue with hydrologic connectivity is scale. Hydrology is a fine-featured element within the landscape and depicting it at a coarse level causes most of the hydrologic network to appear missing or incomplete. Intermediate- and fine-level scales capture more of the network, along with giving a viewer a better idea of the degree of alteration that might have occurred. Hydrologic connectivity is important especially when considering adaptation and dispersal as it relates to genetics, abundance, and distribution of organisms or when evaluating the change in the structure and form of the hydrologic system that can be caused by seasonal variations. For instance, aquatic species may be blocked from accessing suitable habitat because of a man-made structure within a channel, or in a high water event, a stream has been straightened and, thus, loses the ability to slow down the velocity of water resulting in downcutting of the channel bed and/or erosion of its banks.

To aid in understanding the complexity of hydrologic structure, viewing the hydrology at a watershed level may help identify the degree of fragmentation that has taken place by alterations. Though important, it may not give the viewer any idea of the degree of disconnects like erosion, downcutting, and barriers within a specific stream reach. To obtain this kind of knowledge usually requires observation(s) or surveying at the site level. Even with finer features being depicted along with alterations, the study of hydrologic connectivity as it relates to habitat structure, functions, and ecological processes is still an emerging discipline (Merenlender and Matella 2013).

Climate Change Adaptation

Over the next century, climate change will cause habitat to shift, shrink, and even disappear (Rudnick et al. 2012). Reserve and linkage designs based on current habitat distribution may not allow species to respond and adapt to changing ecological conditions. Connectivity is a critical part of a robust climate adaptation strategy. There are several approaches to incorporating climate change into connectivity designs, including fine-filter species-based modeling using climate change simulations. Another simpler alternative is to design linkages based the assumptions that 1) a reserve network that harbors the greatest climatic diversity will allow for greater adaptation and 2) maintaining access to cooler climates is a high priority. Finally, one could use the coarse-filter approach that river valleys provide gentle temperature (and moisture) gradients that may allow species to shift their ranges along that gradient.

One potential limitation of using connectivity as a conservation strategy for climate change is the uncertainty in the estimation and effects of connectivity (Hodgson et al. 2009, LaPoint et al. 2013). On the other hand, the positive effect of increased habitat area and quality on population size is well established. Expanding on existing protected areas and mitigating known threats may result in more robust populations that are better able to cope with changing conditions. Other strategies for dealing with climate change are to concentrate conservation efforts in centers of endemism and in regions with high existing environmental heterogeneity. Regardless of the strategies employed, because of the uncertainty inherent in conservation planning, particularly in the face of climate change, monitoring and adaptive management are critical elements of a conservation strategy.

ENVIRONMENTALLY DISTRIBUTED ECOLOGICAL NETWORKS (EDENS) AND CITIZEN SCIENCE

Because our ecosystems are continuing to change, our knowledge is often limited. Thus, we need to strive for continual learning. Acquiring data and conducting ongoing monitoring are essential pieces to SCAG's framework and to maintaining a viable and up-to-date conservation strategy. There are about 18 million people within the SCAG region; SCAG can use this resource to help meet their conservation goals and objectives. An excellent way to obtain additional insight about our local resources is to use EDENs and citizen science. This type of structure also lends itself well to the adaptive management concept, which is the intentional use of experiments to investigate ecology (ISAB 2013). Since no one organization can do all what is needed to observe, inventory, and monitor our natural resources, it makes sense to seek help in a constructive manner. Additionally, other regional projects that may occur within the SCAG region should be made aware of SCAG's conservation needs to ensure data compatibility.

How might this work for the SCAG region? Currently, the number of protected sites within the six counties consists of 3,606 sites (Appendix E); this equates to about 35% of the entire SCAG area. These sites can serve as EDENs because they have some permanent protection from conversion of natural land cover with a mandate to maintain a natural state. In addition, along California's South Coast Region (Point Conception to California/Mexico border) there are an additional 36 Marine Protected Areas (California Ocean Science Trust 2011). The South Coast Monitoring Plan (SCMP) (http://monitoringenterprise.org/where/southcoast.php) provides an approach to monitoring key metrics, monitoring questions, and guidance for setting priorities. The SCMP was adopted by the California Department of Fish and Wildlife in August 2011 and has been developed to meet requirements of the California's Marine Life Protection Act. So SCAG has a great opportunity to connect terrestrial and marine findings so that one may inform the other.

Environmentally Distributed Ecological Networks (EDENs)

EDENs are a set of sites where the same ecological measurements are made by multiple users in a coordinated manner (Craine et al. 2007). These measurements can vary from a one-time event to semiannual or annual occurrence. Establishing EDENs in Southern California can facilitate evaluation of ecological processes and species along an environmental gradient. They lend themselves to simple observations or experimental inquiries and can focus on populations or ecosystem mechanisms. They have been used to quantify changes in range and abundance of wildlife species over time and to help understand the effects of climate change. Thus, EDENs can serve as a platform for SCAG to link scientists with interested volunteers and community groups to explore a host of various questions.

Steps to setting up and running an EDEN (Craine et al. 2007) are listed below:

1. Identifying questions – What are the main questions that the network is to answer? The specific questions will dictate extant, intensity, and temporal scope.

2. Running a pilot project – This is to test the feasibility to answer the questions. It includes conducting a power of analysis to see how many sites are needed, as well as setting protocols for data collection, repeatability, and training requirements.

3. Assembling the network – Upon successful completion of the pilot project, modular structure of the nodes needs to be assembled. Networks can have one coordinating site or be decentralized. Once the structure is determined then the nodes can be passive or actively assembled.

4. Training participants – This includes workshops for developing skills, implementing methods, and testing proficiency.

5. Collecting data and samples following field protocols.

6. Moving data and sampling – Once the surveys or samples are collected, standardized survey sheets (paper or electronic) and information need to be sent to a central/lead investigator or website.

7. Data quality control –To be included in the training of the participants to ensure data quality and usability of the information.

8. Archiving and disseminating data – Archiving should use best practice for data storage. Software is a natural use for archiving and disseminating the information via web site or services. When possible web-based GIS should be used to make the information easily accessible.

9. Analyzing data – This step evaluates the data collected and applies statistical analyses along with visual presentation.

10. Follow-up – Additional surveys or replications may be needed but will depend on the kind of questions being asked. This also includes receiving feedback on what worked and did not work and suggested improvements.

Two examples in the U.S. can be used to describe the EDEN concept. One is the North American Breeding Bird Survey (BBS) maintained by the U.S. Geological Survey, and the other is the Christmas Bird Count (CBC) sustained by the Audubon Society. Both of these efforts use volunteers to collect bird information or employ the practice of citizen science but vary in training and application.

The two projects are alike in that they both collect bird information, although at different times of the year; the BBS is conducted in late spring and early summer while the CBC is in winter. The BBS consists of over 4,000 routes, and the observers must be skilled in identifying birds and their songs [http://www.pwrc.usgs.gov/bbs/participate]. The CBC involves identifying birds but not their songs and covers about 2,200 routes [http://birds.audubon.org/sites/default/files/documents/cbc_one_pager_2012-10-5-12.pdf].

Citizen Science

As noted above, citizen science has been used in the U.S. for almost 40 years and has been in operation for 50 years in Europe. In California, an example of a citizen science project would be the collection of roadkill data by the UC Davis Research Program on Wildlife Movement/Connectivity [http://roadecology.ucdavis.edu/research/projects/california-roadkill-observation-system-cros]. Another example is the SCMP, which incorporates the use of citizen science groups and community organizations as partners assisting with the collecting, monitoring, interpreting, and dissemination of information. Participants are trained in sampling protocols as well as data quality and control (quality assurance/quality control [QA/QC]) measures to be used in collecting data. The Marine Protection Areas program has existed since 2003 in the Channel Islands.

The success of any citizen science program is in building participation via partnerships. The SCMP provides a clear understanding of what each partner provides and what is expected from them. To establish this clarity, SCMP calls for use of both formal and informal agreements, from brief memoranda of understanding to detailed contracts. These agreements includes details of the information to be collected, methods to be employed, standards and formats for information collection and reporting, training of participants, and resources to be provided by each partner (California Ocean Science Trust 2011).

CONCLUSION

Southern California is an area of high biodiversity with a large number of endemic and rare species (Myers et al. 2000, Rubinoff 2001). The challenge is how to best allocate limited resources to protect these species and their habitats in the face of a growing human population and continued land development. This will be an ongoing challenge for conservation planners in the SCAG region. Yet it can also be viewed as an opportunity to make a significant contribution to conservation efforts while enhancing the quality of life for millions of Southern California residents now and in the future.

This conservation framework and assessment report delineates a strategic process for identifying and prioritizing areas for conservation. This process begins with compiling data on the biodiversity of the region. The coarse-scale CHAP methodology provides a consistent look at wildlife habitat values across the region using functional redundancy as a metric of biodiversity and ecological resilience. CHAP integrates peer-reviewed species ranges, habitat associations, and wildlife habitat types from the CWHR system with its peer-reviewed IBIS database that includes species functions and KECs. The methodology is hierarchical, as shown by the coarse- and fine-scale evaluations, and can also be used at the local level for the purposes of mitigation and habitat restoration.

In addition to the CHAP assessment, this report contains examples of how other GIS datasets possessed by SCAG can be used in the systematic conservation planning process, as well as some of the limitations of the data. Data gaps have been identified in the GIS inventory report (Leidos 2014). These include data from a number of regional Habitat Conservation Plans (HCPs) and Natural Community Conservation Plans (NCCPs) that are being implemented or are in development in the SCAG region (Appendix F, Map F-13). Other available data that SCAG should consider acquiring are regional linkage data (www.scwildlands.org) and climate change data (e.g., http://cal-adapt.org).

Data Considerations: Although SCAG has numerous datasets, much of the information does not lend itself to comparative evaluation because of a lack in consistent use and definition of attributes. That is, simply having a data dictionary does not necessarily resolve this problem. Mixing or compiling different datasets can lead to false positive results, that is, the data results appear positive because of an artifact of the data or application, when in reality results are negative or unchanged. For example, often GIS data use the natural breaks to divide the findings into four to six categories and when comparing between different hierarchical scales, the values most likely will have changed. Hence, the natural breaks will change and a comparison may show improvement when the only change is that the natural breaks now occur at different intervals.

Further, SCAG's GIS datasets were often developed for other purposes; therefore, SCAG planners and GIS staff need to exercise caution when incorporating this information. To avoid any misuse of these data, SCAG may want to retain additional technical support with expertise in conservation planning and GIS throughout the conservation strategy process. Finally, there are also other datasets that would be recommended and appear to be in need of development that do not exist for the entire SCAG region. These are 1) historical vegetation maps and/or aerial photos for analyzing changes in land cover and habitat value over time; 2) a finer-scale vegetation map for the region with CWHR habitat types similar to what was done for the western Riverside County Multiple Species Habitat Conservation Plan; 3) fish information and their species range maps; and 4) establishment and enhancement of the collaboration with California Ocean Science Trust to include marine species.

This report provides a framework and assessment for conservation planning. The next step is to engage stakeholders and scientific experts in the planning process to set conservation goals, identify priority conservation areas, and ultimately develop an implementable plan.

GLOSSARY OF KEY TERMS

Advance Mitigation – An approach to plan and implement mitigation prior to a permitted impact occurring.

Backcasting – A strategic approach to planning for sustainable development whereby a successful outcome is imagined in the future, then asking the question: What do we need to do today to reach that vision?

Biodiversity – The variety of organisms considered at all levels, from genetic variants belonging to the same species through arrays of genera, families, and still higher taxonomic levels; includes the variety of ecosystems, which comprise both the communities of organisms within particular habitats and the physical conditions under which they live.

Community – Any grouping of populations of different organisms that live together in a particular environment.

Complementarity – The number of unrepresented species or other biodiversity features that a new area adds.

Connectivity – Condition, in which the spatial arrangement of land cover types allows organisms and ecological processes (such as disturbance) to move across the landscape. Connectivity is the opposite of fragmentation.

Conservation strategy – A management plan for a species, group of species, or ecosystem that prescribes standards and guidelines that, if implemented, provide a high likelihood that the species, groups of species, or ecosystem, with its full complement of species and processes, will continue to exist well-distributed throughout a planning area, i.e., a viable population.

Corridor – A more or less continuous connection between landmasses or habitats; a migration route that allows more of less uninhibited migration of most of the animals of one faunal region to another. In terms of conservation biology, a connection between habitat fragments in a fragmented landscape.

Corridors – The landscape elements that connect similar patches through a dissimilar matrix or aggregation of patches.

Critical functional link – Species that only perform a specific ecological function in a species community.

Disturbance regime – The pattern of intervals between disturbance and severity of disturbance. For landscapes, this can be for a given disturbance, such as fire, or for a complex of disturbances.

Down wood – As snags decay they fall to the ground and provide shelter and food for an array of species. They store nutrients and moisture and aid in soil development. Down wood found in streams is often referred to as coarse woody debris.

Ecological integrity – The structure, composition, and function of the ecosystem are unimpaired by stresses from human activity; natural ecological processes are intact and self-sustaining, the ecosystem evolves naturally and its capacity for self-renewal is maintained; and the ecosystem's biodiversity is ensured (BC Parks Legacy Panel).

Ecosystem – A system that includes all living organisms (biotic factors) in an area as well as its physical environment (abiotic factors) functioning together as a unit. That is, an ecosystem is made up of plants, animals, microorganisms, soil, rocks, minerals, water sources, and local atmosphere [http://www.biology-online.org/dictionary/Ecosystem, accessed 5/26/2014].

Ecosystem-based management – The careful and skillful integration of ecological, economic, social, and managerial principles to conserve, enhance, and restore ecosystems (including their functions, processes, constituent species, and productive capacities) to maintain their long-term viability and integrity while seeking desired conditions for uses, products, values, and services.

Ecosystem services – The services provided by ecosystems include formation of soil and renewal of its fertility, consistent flows of fresh water, maintenance of the composition of the atmosphere, pollination of flowers and crops, control of the distribution and abundance of pests and pathogens, production of fish and wildlife, aesthetic, recreational, and spiritual values from natural landscapes, maintenance of a "genetic library" of global biodiversity as a source of future insights and innovations benefitting humankind, and important contributions to keeping climatic conditions in the range to which human society and current ecosystems are adapted (PCAST, 2011).

Endemism – A species that is unique to a geographic location.

Forbs – Herbaceous flowering plants other than grasses.

Functional profile – A chart that depicts the degree of functional redundancy compared across a species list.

Functional specialist – Species with the narrowest functional role and may be more vulnerable to extirpation from changes in conditions supporting that function.

Habitat – The place, including physical and biotic conditions, where a plant or an animal usually occurs.

Habitat Conservation Plan – Is a plan to satisfy the federal Endangered Species Act to receive a permit from the US Fish and Wildlife Service authorizing impacts to threatened and endangered species.

Habitat type – Place where an animal or plant normally lives, often characterized by an aggregation of plant alliances, associations or physical characteristic.

Habitat unit – Represents an overall site's value. It is determined by multiplying the per-acre value times the area (acreage) of each mapping unit (polygon) at a site. Each mapping unit's value is then summed across a site.

Hydrologic connectivity – Water transfer of matter, energy and/or organisms within or between elements of the hydrologic cycle.

Invasive species – Also referred to as non-natives, exotics, or introduced species. These species vary in their ecological aggressiveness to invade or exploit a site; most all work to reduce or suppress the diversity at a site.

Key environmental correlates – Fine feature habitat elements physical or biological thought to most influence a species distribution, abundance, fitness, and viability.

Key ecological functions – The principal way organisms influence the environment

Landscape – A spatially heterogeneous area with repeating patterns of elements and associated disturbance regimes, with similar climate and geomorphology.

Landscape connectivity – The spatial contiguity within the landscape; a measure of how easy or difficult it is for organisms to move through the landscape without crossing habitat barriers.

Life history – Key parts or events of a organisms lifetime like age of first reproduction, number of offspring, age of sexual maturity, dispersal distance, body size and weight.

Mitigation – Restoring or protecting functions and values from of an impacted resource.

Mean functional redundancy index – Determined by the number of species at a province or basin level divided by the number of functions those species can perform.

Natural Community Conservation Plan – Is the state of California's counterpart to the federal Habitat Conservation Plan. It provides a means to comply with the Natural Community Conservation Plan Act and securing take authorization at the State Level.

Per-acre value - Determined by the number of species at a site or area divided by the number of functions those species can perform plus the number of key environmental correlates recorded at a site and the number of functions they characterize.

Protected areas – Areas dedicated to the preservation of biological diversity and to other natural, recreation, and cultural uses, managed for these purposes through legal or other effective means (USGS 2012). Protected areas in this report are defined as having GAP status 1 or 2:

> Status 1: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference or are mimicked through management.
>
> Status 2: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance.

Representation – Systematic or opportunistic approach in to conserve a full complement of species, habitats, functions, and ecological processes (services) across a landscape.

Resilience – The ability of an ecosystem to maintain diversity, integrity, and ecological processes following disturbance.

Snags – Standing dying or dead tree, which can occur in any tree size or height. Standing snags provide denning, foraging, nesting, and roosting habitat for a wide array of species.

Stand structure – The physical and temporal distribution of plants in a stand.

Sustainability – The ability to sustain diversity, productivity, resilience to stress, health, renewability, and/or yields of desired values, resources uses, products, or services from an ecosystem while maintaining the integrity of the ecosystem over time.

Sustainable development – The use of land and water to sustain production indefinitely without environmental deterioration, ideally without loss of native biodiversity.

Sustainable ecological system – Emphasizing and maintaining the underlying ecological processes that ensure long-term production of goods, services, and values without impairing productivity of the land.

Watershed – An area or a region that is bordered by a divide and from which water drains to a particular watercourse or body of water.

Wildlife habitats – A term that has been widely misapplied and misunderstood (Hall et al. 1997). As applied to wildlife, it means species-specific use of a wildlife habitat type. The habitat is fundamentally linked to the distribution and abundance of species and underlies explanation of factors, patterns, and processes that support the fitness of wildlife at the individual, population, and community levels, as well as their continuing evolution. Habitat is scalable and at the coarse level they can be illustrated as wildlife habitat types, the intermediate scale can be shown by structural conditions and the finest level are represented with fine feature elements or key environmental correlates (KECs) at a site. Simply showing vegetation types is not equivalent to wildlife habitat types, because habitat types are made up of groups of vegetation cover types (or land use/land cover types) that were determined based on the similarity of wildlife use and there is a lack of interrelationships with different vegetation types (O'Neil and Johnson 2001 [Chapter 1 – Oregon and Washington Wildlife Species and Their Habitats]).

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LINKS TO RESOURCES IN TEXT

Animal Tracking Data: www.movebank.org

California Cap and Trade:
http://www.c2es.org/us-states-regions/key-legislation/california-cap-trade#Basics

California Climate Change Research: http://cal-adapt.org

California Regional Linkage Plans: www.scwildlands.org

California Road-kill Observation System:
http://roadecology.ucdavis.edu/research/projects/california-roadkill-observation-system-cros

North American Breeding Bird Survey: www.pwrc.usgs.gov/bbs/participate

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APPENDIX A.
CONSERVATION TERMINOLOGY DOS AND DON'TS

The following information comes from two national surveys. The first one was on Lesson Learned Regarding the Language of Conservation (Weigel 2004) and second was about Key Findings from a Recent National Opinion Research on Ecosystem Services (Mertz 2010).

Ecosystem services is a term that apparently does not resonate with the public (Mertz 2010). Terms preferred by the public include *nature's value, nature benefits, environmental value*, and possibly *wildlife habitat value*. This is because the term *wildlife* also resonates with the public along with the term *habitat* (Weigel 2004).

DO NOT use "endangered species" as interchangeable with wildlife – voters view them differently. While voters are broadly supportive of protecting wildlife, the focus groups demonstrated that "endangered species" is a more polarizing term. Voters can point to examples where environmental regulations have held up important projects in order to protect what many deem to be obscure and unimportant species.

DO NOT say "open space." "Open space" is NOT one of the better terms to use in the vocabulary of conservation, and "urban open space" is even worse. In the focus groups, voters perceived "open space" as empty land, not near them, and did not necessarily see how they benefited from it or could use it. "Urban open space" was perceived as a bench between sky scrapers or an abandoned lot. Moreover, the survey demonstrates that "loss of open space" rates lower as a concern for voters (38% extremely or very serious problem) than many other environmental concerns, even those somewhat related such as "poorly planned growth and development" (45% extremely or very serious concern). Pluralities of both western U.S. and national voters indicate they think their community currently has "the right amount" of open space (51% and 46%, respectively).

DO say "natural areas" instead. In the focus groups, "natural areas" brought to mind images of trees, mountains, or water, such as streams or waterfalls. Natural areas could be wildlife habitat, could have trails for public use, or simply could have scenic value. This phrase implies a pristine state where "nothing's been touched" and "nobody is around"—the polar opposite of sprawl.

DO NOT use any of the following terms, as the consistently negative response from the focus groups indicate they should be replaced in how we talk about conservation:

- "Undeveloped land" is simply land that has not been developed YET but will be developed. In drought-stricken areas, "green space" can imply wide swaths of water-guzzling Bermuda grass. DO NOT go there.
- "Working landscapes" does not mean anything to respondents. They cannot place a scene or image that would be a "working landscape." Using the term, therefore, evokes nothing.
- "Natural landscapes" also does not work as well as "natural areas." Landscape is too close to "landscaping" and some in the focus groups equated this to xeriscaping or other gardening terms.

DO stress "planning" in terms of growth. Voters want well-thought-out and responsible planning for growth. A growth-related message that focuses on planning tested well nationally: "Continued growth in our area will lead to more and more development, traffic, and pollution. We must plan carefully for this growth and reduce its negative impacts by preserving clean air, clean water, and natural areas" (53% were much more inclined to support state or local community purchasing land).

DO use phrases that imply ownership and inclusion, such as "our" and "we." All of the messages in the survey incorporate this language and this is, in part, why they all test so well. So, it is "OUR natural areas" and "WE need to protect OUR beaches, lakes, natural areas and wildlife…."

DO connect land conservation to "future generations." Evoking children and future generations consistently tests very well as a rationale for land preservation. For example, 64% of voters nationally rate providing "opportunities for kids to learn about the environment" as a very important reason for their state or local community to buy land and protect it from development (ranks sixth overall).

APPENDIX B.
RELATIONSHIP MATRIX DESCRIPTIONS

MATRIX 1: Potential Species by Function Matrix

The potential species list generated by IBIS (see Appendix B) is aligned with key ecological functions (KEFs) that could potentially be performed in the habitat type and structural condition represented by the polygon. For example, if the polygon represents a "shrub-steppe" habitat type, the KEFs thought to be performed in that habitat type by the potential species are included in the relationship matrix. This information is acquired from IBIS. The result of this matrix is the number of potential species performing key functions in that habitat type. See the example in Table B-1.

Table B-1. Potential Species by Function Matrix

Lowland Mixed Conifer **Habitat Type** *Species Value (Potential)*	**Function 1** ***Secondary Consumer***	**Function 2** ***Breaks up Down Wood***	**Function 3** ***Primary Excavator***	**Function 4** ***Eats Terrestrial Insects***
Downey Woodpecker	**0**	**1**	**1 (tree)**	**1**
Bobcat	**1**	**0**	**0**	**0**
Belted Kingfisher	**1**	**0**	**1 (burrows)**	**1**
Great Blue Heron	**1**	**0**	**0**	**1**

MATRIX 2: Actual KEC by Function Matrix

In this matrix, the functions, or KEFs, are again related to key environmental correlates (KECs), but this time the KECs are those actually present at the site (based on field data inventory). Because this is an actual account, those KEFs not correlated to an actual KEC are then removed. The result of this matrix is the number of KEFs characterized by KECs specific to that polygon. See the example in Table B-2.

Table B-2. Actual KEC by Function Matrix

Lowland Mixed Conifer **Habitat Type** *KEC Value (Potential)*	**Function 1** ***Creates Snags***	**Function 2** ***Breaks up Down Wood***	**Function 3** ***Primary Excavator***	**Function 4** ***Eats Terrestrial Insects***
KEC 1 ***Down wood***	**0**	**1**	**0**	**1**
KEC 2 ***Snags***	**1**	**0**	**1**	**1**
KEC 3 ***Tree cavities***	**1**	**1**	**1**	**1**
KEC 4 ***Hollow living trees***	**0**	**1**	**0**	**1**

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APPENDIX C.

POTENTIAL SPECIES LIST FOR SCAG REGION BASED ON CWHR SPECIES' RANGES (550 TOTAL)

Table C-1 is a potential species list for the SCAG region based on CWHR species' ranges (550 total). Status codes include: SC – state candidate, ST – state threatened, SE – state endangered, FT – federal threatened, FE – federal endangered. An asterisk denotes status for a certain subspecies or DPS (Distinct Population Segment). Alternative scientific and common names are listed in the Scientific Name 2 and Common Name 2 columns. Species listing information source: California Department of Fish and Wildlife, State and Federally Listed Endangered & Threatened Animals of California, March 2014.

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
A032	Amphibian	*Anaxyrus boreas*	Western Toad	*Bufo boreas*			
A035	Amphibian	*Anaxyrus californicus*	Arroyo Toad	*Bufo californicus*			FE
A037	Amphibian	*Anaxyrus cognatus*	Great Plains Toad	*Bufo cognatus*			
A036	Amphibian	*Anaxyrus punctatus*	Red-spotted Toad	*Bufo punctatus*			
A034	Amphibian	*Anaxyrus woodhousii*	Woodhouse's Toad	*Bufo woodhousii*			
A022	Amphibian	*Aneides lugubris*	Arboreal Salamander				
A053	Amphibian	*Batrachoseps gabrieli*	San Gabriel Mtns Slender Salamander				
A013	Amphibian	*Batrachoseps major*	Garden Slender Salamander		Desert Slender Salamander (*aridus* subsp.)	SE*	FE*
A015	Amphibian	*Batrachoseps nigriventris*	Black-bellied Slender Salamander				
A016	Amphibian	*Batrachoseps pacificus*	Channel Islands Slender Salamander**				
A018	Amphibian	*Batrachoseps stebbinsi*	Tehachapi Slender Salamander			ST	
A012	Amphibian	*Ensatina eschscholtzii*	Ensatina		Yellow-blotched Ensatina (*croceater* subsp.)		
A066	Amphibian	*Ensatina eschscholtzii klauberi*	Large-blotched Ensatina	*Ensatina klauberi*			

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
A030	Amphibian	*Incilius alvarius*	Sonoran Desert (Colorado River) Toad	*Bufo alvarius*			
A050	Amphibian	*Lithobates berlandieri*	Rio Grande Leopard Frog	*Rana berlandieri*			
A046	Amphibian	*Lithobates catesbeiana*	Bullfrog	*Rana catesbeiana*			
A038	Amphibian	*Pseudacris cadaverina*	California Treefrog	*Hyla cadaverina*			
A039	Amphibian	*Pseudacris regilla*	Pacific Treefrog	*Hyla regilla*	Pacific Chorus Frog		
A043	Amphibian	*Rana boylii*	Foothill Yellow-legged Frog				
A071	Amphibian	*Rana draytonii*	California Red-legged Frog	*Rana aurora*			FT
A044	Amphibian	*Rana muscosa*	Mountain Yellow-legged Frog		Sierra Madre Yellow-legged Frog, southern California DPS	SE	FE*
A027	Amphibian	*Scaphiopus couchii*	Couch's Spadefoot				
A028	Amphibian	*Spea hammondii*	Western Spadefoot				
A008	Amphibian	*Taricha rivularis*	Red-bellied Newt				
A007	Amphibian	*Taricha torosa*	California Newt		Coast Range Newt		
B116	Bird	*Accipiter cooperii*	Cooper's Hawk				
B117	Bird	*Accipiter gentilis*	Northern Goshawk				
B115	Bird	*Accipiter striatus*	Sharp-shinned Hawk				
B170	Bird	*Actitis macularius*	Spotted Sandpiper	*Actitis macularia*			
B548	Bird	*Aechmophorus clarkii*	Clark's Grebe				
B010	Bird	*Aechmophorus occidentalis*	Western Grebe				
B274	Bird	*Aegolius acadicus*	Northern Saw-whet Owl				
B282	Bird	*Aeronautes saxatalis*	White-throated Swift				
B519	Bird	*Agelaius phoeniceus*	Red-winged Blackbird				
B520	Bird	*Agelaius tricolor*	Tricolored Blackbird				
B487	Bird	*Aimophila ruficeps*	Rufous-crowned Sparrow				
B076	Bird	*Aix sponsa*	Wood Duck				
B132	Bird	*Alectoris chukar*	Chukar				

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
B501	Bird	*Ammodramus savannarum*	Grasshopper Sparrow				
B497	Bird	*Amphispiza belli*	Sage Sparrow				FT*
B496	Bird	*Amphispiza bilineata*	Black-throated Sparrow				
B080	Bird	*Anas acuta*	Northern Pintail				
B087	Bird	*Anas americana*	American Wigeon				
B084	Bird	*Anas clypeata*	Northern Shoveler				
B077	Bird	*Anas crecca*	Green-winged Teal				
B083	Bird	*Anas cyanoptera*	Cinnamon Teal				
B082	Bird	*Anas discors*	Blue-winged Teal				
B086	Bird	*Anas penelope*	Eurasian Wigeon				
B079	Bird	*Anas platyrhynchos*	Mallard				
B085	Bird	*Anas strepera*	Gadwall				
B070	Bird	*Anser albifrons*	Greater White-fronted Goose				
B404	Bird	*Anthus rubrescens*	American Pipit				
B278	Bird	*Antrostomus arizonae*	Whip-poor-will	*Caprimulgus vociferus*	Mexican Whip-poor-will		
B348	Bird	*Aphelocoma californica*	Western Scrub-Jay				
B551	Bird	*Aphelocoma insularis*	Island Scrub-Jay**				
B126	Bird	*Aquila chrysaetos*	Golden Eagle				
B286	Bird	*Archilochus alexandri*	Black-chinned Hummingbird				
B052	Bird	*Ardea alba*	Great Egret				
B051	Bird	*Ardea herodias*	Great Blue Heron				
B177	Bird	*Arenaria interpres*	Ruddy Turnstone				
B178	Bird	*Arenaria melanocephala*	Black Turnstone				
B273	Bird	*Asio flammeus*	Short-eared Owl				
B272	Bird	*Asio otus*	Long-eared Owl				
B269	Bird	*Athene cunicularia*	Burrowing Owl				
B359	Bird	*Auriparus flaviceps*	Verdin				

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
B094	Bird	*Aythya affinis*	Lesser Scaup				
B090	Bird	*Aythya americana*	Redhead				
B091	Bird	*Aythya collaris*	Ring-necked Duck				
B093	Bird	*Aythya marila*	Greater Scaup				
B089	Bird	*Aythya valisineria*	Canvasback				
B358	Bird	*Baeolophus inornatus*	Oak Titmouse				
B552	Bird	*Baeolophus ridgewayi*	Juniper Titmouse				
B407	Bird	*Bombycilla cedrorum*	Cedar Waxwing				
B049	Bird	*Botaurus lentiginosus*	American Bittern				
B075	Bird	*Branta canadensis*	Canada Goose				
B265	Bird	*Bubo virginianus*	Great Horned Owl				
B057	Bird	*Bubulcus ibis*	Cattle Egret				
B103	Bird	*Bucephala albeola*	Bufflehead				
B101	Bird	*Bucephala clangula*	Common Goldeneye				
B102	Bird	*Bucephala islandica*	Barrow's Goldeneye				
B123	Bird	*Buteo jamaicensis*	Red-tailed Hawk				
B125	Bird	*Buteo lagopus*	Rough-legged Hawk				
B119	Bird	*Buteo lineatus*	Red-shouldered Hawk				
B124	Bird	*Buteo regalis*	Ferruginous Hawk				
B121	Bird	*Buteo swainsoni*	Swainson's Hawk			ST	
B058	Bird	*Butorides virescens*	Green Heron				
B514	Bird	*Calcarius lapponicus*	Lapland Longspur				
B181	Bird	*Calidris alba*	Sanderling				
B191	Bird	*Calidris alpina*	Dunlin				
B648	Bird	*Calidris bairdii*	Baird's Sandpiper				
B180	Bird	*Calidris canutus*	Red Knot				
B193	Bird	*Calidris himantopus*	Stilt Sandpiper				
B183	Bird	*Calidris mauri*	Western Sandpiper				
B649	Bird	*Calidris melanotos*	Pectoral Sandpiper				
B185	Bird	*Calidris minutilla*	Least Sandpiper				
B179	Bird	*Calidris virgata*	Surfbird	Aphriza virgata			

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
B140	Bird	*Callipepla californica*	California Quail				
B139	Bird	*Callipepla gambelii*	Gambel's Quail				
B287	Bird	*Calypte anna*	Anna's Hummingbird				
B288	Bird	*Calypte costae*	Costa's Hummingbird				
B365	Bird	*Campylorhynchus brunneicapillus*	Cactus Wren				
B463	Bird	*Cardellina pusilla*	Wilson's Warbler	*Wilsonia pusilla*			
B806	Bird	*Cardinalis cardinalis*	Northern Cardinal				
B108	Bird	*Cathartes aura*	Turkey Vulture				
B386	Bird	*Catharus guttatus*	Hermit Thrush				
B385	Bird	*Catharus ustulatus*	Swainson's Thrush				
B367	Bird	*Catherpes mexicanus*	Canyon Wren				
B239	Bird	*Cepphus columba*	Pigeon Guillemot**				
B247	Bird	*Cerorhinca monocerata*	Rhinoceros Auklet				
B364	Bird	*Certhia americana*	Brown Creeper				
B702	Bird	*Chaetura pelagica*	Chimney Swift				
B391	Bird	*Chamaea fasciata*	Wrentit				
B159	Bird	*Charadrius montanus*	Mountain Plover				
B154	Bird	*Charadrius nivosus*	Snowy Plover	*Charadrius alexandrinus*			FT
B156	Bird	*Charadrius semipalmatus*	Semipalmated Plover				
B158	Bird	*Charadrius vociferus*	Killdeer				
B071	Bird	*Chen caerulescens*	Snow Goose				
B072	Bird	*Chen rossii*	Ross's Goose				
B495	Bird	*Chondestes grammacus*	Lark Sparrow				
B275	Bird	*Chordeiles acutipennis*	Lesser Nighthawk				
B276	Bird	*Chordeiles minor*	Common Nighthawk				
B211	Bird	*Chroicocephalus philadelphia*	Bonaparte's Gull	*Larus philadelphia*			
B373	Bird	*Cinclus mexicanus*	American Dipper				

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
B114	Bird	*Circus cyaneus*	Northern Harrier				
B372	Bird	*Cistothorus palustris*	Marsh Wren				
B097	Bird	*Clangula hyemalis*	Long-tailed Duck				
B546	Bird	*Coccothraustes vespertinus*	Evening Grosbeak				
B259	Bird	*Coccyzus americanus*	Yellow-billed Cuckoo			SE	
B307	Bird	*Colaptes auratus*	Northern Flicker				
B549	Bird	*Colaptes chrysoides*	Gilded Flicker			SE	
B250	Bird	*Columba livia*	Rock Pigeon				
B256	Bird	*Columbina inca*	Inca Dove				
B257	Bird	*Columbina passerina*	Common Ground-Dove				
B309	Bird	*Contopus cooperi*	Olive-sided Flycatcher				
B311	Bird	*Contopus sordidulus*	Western Wood-Pewee				
B353	Bird	*Corvus brachyrhynchos*	American Crow				
B354	Bird	*Corvus corax*	Common Raven				
B346	Bird	*Cyanocitta stelleri*	Steller's Jay				
B067	Bird	*Cygnus columbianus*	Tundra Swan				
B279	Bird	*Cypseloides niger*	Black Swift				
B065	Bird	*Dendrocygna bicolor*	Fulvous Whistling-Duck				
B053	Bird	*Egretta thula*	Snowy Egret				
B111	Bird	*Elanus leucurus*	White-tailed Kite				
B320	Bird	*Empidonax difficilis*	Pacific-slope Flycatcher				
B318	Bird	*Empidonax oberholseri*	Dusky Flycatcher				
B315	Bird	*Empidonax traillii*	Willow Flycatcher			SE	
B319	Bird	*Empidonax wrightii*	Gray Flycatcher				
B337	Bird	*Eremophila alpestris*	Horned Lark				
B524	Bird	*Euphagus cyanocephalus*	Brewer's Blackbird				
B128	Bird	*Falco columbarius*	Merlin				
B131	Bird	*Falco mexicanus*	Prairie Falcon				
B129	Bird	*Falco peregrinus*	Peregrine Falcon			Delisted	Delisted

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
B127	Bird	*Falco sparverius*	American Kestrel				
B248	Bird	*Fratercula cirrhata*	Tufted Puffin**				
B149	Bird	*Fulica americana*	American Coot				
B199	Bird	*Gallinago delicata*	Wilson's Snipe				
B148	Bird	*Gallinula chloropus*	Common Moorhen				
B003	Bird	*Gavia immer*	Common Loon				
B002	Bird	*Gavia pacifica*	Pacific Loon				
B001	Bird	*Gavia stellata*	Red-throated Loon				
B226	Bird	*Gelochelidon nilotica*	Gull-billed Tern				
B260	Bird	*Geococcyx californianus*	Greater Roadrunner				
B460	Bird	*Geothlypis tolmiei*	Macgillivray's Warbler	*Oporornis tolmiei*			
B461	Bird	*Geothlypis trichas*	Common Yellowthroat				
B267	Bird	*Glaucidium gnoma*	Northern Pygmy Owl				
B150	Bird	*Grus canadensis*	Sandhill Crane			ST*	
B109	Bird	*Gymnogyps californianus*	California Condor			SE	FE
B349	Bird	*Gymnorhinus cyanocephalus*	Pinyon Jay				
B162	Bird	*Haematopus bachmani*	Black Oystercatcher**				
B634	Bird	*Haematopus palliatus*	American Oystercatcher				
B537	Bird	*Haemorhous cassinii*	Cassin's Finch	*Carpodacus cassinii*			
B538	Bird	*Haemorhous mexicanus*	House Finch	*Carpodacus mexicanus*			
B536	Bird	*Haemorhous purpureus*	Purple Finch	*Carpodacus purpureus*			
B113	Bird	*Haliaeetus leucocephalus*	Bald Eagle			SE	Delisted
B163	Bird	*Himantopus mexicanus*	Black-necked Stilt				
B344	Bird	*Hirundo rustica*	Barn Swallow				
B227	Bird	*Hydroprogne caspia*	Caspian Tern	*Sterna caspia*			
B467	Bird	*Icteria virens*	Yellow-breasted Chat				
B532	Bird	*Icterus bullockii*	Bullock's Oriole				

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
B530	Bird	*Icterus cucullatus*	Hooded Oriole				
B533	Bird	*Icterus parisorum*	Scott's Oriole				
B050	Bird	*Ixobrychus exilis*	Least Bittern				
B390	Bird	*Ixoreus naevius*	Varied Thrush				
B512	Bird	*Junco hyemalis*	Dark-eyed Junco				
B410	Bird	*Lanius ludovicianus*	Loggerhead Shrike	*Lanius ludovicianus mearnsi*	San Clemente Loggerhead Shrike		FE
B216	Bird	*Larus argentatus*	Herring Gull				
B215	Bird	*Larus californicus*	California Gull				
B213	Bird	*Larus canus*	Mew Gull				
B214	Bird	*Larus delawarensis*	Ring-billed Gull				
B221	Bird	*Larus glaucescens*	Glaucous-winged Gull				
B212	Bird	*Larus heermanni*	Heermann's Gull				
B219	Bird	*Larus livens*	Yellow-footed Gull				
B220	Bird	*Larus occidentalis*	Western Gull				
B217	Bird	*Larus thayeri*	Thayer's Gull				
B143	Bird	*Laterallus jamaicensis*	Black Rail	*Laterallus jamaicensis conturniculus*	California Black Rail	ST	
B196	Bird	*Limnodromus griseus*	Short-billed Dowitcher				
B197	Bird	*Limnodromus scolopaceus*	Long-billed Dowitcher				
B176	Bird	*Limosa fedoa*	Marbled Godwit				
B104	Bird	*Lophodytes cucullatus*	Hooded Merganser				
B539	Bird	*Loxia curvirostra*	Red Crossbill				
B293	Bird	*Megaceryle alcyon*	Belted Kingfisher	*Ceryle alcyon*			
B264	Bird	*Megascops kennicottii*	Western Screech Owl				
B296	Bird	*Melanerpes formicivorus*	Acorn Woodpecker				
B294	Bird	*Melanerpes lewis*	Lewis's Woodpecker				
B297	Bird	*Melanerpes uropygialis*	Gila Woodpecker			SE	
B100	Bird	*Melanitta fusca*	White-winged Scoter				
B098	Bird	*Melanitta nigra*	Black Scoter				

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
B099	Bird	*Melanitta perspicillata*	Surf Scoter				
B138	Bird	*Meleagris gallopavo*	Wild Turkey				
B506	Bird	*Melospiza lincolnii*	Lincoln's Sparrow				
B505	Bird	*Melospiza melodia*	Song Sparrow				
B485	Bird	*Melozone aberti*	Abert's Towhee	*Pipilo aberti*			
B484	Bird	*Melozone crissalis*	California Towhee	*Pipilo crissalis, Melozone crissalis eremophilus*	Inyo California Towhee	SE	FT
B105	Bird	*Mergus merganser*	Common Merganser				
B106	Bird	*Mergus serrator*	Red-breasted Merganser				
B268	Bird	*Micrathene whitneyi*	Elf Owl			SE	
B393	Bird	*Mimus polyglottos*	Northern Mockingbird				
B527	Bird	*Molothrus aeneus*	Bronzed Cowbird				
B528	Bird	*Molothrus ater*	Brown-headed Cowbird				
B382	Bird	*Myadestes townsendi*	Townsend's Solitaire				
B603	Bird	*Mycteria americana*	Wood Stork				
B326	Bird	*Myiarchus cinerascens*	Ash-throated Flycatcher				
B328	Bird	*Myiarchus tyrannulus*	Brown-crested Flycatcher				
B350	Bird	*Nucifraga columbiana*	Clark's Nutcracker				
B173	Bird	*Numenius americanus*	Long-billed Curlew				
B172	Bird	*Numenius phaeopus*	Whimbrel				
B059	Bird	*Nycticorax nycticorax*	Black-crowned Night Heron				
B579	Bird	*Oceanodroma furcata*	Fork-Tailed Storm-Petrel				
B581	Bird	*Oceanodroma homochroa*	Ashy Storm-Petrel				
B580	Bird	*Oceanodroma leucorhoa*	Leach's Storm-Petrel				
B584	Bird	*Oceanodroma melania*	Black Storm-Petrel				
B141	Bird	*Oreortyx pictus*	Mountain Quail				
B394	Bird	*Oreoscoptes montanus*	Sage Thrasher				
B425	Bird	*Oreothlypis celata*	Orange-crowned Warbler	*Vermivora celata*			

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
B428	Bird	*Oreothlypis luciae*	Lucy's Warbler	*Vermivora luciae*			
B426	Bird	*Oreothlypis ruficapilla*	Nashville Warbler	*Vermivora ruficapilla*			
B427	Bird	*Oreothlypis virginiae*	Virginia's Warbler	*Vermivora virginiae*			
B107	Bird	*Oxyura jamaicensis*	Ruddy Duck				
B110	Bird	*Pandion haliaetus*	Osprey				
B620	Bird	*Parabuteo unicinctus*	Harris's Hawk				
B547	Bird	*Passer domesticus*	House Sparrow				
B499	Bird	*Passerculus sandwichensis*	Savannah Sparrow			SE*	
B504	Bird	*Passerella iliaca*	Fox Sparrow				
B477	Bird	*Passerina amoena*	Lazuli Bunting				
B476	Bird	*Passerina caerulea*	Blue Grosbeak				
B809	Bird	*Passerina cyanea*	Indigo Bunting				
B251	Bird	*Patagioenas fasciata*	Band-tailed Pigeon				
B042	Bird	*Pelecanus erythrorhynchos*	American White Pelican				
B043	Bird	*Pelecanus occidentalis*	Brown Pelican			Delisted	Delisted
B343	Bird	*Petrochelidon pyrrhonota*	Cliff Swallow				
B408	Bird	*Phainopepla nitens*	Phainopepla				
B044	Bird	*Phalacrocorax auritus*	Double-crested Cormorant				
B047	Bird	*Phalacrocorax pelagicus*	Pelagic Cormorant				
B046	Bird	*Phalacrocorax penicillatus*	Brandt's Cormorant				
B277	Bird	*Phalaenoptilus nuttallii*	Common Poorwill				
B656	Bird	*Phalaropus fulicarius*	Red Phalarope				
B655	Bird	*Phalaropus lobatus*	Red-necked Phalarope				
B133	Bird	*Phasianus colchicus*	Ring-necked Pheasant				
B475	Bird	*Pheucticus melanocephalus*	Black-headed Grosbeak				
B352	Bird	*Pica nuttalli*	Yellow-billed Magpie				

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
B305	Bird	*Picoides albolarvatus*	White-headed Woodpecker				
B302	Bird	*Picoides nuttallii*	Nuttall's Woodpecker				
B303	Bird	*Picoides pubescens*	Downy Woodpecker				
B301	Bird	*Picoides scalaris*	Ladder-backed Woodpecker				
B304	Bird	*Picoides villosus*	Hairy Woodpecker				
B482	Bird	*Pipilo chlorurus*	Green-tailed Towhee				
B483	Bird	*Pipilo maculatus*	Spotted Towhee				
B471	Bird	*Piranga ludoviciana*	Western Tanager				
B469	Bird	*Piranga rubra*	Summer Tanager				
B062	Bird	*Plegadis chihi*	White-faced Ibis				
B629	Bird	*Pluvialis fulva*	Pacific Golden-Plover				
B151	Bird	*Pluvialis squatarola*	Black-bellied Plover				
B007	Bird	*Podiceps auritus*	Horned Grebe				
B009	Bird	*Podiceps nigricollis*	Eared Grebe				
B006	Bird	*Podilymbus podiceps*	Pied-billed Grebe				
B356	Bird	*Poecile gambeli*	Mountain Chickadee				
B377	Bird	*Polioptila caerulea*	Blue-gray Gnatcatcher				
B553	Bird	*Polioptila californica*	California Gnatcatcher		Coastal California Gnatcatcher		FT
B378	Bird	*Polioptila melanura*	Black-tailed Gnatcatcher				
B494	Bird	*Pooecetes gramineus*	Vesper Sparrow				
B146	Bird	*Porzana carolina*	Sora				
B338	Bird	*Progne subis*	Purple Martin				
B360	Bird	*Psaltriparus minimus*	Bushtit				
B263	Bird	*Psiloscops flammeolus*	Flammulated Owl	*Otus flammeolus*			
B244	Bird	*Ptychoramphus aleuticus*	Cassin's Auklet				
B324	Bird	*Pyrocephalus rubinus*	Vermilion Flycatcher				
B525	Bird	*Quiscalus mexicanus*	Great-tailed Grackle				
B145	Bird	*Rallus limicola*	Virginia Rail				

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
B144	Bird	*Rallus longirostris*	Clapper Rail			SE, ST*	FE
B164	Bird	*Recurvirostra americana*	American Avocet				
B376	Bird	*Regulus calendula*	Ruby-crowned Kinglet				
B375	Bird	*Regulus satrapa*	Golden-crowned Kinglet				
B236	Bird	*Rynchops niger*	Black Skimmer				
B366	Bird	*Salpinctes obsoletus*	Rock Wren				
B321	Bird	*Sayornis nigricans*	Black Phoebe				
B323	Bird	*Sayornis saya*	Say's Phoebe				
B289	Bird	*Selasphorus calliope*	Calliope Hummingbird	*Stellula calliope*			
B290	Bird	*Selasphorus platycercus*	Broad-tailed Hummingbird				
B292	Bird	*Selasphorus sasin*	Allen's Hummingbird				
B435	Bird	*Setophaga coronata*	Yellow-rumped Warbler	*Dendroica coronata*			
B436	Bird	*Setophaga nigrescens*	Black-throated Gray Warbler	*Dendroica nigrescens*			
B438	Bird	*Setophaga occidentalis*	Hermit Warbler	*Dendroica occidentalis*			
B430	Bird	*Setophaga petechia*	Yellow Warbler	*Dendroica petechia*			
B773	Bird	*Setophaga ruticilla*	American Redstart				
B437	Bird	*Setophaga townsendi*	Townsend's Warbler	*Dendroica townsendi*			
B381	Bird	*Sialia currucoides*	Mountain Bluebird				
B380	Bird	*Sialia mexicana*	Western Bluebird				
B361	Bird	*Sitta canadensis*	Red-breasted Nuthatch				
B362	Bird	*Sitta carolinensis*	White-breasted Nuthatch				
B363	Bird	*Sitta pygmaea*	Pygmy Nuthatch				
B298	Bird	*Sphyrapicus nuchalis*	Red-naped Sapsucker				
B299	Bird	*Sphyrapicus ruber*	Red-breasted Sapsucker				
B300	Bird	*Sphyrapicus thyroideus*	Williamson's Sapsucker				
B544	Bird	*Spinus lawrencei*	Lawrence's Goldfinch	*Carduelis lawrencei*			
B542	Bird	*Spinus pinus*	Pine Siskin	*Carduelis pinus*			
B543	Bird	*Spinus psaltria*	Lesser Goldfinch	*Carduelis psaltria*			

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
B545	Bird	*Spinus tristis*	American Goldfinch	*Carduelis tristis*			
B493	Bird	*Spizella atrogularis*	Black-chinned Sparrow				
B491	Bird	*Spizella breweri*	Brewer's Sparrow				
B489	Bird	*Spizella passerina*	Chipping Sparrow				
B341	Bird	*Stelgidopteryx serripennis*	Northern Rough-winged Swallow				
B233	Bird	*Sterna forsteri*	Forster's Tern				
B231	Bird	*Sterna hirundo*	Common Tern				
B234	Bird	*Sternula antillarum*	Least Tern	*Sterna antillarum*		SE	FE
B253	Bird	*Streptopelia chinensis*	Spotted Dove				
B252	Bird	*Streptopelia risoria*	Ringed Turtle-Dove				
B270	Bird	*Strix occidentalis*	Spotted Owl			SC	FT
B521	Bird	*Sturnella neglecta*	Western Meadowlark				
B411	Bird	*Sturnus vulgaris*	European Starling				
B241	Bird	*Synthliboramphus hypoleucus*	Xantus's Murrelet**		split into 2 spp: Scripps's (*scrippsi*) and Guadalupe (*hypoleucus*)	ST	
B339	Bird	*Tachycineta bicolor*	Tree Swallow				
B340	Bird	*Tachycineta thalassina*	Violet-green Swallow				
B229	Bird	*Thalasseus elegans*	Elegant Tern	*Sterna elegans*			
B228	Bird	*Thalasseus maximus*	Royal Tern	*Sterna maxima*			
B368	Bird	*Thryomanes bewickii*	Bewick's Wren				
B396	Bird	*Toxostoma bendirei*	Bendire's Thrasher				
B399	Bird	*Toxostoma crissale*	Crissal Thrasher				
B400	Bird	*Toxostoma lecontei*	Le Conte's Thrasher				
B398	Bird	*Toxostoma redivivum*	California Thrasher				
B166	Bird	*Tringa flavipes*	Lesser Yellowlegs				
B169	Bird	*Tringa incanus*	Wandering Tattler	*Heteroscelus incanus*			
B165	Bird	*Tringa melanoleuca*	Greater Yellowlegs				
B168	Bird	*Tringa semipalmatus*	Willet	*Catoptrophorus semipalmatus*			

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
B369	Bird	*Troglodytes aedon*	House Wren				
B370	Bird	*Troglodytes pacificus*	Pacific Wren	*Troglodytes troglodytes*	Winter Wren		
B389	Bird	*Turdus migratorius*	American Robin				
B333	Bird	*Tyrannus verticalis*	Western Kingbird				
B331	Bird	*Tyrannus vociferans*	Cassin's Kingbird				
B262	Bird	*Tyto alba*	Barn Owl				
B237	Bird	*Uria aalge*	Common Murre				
B413	Bird	*Vireo bellii*	Bell's Vireo			SE	FE*
B415	Bird	*Vireo cassinii*	Cassin's Vireo				
B418	Bird	*Vireo gilvus*	Warbling Vireo				
B417	Bird	*Vireo huttoni*	Hutton's Vireo				
B554	Bird	*Vireo plumbeus*	Plumbeous Vireo				
B414	Bird	*Vireo vicinior*	Gray Vireo				
B522	Bird	*Xanthocephalus xanthocephalus*	Yellow-headed Blackbird				
B254	Bird	*Zenaida asiatica*	White-winged Dove				
B255	Bird	*Zenaida macroura*	Mourning Dove				
B798	Bird	*Zonotrichia albicollis*	White-throated Sparrow				
B509	Bird	*Zonotrichia atricapilla*	Golden-crowned Sparrow				
B510	Bird	*Zonotrichia leucophrys*	White-crowned Sparrow				
B799	Bird	*Zonotrichia querula*	Harris's Sparrow				
M067	Mammal	*Ammospermophilus leucurus*	White-tailed Antelope Squirrel				
M068	Mammal	*Ammospermophilus nelsoni*	Nelson's Antelope Squirrel			ST	
M182	Mammal	*Antilocapra americana*	Pronghorn				
M038	Mammal	*Antrozous pallidus*	Pallid Bat				
M168	Mammal	*Arctocephalus townsendi*	Guadalupe Fur-Seal			ST	FT
M152	Mammal	*Bassariscus astutus*	Ringtail				
M075	Mammal	*Callospermophilus lateralis*	Golden-mantled Ground Squirrel	*Spermophilus lateralis*			

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
M146	Mammal	*Canis latrans*	Coyote				
M186	Mammal	*Capra hircus*	Feral Goat**				
M112	Mammal	*Castor canadensis*	American Beaver				
M177	Mammal	*Cervus elaphus*	Elk				
M092	Mammal	*Chaetodipus baileyi*	Bailey's Pocket Mouse				
M095	Mammal	*Chaetodipus californicus*	California Pocket Mouse				
M094	Mammal	*Chaetodipus fallax*	San Diego Pocket Mouse				
M091	Mammal	*Chaetodipus formosus*	Long-tailed Pocket Mouse				
M093	Mammal	*Chaetodipus penicillatus*	Desert Pocket Mouse				
M096	Mammal	*Chaetodipus spinatus*	Spiny Pocket Mouse				
M037	Mammal	*Corynorhinus townsendii*	Townsend's Big-eared Bat			SC	
M001	Mammal	*Didelphis virginiana*	Virginia Opossum				
M103	Mammal	*Dipodomys agilis*	Pacific Kangaroo Rat				
M109	Mammal	*Dipodomys deserti*	Desert Kangaroo Rat				
M104	Mammal	*Dipodomys heermanni*	Heermann's Kangaroo Rat				
M106	Mammal	*Dipodomys ingens*	Giant Kangaroo Rat			SE	FE
M110	Mammal	*Dipodomys merriami*	Merriam's Kangaroo Rat	*Dipodomys merriami parvus*	San Bernardino kangaroo rat		FE
M100	Mammal	*Dipodomys microps*	Chisel-toothed Kangaroo Rat				
M111	Mammal	*Dipodomys nitratoides*	Fresno Kangaroo Rat			SE	SE
M107	Mammal	*Dipodomys panamintinus*	Panamint Kangaroo Rat				
M108	Mammal	*Dipodomys stephensi*	Stephens' Kangaroo Rat			ST	FE
M032	Mammal	*Eptesicus fuscus*	Big Brown Bat				
M175	Mammal	*Equus asinus*	Feral Ass				
M145	Mammal	*Erethizon dorsatum*	Common Porcupine				
M036	Mammal	*Euderma maculatum*	Spotted Bat				
M042	Mammal	*Eumops perotis*	Western Mastiff Bat				

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
M080	Mammal	*Glaucomys sabrinus*	Northern Flying Squirrel				
M030	Mammal	*Lasionycteris noctivagans*	Silver-haired Bat				
M033	Mammal	*Lasiurus blossevillii*	Western Red Bat				
M034	Mammal	*Lasiurus cinereus*	Hoary Bat				
M035	Mammal	*Lasiurus xanthinus*	Western Yellow Bat		Southwestern Yellow Bat		
M051	Mammal	*Lepus californicus*	Black-tailed Jackrabbit				
M166	Mammal	*Lynx rufus*	Bobcat				
M019	Mammal	*Macrotus californicus*	California Leaf-nosed Bat				
M162	Mammal	*Mephitis mephitis*	Striped Skunk				
M134	Mammal	*Microtus californicus*	California Vole			SE*	FE*
M136	Mammal	*Microtus longicaudus*	Long-tailed Vole				
M173	Mammal	*Mirounga angustirostris*	Northern Elephant Seal				
M142	Mammal	*Mus musculus*	House Mouse				
M157	Mammal	*Mustela frenata*	Long-tailed Weasel				
M028	Mammal	*Myotis californicus*	California Myotis				
M029	Mammal	*Myotis ciliolabrum*	Western Small-footed Myotis				
M025	Mammal	*Myotis evotis*	Long-eared Myotis				
M021	Mammal	*Myotis lucifugus*	Little Brown Myotis				
M022	Mammal	*Myotis occultus*	Occult Little Brown Bat		Arizona Myotis		
M026	Mammal	*Myotis thysanodes*	Fringed Myotis				
M024	Mammal	*Myotis velifer*	Cave Myotis				
M027	Mammal	*Myotis volans*	Long-legged Myotis				
M023	Mammal	*Myotis yumanensis*	Yuma Myotis				
M060	Mammal	*Neotamias merriami*	Merriam's Chipmunk	*Tamias merriami*			
M061	Mammal	*Neotamias obscurus*	California Chipmunk	*Tamias obscurus*	Dusky Chipmunk		

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
M064	Mammal	*Neotamias panamintinus*	Panamint Chipmunk	*Tamias panamintinus*			
M063	Mammal	*Neotamias speciosus*	Lodgepole Chipmunk	*Tamias speciosus*			
M125	Mammal	*Neotoma albigula*	White-throated Woodrat				
M127	Mammal	*Neotoma fuscipes*	Dusky-footed Woodrat				
M126	Mammal	*Neotoma lepida*	Desert Woodrat				
M233	Mammal	*Neotoma macrotis*	Large-eared Woodrat				
M014	Mammal	*Notiosorex crawfordi*	Desert Shrew				
M040	Mammal	*Nyctinomops femorosaccus*	Pocketed Free-tailed Bat				
M181	Mammal	*Odocoileus hemionus*	Mule Deer				
M139	Mammal	*Ondatra zibethicus*	Common Muskrat				
M122	Mammal	*Onychomys torridus*	Southern Grasshopper Mouse				
M072	Mammal	*Otospermophilus beecheyi*	California Ground Squirrel	*Spermophilus beecheyi*			
M071	Mammal	*Otospermophilus variegatus*	Rock Squirrel	*Spermophilus variegatus*			
M183	Mammal	*Ovis canadensis*	Bighorn Sheep			ST*	FE*
M089	Mammal	*Perognathus alticolus*	White-eared Pocket Mouse				
M087	Mammal	*Perognathus inornatus*	San Joaquin Pocket Mouse				
M086	Mammal	*Perognathus longimembris*	Little Pocket Mouse				FE*
M119	Mammal	*Peromyscus boylii*	Brush Mouse				
M116	Mammal	*Peromyscus californicus*	California Mouse				
M118	Mammal	*Peromyscus crinitus*	Canyon Mouse				
M115	Mammal	*Peromyscus eremicus*	Cactus Mouse				
M234	Mammal	*Peromyscus fraterculus*	Baja Mouse				
M117	Mammal	*Peromyscus maniculatus*	Deer Mouse				
M120	Mammal	*Peromyscus truei*	Pinyon Mouse				
M171	Mammal	*Phoca vitulina*	Harbor Seal				

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
M031	Mammal	*Pipistrellus hesperus*	Western Pipistrelle				
M153	Mammal	*Procyon lotor*	Raccoon				
M165	Mammal	*Puma concolor*	Mountain Lion				
M141	Mammal	*Rattus norvegicus*	Norway Rat				
M140	Mammal	*Rattus rattus*	Black Rat				
M113	Mammal	*Reithrodontomys megalotis*	Western Harvest Mouse				
M018	Mammal	*Scapanus latimanus*	Broad-footed Mole		Broad-handed Mole		
M077	Mammal	*Sciurus griseus*	Western Gray Squirrel				
M078	Mammal	*Sciurus niger*	Eastern Fox Squirrel				
M124	Mammal	*Sigmodon arizonae*	Arizona Cotton Rat				
M123	Mammal	*Sigmodon hispidus*	Hispid Cotton Rat				
M004	Mammal	*Sorex monticolus*	Dusky Shrew				
M006	Mammal	*Sorex ornatus*	Ornate Shrew				
M012	Mammal	*Sorex trowbridgii*	Trowbridge's Shrew				
M161	Mammal	*Spilogale gracilis*	Western Spotted Skunk				
M176	Mammal	*Sus scrofa*	Wild Pig				
M047	Mammal	*Sylvilagus audubonii*	Desert Cottontail				
M045	Mammal	*Sylvilagus bachmani*	Brush Rabbit				
M046	Mammal	*Sylvilagus nuttallii*	Mountain Cottontail				
M039	Mammal	*Tadarida brasiliensis*	Brazilian Free-tailed Bat				
M160	Mammal	*Taxidea taxus*	American Badger				
M081	Mammal	*Thomomys bottae*	Botta's Pocket Gopher				
M149	Mammal	*Urocyon cinereoargenteus*	Gray Fox				
M150	Mammal	*Urocyon littoralis*	Island Gray Fox**			ST	FE*
M151	Mammal	*Ursus americanus*	Black Bear				
M148	Mammal	*Vulpes macrotis*	Kit Fox				
M147	Mammal	*Vulpes vulpes*	Red Fox			ST	
M073	Mammal	*Xerospermophilus mohavensis*	Mohave Ground Squirrel	*Spermophilus mohavensis*		ST	

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
M074	Mammal	*Xerospermophilus tereticaudus*	Round-tailed Ground Squirrel	*Spermophilus tereticaudus, Xerospermophilus tereticaudus chlorus*	Palm Springs round-tailed ground squirrel		
M170	Mammal	*Zalophus californianus*	California Sea-Lion				
R004	Reptile	*Actinemys marmorata*	Western Pond Turtle	*Emys marmorata*	Pacific Pond Turtle		
R043	Reptile	*Anniella stebbinsi*	California Legless Lizard	*Anniella pulchra*	Southern California Legless Lizard		
R056	Reptile	*Arizona elegans*	Glossy Snake				
R038	Reptile	*Aspidoscelis hyperytha*	Orange-throated Whiptail		Belding's Orange-throated Whiptail (*beldingi* subsp.)		
R039	Reptile	*Aspidoscelis tigris*	Western Whiptail		Coastal Whiptail (*Stejnegeri* subsp.), Great Basin Whiptail (*tigris* subsp.)		
R012	Reptile	*Callisaurus draconoides*	Zebra-tailed Lizard		Western Zebra-tailed Lizard (*rhodostictus* subsp.)		
R046	Reptile	*Charina umbratica*	Rubber Boa	*Charina bottae umbratica*	Southern Rubber Boa	ST	
R067	Reptile	*Chionactis occipitalis*	Western Shovel-nosed Snake				
R007	Reptile	*Coleonyx switaki*	Barefoot Gecko		Peninsular Banded Gecko (*Coleonyx switaki switaki*)	ST	
R008	Reptile	*Coleonyx variegatus*	Western Banded Gecko		San Diego Banded Gecko (*abbotti* subsp.), Desert Banded Gecko (*variegatus* subsp.)		

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
R051	Reptile	*Coluber constrictor*	Racer		Western Yellow-bellied Racer (*mormon* subsp.)		
R052	Reptile	*Coluber flagellum*	Coachwhip	*Masticophis flagellum*	Red Racer (*piceus* subsp.)		
R053	Reptile	*Coluber lateralis*	California Striped Racer	*Masticophis lateralis*	*lateralis* subsp.		
R054	Reptile	*Coluber taeniatus*	Striped Whipsnake	*Masticophis taeniatus*	Desert Striped Whipsnake (*taeniatus* subsp.)		
R072	Reptile	*Crotalus atrox*	Western Diamond-backed Rattlesnake				
R075	Reptile	*Crotalus cerastes*	Sidewinder				
R074	Reptile	*Crotalus mitchellii*	Speckled Rattlesnake		Southwestern Speckled Rattlesnake (*pyrrhus* subsp.)		
R076	Reptile	*Crotalus oreganus*	Western Rattlesnake	*Crotalus viridis*	Southern Pacific Rattlesnake (*helleri* subsp.)		
R073	Reptile	*Crotalus ruber*	Red Diamond Rattlesnake				
R077	Reptile	*Crotalus scutulatus*	Mojave Rattlesnake		Northern Mohave Rattlesnake (*scutulatus* subsp.)		
R017	Reptile	*Crotaphytus bicinctores*	Great Basin Collared Lizard				
R093	Reptile	*Crotaphytus vestigium*	Baja California Collared Lizard		Baja Black-collared Lizard		
R048	Reptile	*Diadophis punctatus*	Ring-necked Snake				
R010	Reptile	*Dipsosaurus dorsalis*	Desert Iguana		Northern Desert Iguana (*dorsalis* subsp.)		
R040	Reptile	*Elgaria multicarinata*	Southern Alligator Lizard				
R041	Reptile	*Elgaria panamintina*	Panamint Alligator Lizard				

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
R037	Reptile	*Eumeces gilberti*	Gilbert's Skink		Western Red-tailed Skink (*Plestiodon "gilberti" rubricaudatus*)		
R019	Reptile	*Gambelia sila*	Blunt-nosed Leopard Lizard			SE	FE
R018	Reptile	*Gambelia wislizenii*	Long-nosed Leopard Lizard				
R005	Reptile	*Gopherus agassizii*	Desert Tortoise		Mohave Desert Tortoise	ST	FT
R044	Reptile	*Heloderma suspectum*	Gila Monster		Banded Gila Monster (*cinctum* subsp.)		
R071	Reptile	*Hypsiglena chlorophaea*	Night Snake	*Hypsiglena torquata*	Northern Desert Nightsnake (*deserticola* subsp.)		
R002	Reptile	*Kinosternon sonoriense*	Sonora Mud Turtle				
R058	Reptile	*Lampropeltis californiae*	Common Kingsnake	*Lampropeltis getula*	California Kingsnake		
R059	Reptile	*Lampropeltis zonata*	California Mountain Kingsnake				
R047	Reptile	*Lichanura trivirgata*	Rosy Boa	*Charina trivirgata*			
R028	Reptile	*Petrosaurus mearnsi*	Banded Rock Lizard		Mearns' Rock Lizard (*mearnsi* subsp.)		
R029	Reptile	*Phrynosoma blainvillii*	Blainville's Horned Lizard	*Phrynosoma coronatum*	Coast Horned Lizard		
R032	Reptile	*Phrynosoma mcallii*	Flat-tailed Horned Lizard				
R030	Reptile	*Phrynosoma platyrhinos*	Desert Horned Lizard		Southern Desert Horned Lizard (*calidiarum* subsp.)		
R009	Reptile	*Phyllodactylus nocticolus*	Leaf-toed Gecko	*Phyllodactylus xanti*	Peninsular Leaf-toed Gecko		
R050	Reptile	*Phyllorhynchus decurtatus*	Spotted Leaf-nosed Snake				
R057	Reptile	*Pituophis catenifer*	Gopher Snake				

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
R036	Reptile	*Plestiodon skiltonianus*	Western Skink	*Eumeces skiltonianus*	Coronado Skink (*interparietalis* subsp.)		
R045	Reptile	*Rena humilis*	Western Blind Snake	*Leptotyphlops humilis*	Desert Threadsnake (*cahuilae* subsp.), Southwestern Threadsnake (*humilis* subsp.)		
R060	Reptile	*Rhinocheilus lecontei*	Long-nosed Snake				
R055	Reptile	*Salvadora hexalepis*	Western Patch-nosed Snake				
R011	Reptile	*Sauromalus ater*	Common Chuckwalla				
R023	Reptile	*Sceloporus graciosus*	Sagebrush Lizard				
R020	Reptile	*Sceloporus magister*	Desert Spiny Lizard				
R022	Reptile	*Sceloporus occidentalis*	Western Fence Lizard				
R021	Reptile	*Sceloporus orcutti*	Granite Spiny Lizard				
R066	Reptile	*Sonora semiannulata*	Western Ground Snake		Variable Groundsnake (*semiannulata* subsp.)		
R069	Reptile	*Tantilla hobartsmithi*	Southwestern Black-headed Snake		Smith's Black-headed Snake		
R068	Reptile	*Tantilla planiceps*	California Black-headed Snake		Western Black-headed Snake		
R063	Reptile	*Thamnophis couchii*	Sierra (Western Aquatic) Garter Snake		Pacific Coast Aquatic Garter Snake		
R062	Reptile	*Thamnophis elegans*	Western Terrestrial Garter Snake				
R080	Reptile	*Thamnophis hammondii*	Two-striped Garter Snake				

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
R065	Reptile	*Thamnophis marcianus*	Checkered Garter Snake		Marcy's Checkered Gartersnake (*marcianus* subsp.)		
R061	Reptile	*Thamnophis sirtalis*	Common Garter Snake		South Coast Garter Snake		
R003	Reptile	*Trachemys scripta*	Pond Slider	*Trachemys scripta elegans*	Red-eared Slider		
R070	Reptile	*Trimorphodon biscutatus*	Western Lyre Snake	*Trimorphodon lambda, Trimorphodon lyrophanes*	Sonoran Lyresnake, California Lyresnake		
R006	Reptile	*Trionyx spiniferus*	Spiny Softshell		Texas Spiny Softshell (*emoryi* subsp.)		
R014	Reptile	*Uma inornata*	Coachella Valley Fringe-toed Lizard			SE	FT
R013	Reptile	*Uma notata*	Colorado Desert Fringe-toed Lizard				
R015	Reptile	*Uma scoparia*	Mojave Fringe-toed Lizard				
R025	Reptile	*Urosaurus graciosus*	Long-tailed Brush Lizard		Western Long-tailed Brush Lizard (*graciosus* subsp.)		
R027	Reptile	*Urosaurus nigricaudus*	Baja California Brush Lizard				
R026	Reptile	*Urosaurus ornatus*	Ornate Tree Lizard		Colorado River Tree Lizard (*symmetricus* subsp.)		
R024	Reptile	*Uta stansburiana*	Common Side-blotched Lizard		Western Side-blotched Lizard (*elegans* subsp.)		
R094	Reptile	*Xantusia gracilis*	Sandstone Night Lizard				
R033	Reptile	*Xantusia henshawi*	Granite Night Lizard		Henshaw's Night Lizard		

Table C-1. Potential Species List for SCAG Region Based on CWHR Species' Ranges (550 Total) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name	Scientific Name 2	Common Name 2	State Status	Federal Status
R035	Reptile	*Xantusia riversiana*	Island Night Lizard**		San Clemente Night Lizard *(reticulata* subsp.), San Nicolas Night Lizard (riversiana subsp.)		
R034	Reptile	*Xantusia vigilis*	Desert Night Lizard				

* *Batrachoseps major aridus* subsp. (only in Riverside County) is endangered; *Rana muscosa* aka Sierra Madre Yellow-legged Frog, southern California DPS (FE); light-footed clapper rail *Rallus longirostris obsoletus* (SE); Yuma clapper rail *Rallus longirostris yumanensis* (ST); Greater Sandhill Crane *Grus canadensis tabida* (ST); Arizona Bell's vireo *Vireo bellii arizonae*, Least Bell's vireo *Vireo bellii pusillus* (FE); San Clemente Sage Sparrow, *Amphispiza belli clementaea*(FT); Belding's Savanna Sparrow *Passerculus sandwhichensis beldingi* (SE); Amargosa Vole, *Microtus californicus scirpensis* (FE), found in Mojave Desert along Amargosa River in Inyo County near San Bernardino county line; Peninsular Bighorn Sheep DPS *Ovis canadensis nelsoni* (ST, FE); Island Gray Fox *Urocyon littoralis* state listing includes all 6 subspecies on 6 islands; federal listing is only for 4 subspecies on 4 islands; Pacific pocket mouse, *Perognathus longimembris pacificus* (FE); Sierra Nevada red fox, *Vulpes vulpes necator* (ST); introduced populations in southern California not listed.

** Species found in Channel Islands only and not included in CHAP analysis.

APPENDIX D.
FISH AND INVERTEBRATE SPECIES LIST FOR SCAG REGION BASED ON CNDDB DATA (DECEMBER 2012 DOWNLOAD)

Table D-1. Fish and Invertebrate Species List for SCAG Region Based on CNDDB Data (December 2012 Download)

Animal Type	Scientific Name	Common Name	State Status	Federal Status
Fish	*Catostomus latipinnis*	flannelmouth sucker	None	None
Fish	*Catostomus santaanae*	Santa Ana sucker	None	Threatened
Fish	*Cyprinodon macularius*	desert pupfish	Endangered	Endangered
Fish	*Cyprinodon nevadensis amargosae*	Amargosa pupfish	None	None
Fish	*Cyprinodon nevadensis nevadensis*	Saratoga Springs pupfish	None	None
Fish	*Eucyclogobius newberryi*	tidewater goby	None	Endangered
Fish	*Gasterosteus aculeatus williamsoni*	unarmored threespine stickleback	Endangered	Endangered
Fish	*Gila elegans*	bonytail	Endangered	Endangered
Fish	*Gila orcuttii*	arroyo chub	None	None
Fish	*Oncorhynchus mykiss irideus*	southern steelhead - southern California DPS	None	Endangered
Fish	*Ptychocheilus lucius*	Colorado pikeminnow	Endangered	Endangered
Fish	*Rhinichthys osculus ssp. 1*	Amargosa Canyon speckled dace	None	None
Fish	*Rhinichthys osculus ssp. 3*	Santa Ana speckled dace	None	None
Fish	*Siphateles bicolor mohavensis*	Mohave tui chub	Endangered	Endangered
Fish	*Xyrauchen texanus*	razorback sucker	Endangered	Endangered
Invertebrate	*Aglaothorax longipennis*	Santa Monica shieldback katydid	None	None
Invertebrate	*Ammopelmatus kelsoensis*	Kelso jerusalem cricket	None	None
Invertebrate	*Anomala carlsoni*	Carlson's dune beetle	None	None
Invertebrate	*Anomala hardyorum*	Hardy's dune beetle	None	None
Invertebrate	*Assiminea infima*	Badwater snail	None	None
Invertebrate	*Belostoma saratogae*	Saratoga Springs belostoman bug	None	None
Invertebrate	*Branchinecta lynchi*	vernal pool fairy shrimp	None	Threatened

Table D-1. Fish and Invertebrate Species List for SCAG Region Based on CNDDB Data (December 2012 Download) (Continued)

Animal Type	Scientific Name	Common Name	State Status	Federal Status
Invertebrate	*Branchinecta sandiegonensis*	San Diego fairy shrimp	None	Endangered
Invertebrate	*Brennania belkini*	Belkin's dune tabanid fly	None	None
Invertebrate	*Calileptoneta oasa*	Andreas Canyon leptonetid spider	None	None
Invertebrate	*Callophrys mossii hidakupa*	San Gabriel Mountains elfin butterfly	None	None
Invertebrate	*Ceratochrysis bradleyi*	Bradley's cuckoo wasp	None	None
Invertebrate	*Ceratochrysis longimala*	Desert cuckoo wasp	None	None
Invertebrate	*Cicindela gabbii*	western tidal-flat tiger beetle	None	None
Invertebrate	*Cicindela hirticollis gravida*	sandy beach tiger beetle	None	None
Invertebrate	*Cicindela senilis frosti*	senile tiger beetle	None	None
Invertebrate	*Cicindela tranquebarica viridissima*	greenest tiger beetle	None	None
Invertebrate	*Coelus globosus*	globose dune beetle	None	None
Invertebrate	*Danaus plexippus*	monarch butterfly	None	None
Invertebrate	*Dinacoma caseyi*	Casey's June beetle	None	Proposed Endangered
Invertebrate	*Diplectrona californica*	California diplectronan caddisfly	None	None
Invertebrate	*Eremarionta immaculata*	white desertsnail	None	None
Invertebrate	*Eremarionta morongoana*	Morongo (=Colorado) desertsnail	None	None
Invertebrate	*Eremarionta rowelli bakerensis*	Baker's desertsnail	None	None
Invertebrate	*Eremarionta rowelli mccoiana*	California Mccoy snail	None	None
Invertebrate	*Euchloe hyantis andrewsi*	Andrew's marble butterfly	None	None
Invertebrate	*Eucosma hennei*	Henne's eucosman moth	None	None
Invertebrate	*Euphilotes battoides allyni*	El Segundo blue butterfly	None	Endangered
Invertebrate	*Euphydryas editha quino*	quino checkerspot butterfly	None	Endangered
Invertebrate	*Euproserpinus euterpe*	Kern primrose sphinx moth	None	Threatened
Invertebrate	*Glaresis arenata*	Kelso Dunes scarab glaresis beetle	None	None
Invertebrate	*Glaucopsyche lygdamus palosverdesensis*	Palos Verdes blue butterfly	None	Endangered

Table D-1. Fish and Invertebrate Species List for SCAG Region Based on CNDDB Data (December 2012 Download) (Continued)

Animal Type	Scientific Name	Common Name	State Status	Federal Status
Invertebrate	*Halictus harmonius*	haromonius halictid bee	None	None
Invertebrate	*Haplotrema catalinense*	Santa Catalina lancetooth	None	None
Invertebrate	*Hedychridium argenteum*	Riverside cuckoo wasp	None	None
Invertebrate	*Helminthoglypta ayresiana sanctaecrucis*	Ayer's snail	None	None
Invertebrate	*Helminthoglypta mohaveana*	Victorville shoulderband	None	None
Invertebrate	*Helminthoglypta taylori*	westfork shoulderband	None	None
Invertebrate	*Helminthoglypta traskii traskii*	Trask shoulderband	None	None
Invertebrate	*Hydroporus simplex*	simple hydroporus diving beetle	None	None
Invertebrate	*Lepismadora algodones*	Algodones sand jewel beetle	None	None
Invertebrate	*Linderiella santarosae*	Santa Rosa Plateau fairy shrimp	None	None
Invertebrate	*Macrobaenetes kelsoensis*	Kelso giant sand treader cricket	None	None
Invertebrate	*Macrobaenetes valgum*	Coachella giant sand treader cricket	None	None
Invertebrate	*Melitta californica*	California mellitid bee	None	None
Invertebrate	*Micrarionta feralis*	San Nicolas islandsnail	None	None
Invertebrate	*Micrarionta gabbi*	San Clemente islandsnail	None	None
Invertebrate	*Micrarionta opuntia*	pricklypear islandsnail	None	None
Invertebrate	*Miloderes nelsoni*	Nelson's miloderes weevil	None	None
Invertebrate	*Minymischa ventura*	Ventura cuckoo wasp	None	None
Invertebrate	*Oliarces clara*	cheeseweed owlfly (cheeseweed moth lacewing)	None	None
Invertebrate	*Onychobaris langei*	Lange's El Segundo Dune weevil	None	None
Invertebrate	*Panoquina errans*	wandering (=saltmarsh) skipper	None	None
Invertebrate	*Paranomada californica*	California cuckoo bee	None	None
Invertebrate	*Parnopes borregoensis*	Borrego parnopes cuckoo wasp	None	None
Invertebrate	*Pelocoris shoshone*	Amargosa naucorid bug	None	None
Invertebrate	*Plebejus saepiolus aureolus*	San Gabriel Mountains blue butterfly	None	None
Invertebrate	*Plebulina emigdionis*	San Emigdio blue butterfly	None	None

Table D-1. Fish and Invertebrate Species List for SCAG Region Based on CNDDB Data (December 2012 Download) (Continued)

Animal Type	Scientific Name	Common Name	State Status	Federal Status
Invertebrate	*Polyphylla erratica*	Death Valley June beetle	None	None
Invertebrate	*Pristiloma shepardae*	Shepard's snail	None	None
Invertebrate	*Pseudocotalpa andrewsi*	Andrew's dune scarab beetle	None	None
Invertebrate	*Psychomastax deserticola*	desert monkey grasshopper	None	None
Invertebrate	*Radiocentrum avalonense*	Catalina mountainsnail	None	None
Invertebrate	*Rhaphiomidas terminatus abdominalis*	Delhi Sands flower-loving fly	None	Endangered
Invertebrate	*Rhaphiomidas terminatus terminatus*	El Segundo flower-loving fly	None	None
Invertebrate	*Rhopalolemma robertsi*	Roberts' rhopalolemma bee	None	None
Invertebrate	*Socalchemmis gertschi*	Gertsch's socalchemmis spider	None	None
Invertebrate	*Socalchemmis icenoglei*	Icenogle's socalchemmis spider	None	None
Invertebrate	*Stenopelmatus cahuilaensis*	Coachella Valley jerusalem cricket	None	None
Invertebrate	*Sterkia clementina*	San Clemente Island blunt-top snail	None	None
Invertebrate	*Streptocephalus woottoni*	Riverside fairy shrimp	None	Endangered
Invertebrate	*Texella kokoweef*	Kokoweef Crystal Cave harvestman	None	None
Invertebrate	*Trigonoscuta brunnotesselata*	brown tassel trigonoscuta weevil	None	None
Invertebrate	*Trigonoscuta dorothea dorothea*	Dorothy's El Segundo Dune weevil	None	None
Invertebrate	*Trimerotropis occidentiloides*	Santa Monica grasshopper	None	None
Invertebrate	*Tryonia imitator*	mimic tryonia (=California brackishwater snail)	None	None
Invertebrate	*Xerarionta intercisa*	horseshoe snail	None	None
Invertebrate	*Xerarionta redimita*	wreathed cactussnail	None	None

APPENDIX E.

PILOT FINE-SCALE ASSESSMENT: PRADO BASIN

Throughout the United States, there is a move toward assessing restoration and other conservation activities at the ecosystem level. Under current U.S. Army Corps of Engineers (USACE) authority, the objective of civil works ecosystem restoration is to restore degraded ecosystem structure, function, and dynamic processes to a less-degraded, more natural condition. Even partial restoration may provide significant and valuable improvements to degraded ecological resources.

Ecosystem restoration projects should examine the need for improving or re-establishing both the structural components and the functions of the natural system. Restored ecosystems should mimic, as closely as possible, conditions that would occur in the area in the absence of human changes to the landscape and hydrology. Indicators of successful restoration would include the presence of a large variety of native plants and animals, the ability of the area to sustain larger numbers of certain indicator species or more biologically desirable species, and the ability of the restored area to continue to function and produce the desired outputs with a minimum of continuing human intervention. Those restoration opportunities that are associated with wetlands, riparian and other floodplain and aquatic systems are most appropriate for USACE involvement.

The information used in formulating, evaluating and selecting ecosystem restoration alternatives in USACE Civil Works projects includes both quantitative and qualitative information about outputs, costs, significance, acceptability, completeness, effectiveness, and reasonableness of costs. Within the USACE ecosystem restoration policy, *"An ecosystem restoration proposal must be justified on the basis of its contribution to restoring the structure or function, or both, of a degraded ecosystem, when considering the cost of the proposal. Ecosystem restoration projects are justified through a determination that the combined monetary and non-monetary benefits of the project are greater than its monetary and non-monetary costs. As such, plan selection is not based on economic justification in terms of a traditional monetary benefit to cost analysis, since the majority of benefits associated with the primary outputs of ecosystem restoration can rarely be quantified in dollars. Therefore, ecosystem restoration proposals need not have either a benefit-cost ratio greater than 1.0, or positive net economic benefits. However, any monetary incidental benefits which are anticipated from proposed ecosystem restoration projects, and relevant to the particular circumstances associated with the study, should be displayed to aide in decision making"* (USACE, EP 1165-2-502, 1999).

Instead of calculating economic benefits in monetary terms, USACE ecosystem restoration projects calculate the value and benefits of habitat using established habitat assessment methodologies. Evaluating habitat quality is the approach most often taken to compare ecosystem restoration alternatives, because habitat is thought of as a surrogate for ecosystems; it is the setting where plants and animals live, interact, and reproduce. Habitat is frequently viewed in conjunction with species information to gain insight to various uses, structures, and functions existing within a landscape or site. Determining habitat structure and functional integrity of an area is supportive of an ecosystem management approach.

Habitat Units are the currency that the USACE uses to evaluate their ecosystem restoration projects. The concept of habitat units (HUs) is derived from the U.S. Fish and Wildlife Service's

(USFWS) single species habitat assessment methodology known as Habitat Evaluation Procedures (HEP) (1980) and is also used by the USACE. Under HEP, HUs are derived by multiplying an assigned combined habitat suitability index value for a specific species for an assessment area by the total area (e.g., acres) assessed. USACE has replaced HEP with CHAP, which provides an ecosystem based habitat evaluation and assessments at multiple scales. The CHAP method also generates HUs based on an assessment of multiple species (all potential species at a site), habitat features, and functions by habitat type.

The overall goal of the pilot study, Prado Basin Fine-Scale Assessment, is to evaluate existing habitat conditions at a fine level of resolution within an ecosystem context. An ecosystem context is more holistic than assessing just a few individual species (Perkins 2002) especially with federal or stated listed taxa; it calls for a multiple species framework that includes an evaluation of ecological functions. For the purposes of this SCAG conservation assessment, only the existing baseline conditions evaluation is reported below to illustrate the applicability of CHAP at the fine scale within the SCAG region.

Study Site

The majority of the Prado Basin site is located in west Riverside County, with small portions in San Bernardino County and Orange County. The site is located along the Santa Ana River, between the cities of Chino and Corona, California. Within the study site, there are four isolated focal areas (focal area name in parentheses): 1) Yorba Linda Boulevard to Corona Freeway (Upper Main Stem); 2) Prado Dam to slightly west of Hamner Avenue, Eastvale (Reach 9); 3) McCarty Road, Chino, to Hellman Avenue, Chino (Chino Creek); 4) S Euclid Avenue to Pine Avenue (Mill Creek). In total, the Prado Basin CHAP assessment encompasses 4,237 acres (ac) or 1715 hectares (ha) (see Figure E-1).

Methods

A fine-scale CHAP analysis was used to calculate habitat value for the Prado Basin Feasibility Study. The baseline CHAP approach, incorporating the HAB methodology, involves: 1) preliminary mapping, 2) field inventory, 3) species list, 4) data compilation and analysis, and 5) conversion to HUs.

1. <u>Preliminary Mapping</u>

   Using GIS and geo-referenced aerial imagery, the Prado Basin study site was mapped by delineating polygons based on perceived differences in wildlife habitat types or structural conditions within the site. Habitat types were identified using visual differences in land formations, vegetation, and structural condition, as detected and interpreted in the imagery. For Reach 9, a recent Orange County Water District (OCWD) vegetation study in GIS format was used to assist the remote sensing effort. Three- and 12-inch pixel high-resolution imagery supplied by OCWD and the USACE was used.

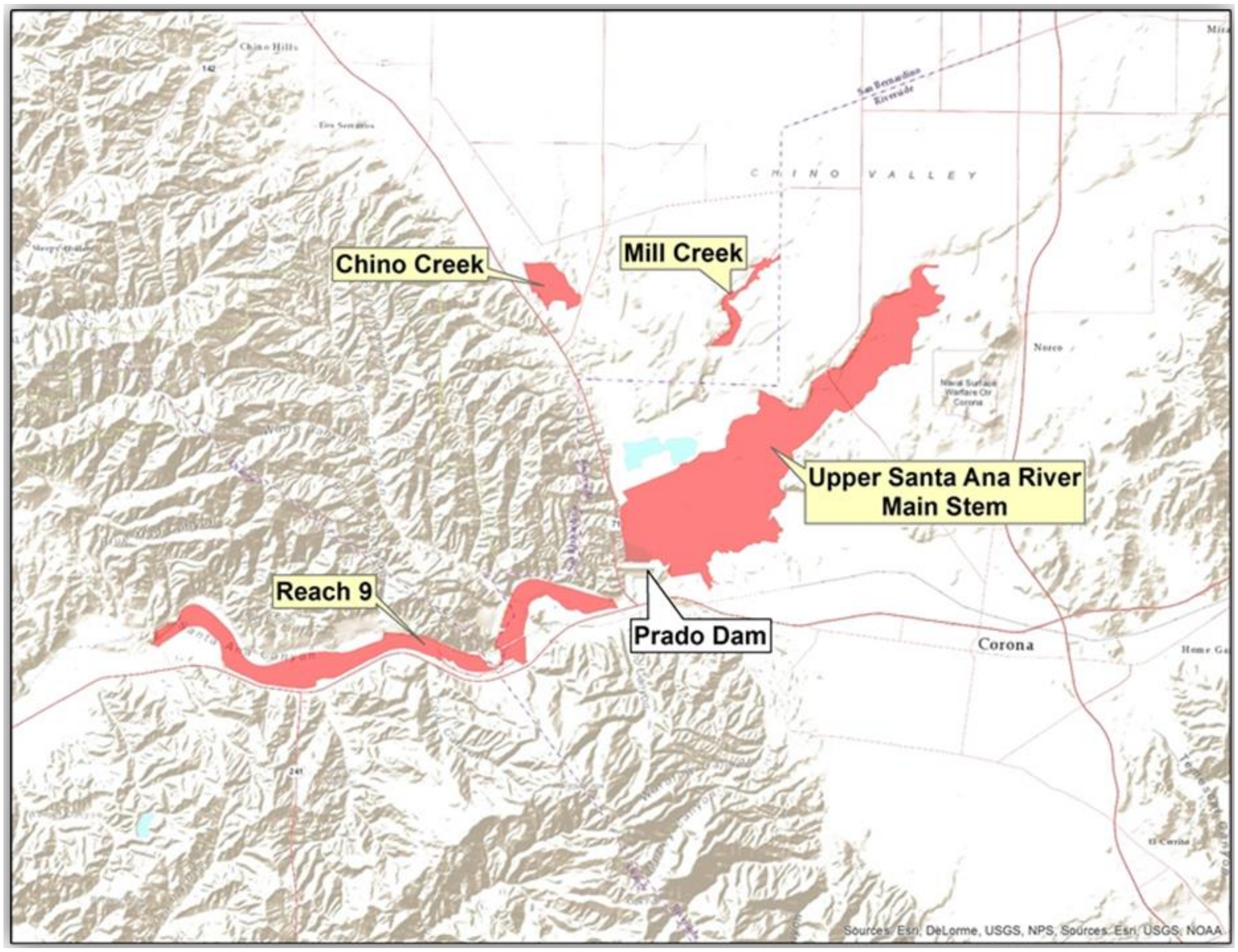

Figure E-1. CHAP Habitat Assessment Focal Areas

2. Field Inventory

The field inventory was conducted in October 2013. NHI field staff, along with biologists from USACE and OCWD, composed the field team. The inventory included an ocular survey that verified the polygon delineations. Habitat type (see Appendix F, Map F-4), structural conditions, and key environmental correlates (KECs) within each polygon were identified and recorded. KECs are structural, biotic, abiotic, and anthropogenic habitat elements that support wildlife species at a site. Invasive plant species and the presence of stressors within each polygon were also recorded.

3. Species List

The CWHR was used to produce a site-specific species list by considering ecological and geographical connections between species and the habitat types within the study area. Factors used to generate the species list are potential species linked to each of the habitat types and potential species linked to the study area based on species range maps and known existing conditions.

That broad-scale list was then reviewed and refined by a habitat evaluation team to create a fine-scale list representative of the study area (Table E-1). The habitat evaluation team for the Prado Basin feasibility study was composed of NHI and USACE staff along with local resource agency experts including U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), Regional Water Quality Control Board (RWQCB), and the Santa Ana Watershed Association (SAWA). The resulting species list is included (Appendix C).

4. Data Compilation and Analysis

Data from the mapping and field inventory was used to generate two relationship matrices including 1) a potential species by function (key ecological functions [KEFs]) matrix and 2) a habitat (KECs) by function (KEFs) matrix. KEFs refer to the main ways organisms use, influence, and alter their biotic and abiotic environments. Simply put, KEFs are the principal set of ecological roles performed by each species in its ecosystem. (For further details on the matrices, see Appendix B).

To create these matrices, the species list was sorted by its association with the CWHR habitat types, and the list of taxa was linked to the associated habitat elements (KECs) and functions (KEFs).

The first matrix determines the mean functional redundancy index (MFRI), which is the mean number of species that perform each key ecological function (KEF) associated with a habitat type in the study area. The MFRI of each habitat type present within the study area was calculated using the species list generated for the Prado Basin CHAP habitat evaluation.

The second matrix is based on the results of the field inventory of the Study area and the list of habitat elements (KECs) observed within each CHAP polygon. The result of the second matrix is the number of functions characterized by habitat elements (KECs) specific to that polygon.

Per-acre values were then computed for each polygon by adding the species-function matrix (MFRI) value for the habitat type of the polygon and polygon specific habitat-function matrix value. In sum, for each polygon, MFRI + KEC matrix = per-acre value.

The per-acre value represents the intrinsic worth of an area to fish and wildlife, determined by accounting for species, habitats, and functions.

5. Conversion to Habitat Units (HUs)

To determine HUs for site conditions, in order to compare study alternatives and inform alternative cost-benefit analyses, each polygon’s per-acre value was multiplied by its acreage. These values were then summed across all polygons to calculate the total HUs for a particular condition or alternative scenario. In sum, for each polygon, per-acre value × acres = HUs.

Table E-1. Prado Basin Feasibility Study, Potential Species List (250 total)
(Species in bold are not on the SCAG species list.[1])

CWHR ID	Animal Type	Scientific Name	Common Name
A032	Amphibian	*Anaxyrus boreas*	Western Toad
A013	Amphibian	*Batrachoseps major*	Garden Slender Salamander
A015	Amphibian	*Batrachoseps nigriventris*	Black-bellied Slender Salamander
A046	Amphibian	*Lithobates catesbeiana*	Bullfrog
A039	Amphibian	*Pseudacris regilla*	Pacific Treefrog
A051	**Amphibian**	***Xenopus laevis***	**African Clawed Frog**
B116	Bird	*Accipiter cooperii*	Cooper's Hawk
B115	Bird	*Accipiter striatus*	Sharp-shinned Hawk
B170	Bird	*Actitis macularius*	Spotted Sandpiper
B548	Bird	*Aechmophorus clarkia*	Clark's Grebe
B010	Bird	*Aechmophorus occidentalis*	Western Grebe
B282	Bird	*Aeronautes saxatalis*	White-throated Swift
B519	Bird	*Agelaius phoeniceus*	Red-winged Blackbird
B487	Bird	*Aimophila ruficeps*	Rufous-crowned Sparrow
B076	Bird	*Aix sponsa*	Wood Duck
B501	Bird	*Ammodramus savannarum*	Grasshopper Sparrow
B080	Bird	*Anas acuta*	Northern Pintail
B087	Bird	*Anas Americana*	American Wigeon
B084	Bird	*Anas clypeata*	Northern Shoveler
B077	Bird	*Anas crecca*	Green-winged Teal
B083	Bird	*Anas cyanoptera*	Cinnamon Teal
B079	Bird	*Anas platyrhynchos*	Mallard
B085	Bird	*Anas strepera*	Gadwall
B404	Bird	*Anthus rubrescens*	American Pipit
B348	Bird	*Aphelocoma californica*	Western Scrub-Jay
B126	Bird	*Aquila chrysaetos*	Golden Eagle
B286	Bird	*Archilochus alexandri*	Black-chinned Hummingbird
B052	Bird	*Ardea alba*	Great Egret
B051	Bird	*Ardea herodias*	Great Blue Heron
B269	Bird	*Athene cunicularia*	Burrowing Owl
B094	Bird	*Aythya affinis*	Lesser Scaup
B091	Bird	*Aythya collaris*	Ring-necked Duck
B358	Bird	*Baeolophus inornatus*	Oak Titmouse
B407	Bird	*Bombycilla cedrorum*	Cedar Waxwing
B049	Bird	*Botaurus lentiginosus*	American Bittern
B075	Bird	*Branta canadensis*	Canada Goose
B265	Bird	*Bubo virginianus*	Great Horned Owl

Table E-1. Prado Basin Feasibility Study, Potential Species List (250 total) (Species in bold are not on the SCAG species list.[1]) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name
B057	Bird	*Bubulcus ibis*	Cattle Egret
B103	Bird	*Bucephala albeola*	Bufflehead
B123	Bird	*Buteo jamaicensis*	Red-tailed Hawk
B119	Bird	*Buteo lineatus*	Red-shouldered Hawk
B058	Bird	*Butorides virescens*	Green Heron
B183	Bird	*Calidris mauri*	Western Sandpiper
B185	Bird	*Calidris minutilla*	Least Sandpiper
B140	Bird	*Callipepla californica*	California Quail
B287	Bird	*Calypte anna*	Anna's Hummingbird
B288	Bird	*Calypte costae*	Costa's Hummingbird
B463	Bird	*Cardellina pusilla*	Wilson's Warbler
B108	Bird	*Cathartes aura*	Turkey Vulture
B386	Bird	*Catharus guttatus*	Hermit Thrush
B385	Bird	*Catharus ustulatus*	Swainson's Thrush
B281	**Bird**	***Chaetura vauxi***	**Vaux's Swift**
B391	Bird	*Chamaea fasciata*	Wrentit
B158	Bird	*Charadrius vociferus*	Killdeer
B495	Bird	*Chondestes grammacus*	Lark Sparrow
B275	Bird	*Chordeiles acutipennis*	Lesser Nighthawk
B114	Bird	*Circus cyaneus*	Northern Harrier
B372	Bird	*Cistothorus palustris*	Marsh Wren
B259	Bird	*Coccyzus americanus*	Yellow-billed Cuckoo
B307	Bird	*Colaptes auratus*	Northern Flicker
B250	Bird	*Columba livia*	Rock Pigeon
B311	Bird	*Contopus sordidulus*	Western Wood-Pewee
B353	Bird	*Corvus brachyrhynchos*	American Crow
B354	Bird	*Corvus corax*	Common Raven
B053	Bird	*Egretta thula*	Snowy Egret
B111	Bird	*Elanus leucurus*	White-tailed Kite
B320	Bird	*Empidonax difficilis*	Pacific-slope Flycatcher
B315	**Bird**	***Empidonax traillii***	**Southwestern Willow Flycatcher**
B337	Bird	*Eremophila alpestris*	Horned Lark
B524	Bird	*Euphagus cyanocephalus*	Brewer's Blackbird
none	**Bird**	***Euplectes franciscanus***	**Orange Bishop**
B128	Bird	*Falco columbarius*	Merlin
B131	Bird	*Falco mexicanus*	Prairie Falcon
B129	Bird	*Falco peregrinus*	Peregrine Falcon
B127	Bird	*Falco sparverius*	American Kestrel

Table E-1. Prado Basin Feasibility Study, Potential Species List (250 total) (Species in bold are not on the SCAG species list.[1]) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name
B149	Bird	*Fulica americana*	American Coot
B199	Bird	*Gallinago delicata*	Wilson's Snipe
B148	Bird	*Gallinula chloropus*	Common Moorhen
B260	Bird	*Geococcyx californianus*	Greater Roadrunner
B461	Bird	*Geothlypis trichas*	Common Yellowthroat
B538	Bird	*Haemorhous mexicanus*	House Finch
B113	Bird	*Haliaeetus leucocephalus*	Bald Eagle
B163	Bird	*Himantopus mexicanus*	Black-necked Stilt
B344	Bird	*Hirundo rustica*	Barn Swallow
B227	Bird	*Hydroprogne caspia*	Caspian Tern
B467	Bird	*Icteria virens*	Yellow-breasted Chat
B532	Bird	*Icterus bullockii*	Bullock's Oriole
B530	Bird	*Icterus cucullatus*	Hooded Oriole
B050	Bird	*Ixobrychus exilis*	Least Bittern
B512	Bird	*Junco hyemalis*	Dark-eyed Junco
B410	Bird	*Lanius ludovicianus*	Loggerhead Shrike
B215	Bird	*Larus californicus*	California Gull
B214	Bird	*Larus delawarensis*	Ring-billed Gull
B220	Bird	*Larus occidentalis*	Western Gull
B197	Bird	*Limnodromus scolopaceus*	Long-billed Dowitcher
B823	**Bird**	***Lonchura punctulata***	**Nutmeg Mannikin**
B293	Bird	*Megaceryle alcyon*	Belted Kingfisher
B264	Bird	*Megascops kennicottii*	Western Screech Owl
B296	Bird	*Melanerpes formicivorus*	Acorn Woodpecker
B506	Bird	*Melospiza lincolnii*	Lincoln's Sparrow
B505	Bird	*Melospiza melodia*	**Song Sparrow**
B484	Bird	*Melozone crissalis*	California Towhee
B393	Bird	*Mimus polyglottos*	Northern Mockingbird
B528	Bird	*Molothrus ater*	Brown-headed Cowbird
B326	Bird	*Myiarchus cinerascens*	Ash-throated Flycatcher
B173	Bird	*Numenius americanus*	Long-billed Curlew
B059	Bird	*Nycticorax nycticorax*	Black-crowned Night Heron
B425	Bird	*Oreothlypis celata*	Orange-crowned Warbler
B426	Bird	*Oreothlypis ruficapilla*	Nashville Warbler
B427	Bird	*Oreothlypis virginiae*	Virginia's Warbler
B107	Bird	*Oxyura jamaicensis*	Ruddy Duck
B110	Bird	*Pandion haliaetus*	Osprey
B547	Bird	*Passer domesticus*	House Sparrow

Table E-1. Prado Basin Feasibility Study, Potential Species List (250 total) (Species in bold are not on the SCAG species list.[1]) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name
B499	Bird	*Passerculus sandwichensis*	Savannah Sparrow
B504	Bird	*Passerella iliaca*	Fox Sparrow
B477	Bird	*Passerina amoena*	Lazuli Bunting
B476	Bird	*Passerina caerulea*	Blue Grosbeak
B042	Bird	*Pelecanus erythrorhynchos*	American White Pelican
B343	Bird	*Petrochelidon pyrrhonota*	Cliff Swallow
B408	Bird	*Phainopepla nitens*	Phainopepla
B044	Bird	*Phalacrocorax auritus*	Double-crested Cormorant
B133	Bird	*Phasianus colchicus*	Ring-necked Pheasant
B475	Bird	*Pheucticus melanocephalus*	Black-headed Grosbeak
B302	Bird	*Picoides nuttallii*	Nuttall's Woodpecker
B303	Bird	*Picoides pubescens*	Downy Woodpecker
B483	Bird	*Pipilo maculatus*	Spotted Towhee
B471	Bird	*Piranga ludoviciana*	Western Tanager
B062	Bird	*Plegadis chihi*	White-faced Ibis
B006	Bird	*Podilymbus podiceps*	Pied-billed Grebe
B377	Bird	*Polioptila caerulea*	Blue-gray Gnatcatcher
B553	Bird	*Polioptila californica*	California Gnatcatcher
B494	Bird	*Pooecetes gramineus*	Vesper Sparrow
B146	Bird	*Porzana carolina*	Sora
B360	Bird	*Psaltriparus minimus*	Bushtit
B525	Bird	*Quiscalus mexicanus*	Great-tailed Grackle
B145	Bird	*Rallus limicola*	Virginia Rail
B164	Bird	*Recurvirostra americana*	American Avocet
B376	Bird	*Regulus calendula*	Ruby-crowned Kinglet
B366	Bird	*Salpinctes obsoletus*	Rock Wren
B321	Bird	*Sayornis nigricans*	Black Phoebe
B323	Bird	*Sayornis saya*	Say's Phoebe
B292	Bird	*Selasphorus sasin*	Allen's Hummingbird
B435	Bird	*Setophaga coronata*	Yellow-rumped Warbler
B436	Bird	*Setophaga nigrescens*	Black-throated Gray Warbler
B438	Bird	*Setophaga occidentalis*	Hermit Warbler
B430	Bird	*Setophaga petechia*	Yellow Warbler
B380	Bird	*Sialia mexicana*	Western Bluebird
B362	Bird	*Sitta carolinensis*	White-breasted Nuthatch
B298	Bird	*Sphyrapicus nuchalis*	Red-naped Sapsucker
B299	Bird	*Sphyrapicus ruber*	Red-breasted Sapsucker
B544	Bird	*Spinus lawrencei*	Lawrence's Goldfinch

Table E-1. Prado Basin Feasibility Study, Potential Species List (250 total)
(Species in bold are not on the SCAG species list.[1]) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name
B542	Bird	*Spinus pinus*	Pine Siskin
B543	Bird	*Spinus psaltria*	Lesser Goldfinch
B545	Bird	*Spinus tristis*	American Goldfinch
B489	Bird	*Spizella passerina*	Chipping Sparrow
B341	Bird	*Stelgidopteryx serripennis*	Northern Rough-winged Swallow
B233	Bird	*Sterna forsteri*	Forster's Tern
B863	**Bird**	***Streptopelia decaocto***	**Eurasian Collared Dove**
B521	Bird	*Sturnella neglecta*	Western Meadowlark
B411	Bird	*Sturnus vulgaris*	European Starling
B339	Bird	*Tachycineta bicolor*	Tree Swallow
B340	Bird	*Tachycineta thalassina*	Violet-green Swallow
B368	Bird	*Thryomanes bewickii*	Bewick's Wren
B398	Bird	*Toxostoma redivivum*	California Thrasher
B165	Bird	*Tringa melanoleuca*	Greater Yellowlegs
B369	Bird	*Troglodytes aedon*	House Wren
B389	Bird	*Turdus migratorius*	American Robin
B333	Bird	*Tyrannus verticalis*	Western Kingbird
B331	Bird	*Tyrannus vociferans*	Cassin's Kingbird
B262	Bird	*Tyto alba*	Barn Owl
B413	Bird	*Vireo bellii*	Bell's Vireo
B418	Bird	*Vireo gilvus*	Warbling Vireo
B417	Bird	*Vireo huttoni*	Hutton's Vireo
B522	Bird	*Xanthocephalus xanthocephalus*	Yellow-headed Blackbird
B255	Bird	*Zenaida macroura*	Mourning Dove
B509	Bird	*Zonotrichia atricapilla*	Golden-crowned Sparrow
B510	Bird	*Zonotrichia leucophrys*	White-crowned Sparrow
	Fish	***Ameiurus melas***	**Black Bullhead**
	Fish	***Ameriurus natalis***	**Yellow Bullhead**
	Fish	***Catostomus santaanae***	**Santa Ana Sucker**
	Fish	***Corassius auratus***	**Goldfish**
	Fish	***Cyprinus carpio***	**Carp**
	Fish	***Dorosma petense***	**Threadfin Shad**
	Fish	***Gambusia affinis***	**Mosquitofish**
	Fish	***Gila orcuttii***	**Arroyo Chub**
	Fish	***Ictalurus punctatus***	**Channel Catfish**
	Fish	***Lepomis cyanellus***	**Green Sunfish**
	Fish	***Lepomis macrochirus***	**Bluegill Sunfish**

Table E-1. Prado Basin Feasibility Study, Potential Species List (250 total)
(Species in bold are not on the SCAG species list.[1]) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name
	Fish	***Micropterus dolomieu***	**Smallmouth Bass**
	Fish	***Micropterus salmoides***	**Largemouth Bass**
	Fish	***Oreochromis sp.***	**Tilapia**
	Fish	***Pimephales promelas***	**Fathead Minnow**
	Fish	***Pomoxis nigromaculatus***	**Black Crappie**
	Invertebrate	***Procambarus clarkii***	**Red Swamp Crayfish**
M038	Mammal	*Antrozous pallidus*	Pallid Bat
M225	**Mammal**	***Canis familiaris***	**Feral Dog**
M146	Mammal	*Canis latrans*	Coyote
M095	Mammal	*Chaetodipus californicus*	California Pocket Mouse
M094	Mammal	*Chaetodipus fallax*	San Diego Pocket Mouse
M001	Mammal	*Didelphis virginiana*	Virginia Opossum
M103	Mammal	*Dipodomys agilis*	Pacific Kangaroo Rat
M032	Mammal	*Eptesicus fuscus*	Big Brown Bat
M033	Mammal	*Lasiurus blossevillii*	Western Red Bat
M051	Mammal	*Lepus californicus*	Black-tailed Jackrabbit
M166	Mammal	*Lynx rufus*	Bobcat
M162	Mammal	*Mephitis mephitis*	Striped Skunk
M134	Mammal	*Microtus californicus*	California Vole
M142	Mammal	*Mus musculus*	House Mouse
M157	Mammal	*Mustela frenata*	Long-tailed Weasel
M028	Mammal	*Myotis californicus*	California Myotis
M025	Mammal	*Myotis evotis*	Long-eared Myotis
M023	Mammal	*Myotis yumanensis*	Yuma Myotis
M127	Mammal	*Neotoma fuscipes*	Dusky-footed Woodrat
M181	Mammal	*Odocoileus hemionus*	Mule Deer
M072	Mammal	*Otospermophilus beecheyi*	California Ground Squirrel
M119	Mammal	*Peromyscus boylii*	Brush Mouse
M116	Mammal	*Peromyscus californicus*	California Mouse
M117	Mammal	*Peromyscus maniculatus*	Deer Mouse
M031	Mammal	*Pipistrellus hesperus*	Western Pipistrelle
M153	Mammal	*Procyon lotor*	Raccoon
M165	Mammal	*Puma concolor*	Mountain Lion
M141	Mammal	*Rattus norvegicus*	Norway Rat
M140	Mammal	*Rattus rattus*	Black Rat
M113	Mammal	*Reithrodontomys megalotis*	Western Harvest Mouse
M018	Mammal	*Scapanus latimanus*	Broad-footed Mole
M006	Mammal	*Sorex ornatus*	Ornate Shrew

Table E-1. Prado Basin Feasibility Study, Potential Species List (250 total)
(Species in bold are not on the SCAG species list.[1]) (Continued)

CWHR ID	Animal Type	Scientific Name	Common Name
M176	Mammal	*Sus scrofa*	Wild Pig
M047	Mammal	*Sylvilagus audubonii*	Desert Cottontail
M039	Mammal	*Tadarida brasiliensis*	Brazilian Free-tailed Bat
M081	Mammal	*Thomomys bottae*	Botta's Pocket Gopher
M149	Mammal	*Urocyon cinereoargenteus*	Gray Fox
R004	Reptile	*Actinemys marmorata*	Western Pond Turtle
R004	Reptile	*Actinemys marmorata*	Western Pond Turtle
R051	Reptile	*Coluber constrictor*	Racer
R052	Reptile	*Coluber flagellum*	Coachwhip
R053	Reptile	*Coluber lateralis*	California Striped Racer
R076	Reptile	*Crotalus oreganus*	Western Rattlesnake
R048	Reptile	*Diadophis punctatus*	Ring-necked Snake
R040	Reptile	*Elgaria multicarinata*	Southern Alligator Lizard
R037	Reptile	*Eumeces gilberti*	Gilbert's Skink
R058	Reptile	*Lampropeltis californiae*	Common Kingsnake
R047	Reptile	*Lichanura trivirgata*	Rosy Boa
R029	Reptile	*Phrynosoma blainvillii*	Blainville's Horned Lizard
R057	Reptile	*Pituophis catenifer*	Gopher Snake
R036	Reptile	*Plestiodon skiltonianus*	Western Skink
R022	Reptile	*Sceloporus occidentalis*	Western Fence Lizard
R061	Reptile	*Thamnophis sirtalis infernalis*	California Red-Sided Garter Snake
R003	Reptile	*Trachemys scripta*	Pond Slider
R006	Reptile	*Trionyx spiniferus*	Spiny Softshell
R024	Reptile	*Uta stansburiana*	Common Side-blotched Lizard

[1] As described in *Comparison of Course-to Fine-Scale Analyses* of the Conservation Framework and Assessment, the SCAG species list (see Appendix D) is generated at the course-scale. The species in bold were added to the list as part of the fine-scale assessment.

Results of the baseline CHAP analysis are provided in the form of a GIS geodatabase and Microsoft Excel spreadsheets. GIS data fields depict the CHAP polygon ID, description, acreage, CWHR wildlife habitat type, structural condition, grass/forb invasive species, shrub invasive species, tree invasive species, invasive species deduction factors, per-acre habitat values, and HUs of each of the 479 polygons. Supporting maps illustrate: a) study area boundaries; b) polygon numbering; c) per-acre habitat value (adjusted to account for invasive plant species); d) percentage of non-native plant species by polygon; and e) wildlife habitat types by polygon. Spreadsheets were developed that contain the calculations of the species-function and habitat-function matrices, along with calculations of CHAP habitat values and a table containing the KECs observed within each CHAP polygon. Some key results when comparing the fine- to coarse-scale analyses are: 1) species list is reduced from to 250 from 546, 2) the MFRI is lower (which is important to note for mitigation) for all habitats except water, because 3) fish species were added, 4) invasive species adjustment is included, 5) habitat and structural conditions (polygons) are depicted in greater detail, 6) fine-scale features (KECs) are accounted for within each polygon, 7) a project boundary is delineated that places the project within 3 counties but still within one basin, and 8) Valley Foothills Riparian is the most abundant habitat within the project boundary.

Per-Acre Adjustment Value for Invasive Species

Since the Prado Basin project area is surrounded by a highly urban setting, there is a large influence of invasive plant species. The project area also is influenced by upstream seed sources in the Santa Ana River main stem. Prior to conversion to HUs, the per-acre baseline value of each polygon was adjusted based on the presence of invasive species. Each polygon was assigned an invasive plant value for each of three structural layers (grass/forb, shrub, and tree) based on the percent composition of invasive species in that layer, as documented in the field inventory. Because invasive species generally negatively influence biodiversity and ecosystem function, the per-acre values were then discounted for the presence of invasives in order to arrive at a corrected per-acre value for each polygon. The value of discount applied for each layer based on presence of invasive species is described in Table E-2. A deduction factor is then determined for the polygon by taking the geo-mean of the deduction factors for each of the three vegetative layers. A geo-mean is used to account for the possibility that a layer does not exist within a polygon (e.g. a polygon containing no trees). The polygon deduction factor was multiplied by the per-acre value to reach the corrected value. In sum, per-acre value × deduction factor = corrected per-acre value.

The percent abundance of invasive species by polygon can also be spatially displayed in a map to show their influence on the habitat value (Appendix F, Maps F-5 – F7).

Table E-2. Invasive Plant Species Deduction Factors

Invasive species cover	*X*
0-10%	1.0
11-35%	0.9
36-65%	0.7
66-90%	0.5
>90%	0.3

OCWD Sediment Removal Pilot Project

OCWD is implementing a pilot demonstration project to evaluate sediment removal in the Prado Basin and re-entrainment of sediment into Reach 9 to help reverse the unnatural sediment flow resulting from Prado Dam. Up to 500,000 cubic yards would be removed from the basin and re-entrained into Reach 9.

The demonstration project was not under way during the October 2013 CHAP field mapping and data collection. However, the project will be implemented before the base year of the study, and therefore, the project is being evaluated as if it were complete in the existing conditions and future without project conditions analysis. CHAP polygon PRD_483 represents the location of the OCWD demonstration project sediment trap (Figure E-2).

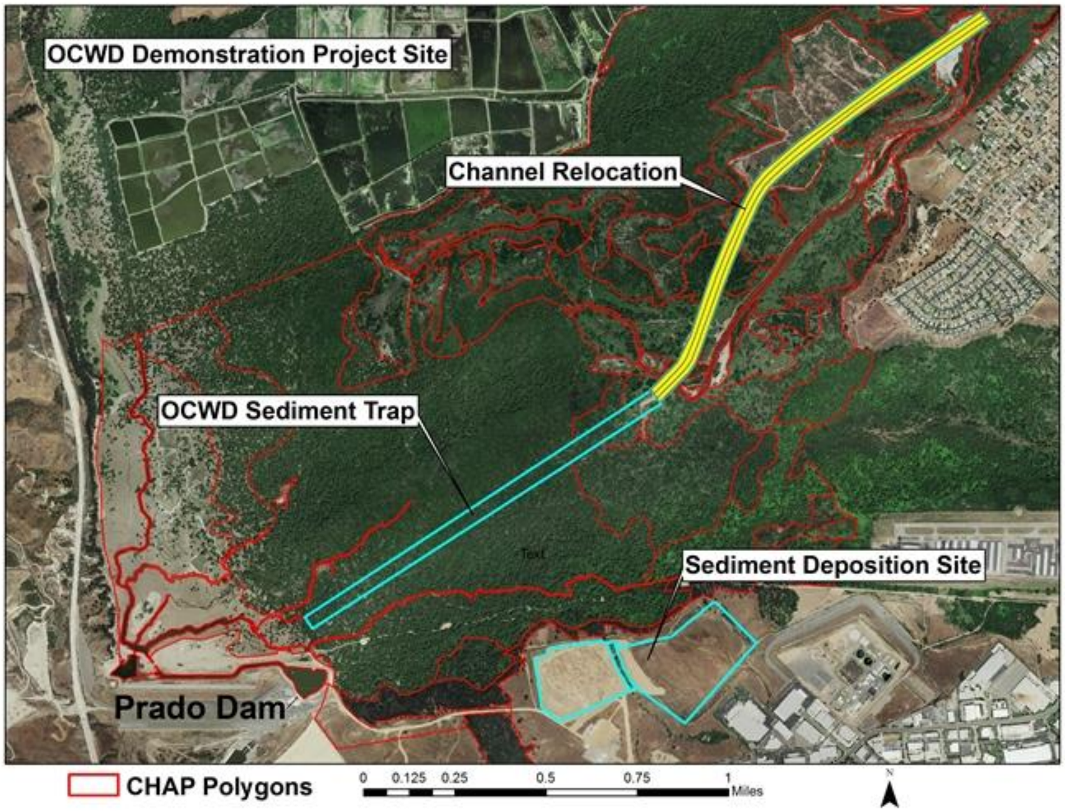

Figure E-2. Location of OCWD Demonstration Project

The sediment trap comprises 30.2 acres. The channel leading into the trap is constructed for 1.4 miles upstream of the trap until it merges with the main channel of the Santa Ana River. While there is an initial habitat loss from clear cutting the area for the trap, there are secondary benefits to having such an opening in an otherwise uniform older willow riparian forest lacking the stand diversity of a system with natural sediment flows and uncontrolled flood events. The trap location will provide nice edge habitat as well as a younger riparian buffer, providing needed diversity for at risk riparian bird species. There are habitat benefits associated with the channel relocation in a system otherwise declining in habitat value without project. The gradient of the new channel is improved to allow for natural scouring and transporting of sediment, leaving the cobble and other structural elements preferred by the Santa Ana sucker exposed. There are also benefits to having the banks of the channel as new riparian initially free from invasive species.

Results

Habitat Types and Vegetation Communities

The 479 polygons in the Prado Basin project area were determined by delineating the California WHR wildlife habitat types that occur within the study boundary, along with further splitting of polygons by structural condition within the same habitat type. The mapping performed by NHI within the project area in late 2013 documented several habitat types, each of which are an aggregation of several vegetation communities. Habitat types as described by the CWHR System included agriculture (cropland, evergreen orchard, pasture), annual grassland, coastal oak woodland, coastal scrub, eucalyptus, fresh emergent wetland, open water/riverine, urban (low density, high density), and valley foothill riparian. There is one small (0.7 acres) polygon in the Chino Creek focal area that did not fall into the traditional California WHR habitat types, and was classified as "unknown." The acreage of each habitat type is shown in Table E-3, and their proportion to the overall project site is illustrated in Figure E-3.

Table E-3. California WHR Habitat Types by Acreage and Proportion of Project Area

California WHR Habitat Type	Acres	Proportion of Project Area
Agriculture (all types)	48.51	1.17%
Annual Grassland	498.24	12.01%
Coastal Oak Woodland	0.54	0.01%
Coastal Scrub	385.04	9.28%
Eucalyptus	40.56	0.98%
Fresh Emergent Wetland	14.07	0.34%
Unknown	0.72	0.02%
Urban	394.10	9.50%
Valley Foothill Riparian	2651.71	63.90%
Water / Riverine	203.99	4.92%

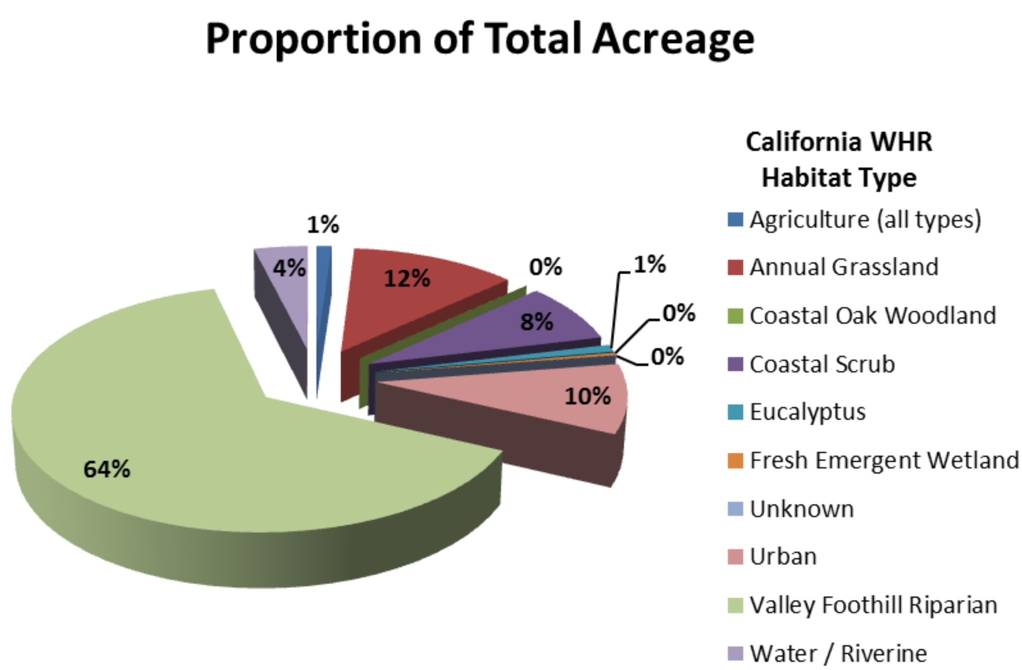

Figure E-3. Proportion of Total Acreage by California WHR Habitat Type

Habitat Units

The habitat assessment shows nine habitat types currently existing within the feasibility study focal areas, totaling 4,237 acres. The baseline existing condition assessment calculated that these acres have a total value of 82,952.8 HUs. A graph illustrating per-acre habitat value by habitat type follows in Figure E-4.

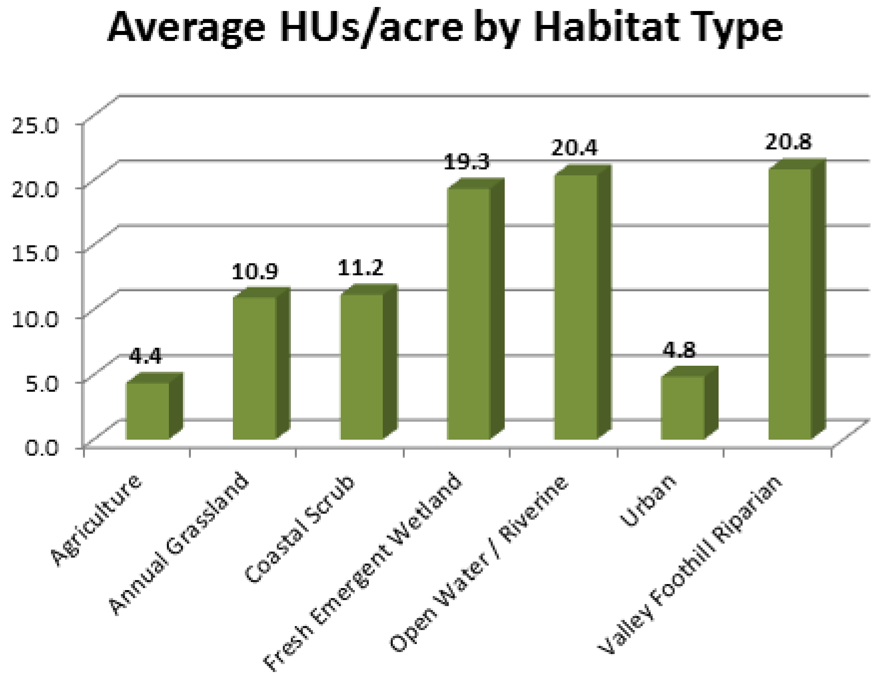

Figure E-4. Average Per-acre Habitat Value by CWHR Wildlife Habitat Type

Per-acre value, or simply HUs/acre, is a good way to compare the habitat value of CHAP polygons within the project site to see the highest and lowest functioning areas without any polygon size bias (Appendix F, Map F-9). The Santa Ana River mainstem focal area has the highest per-acre habitat value of the four areas, and contributes the most to overall habitat value (Table E-4).

Table E-4. Existing Conditions Habitat Value of Prado Basin Study Focal Areas

	Acres	Average Per-Acre Value	Total HUs	Proportion of Total HUs
Santa Ana River Mainstem	2856.70	20.56	66,818.8	80.6%
Reach 9	1089.23	14.12	12,232.2	14.7%
Chino Creek	177.67	11.08	2,281.9	2.8%
Mill Creek	113.88	13.67	1,619.9	2.0%

Valley Foothill Riparian CWHR habitat type not only contributes the most overall habitat value to the site (logical based on acreage proportions), but is also the greatest per-acre contributor of habitat value of any habitat type (Figure E-4).

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APPENDIX F.
ACREAGE OF CWHR HABITAT TYPES AND CHAP-GENERATED MAPS FOR THE SCAG REGION AND PRADO BASIN PILOT STUDY

Table F-1. Total Acreage of CWHR Habitat and Amount and Percentage Protected (GAP 1 or 2) in Each Basin Within the SCAG Region

Basin	CWHR Type	Total Acres	Protected Acres	% Protected
Central California Coastal	Annual Grassland	5,126.53	1,457.22	28.43
	Barren	9,890.54	3,120.29	31.55
	Blue Oak Woodland	28.72	1.53	5.33
	Chamise Redshank Chaparral	788.63	506.31	64.20
	Coastal Oak Woodland	58.04	37.42	64.47
	Coastal Scrub	13,284.23	2,653.53	19.98
	Jeffrey Pine	7,516.54	6,941.51	92.35
	Mixed Chaparral	10,810.05	6,114.56	56.56
	Montane Chaparral	858.80	818.88	95.35
	Montane Hardwood	3,566.71	2,465.72	69.13
	Montane Hardwood Conifer	5,022.54	3,669.74	73.07
	Montane Riparian	148.31	24.13	16.27
	Pinyon Juniper	86,002.09	29,406.52	34.19
	Sagebrush	6,599.83	323.30	4.90
	Sierran Mixed Conifer	4,748.93	4,360.35	91.82
Central California Coastal Total		**154,450.51**	**61,900.99**	**40.08**
Central Nevada Desert Basins	Alkali Desert Scrub	34,474.71	16,729.65	48.53
	Desert Scrub	313,470.06	218,854.71	69.82
	Juniper	11,101.96	11,060.72	99.63
	Pinyon Juniper	7,312.64	7,063.61	96.59
	Sagebrush	21,070.74	20,653.21	98.02
	Urban	999.92	74.60	7.46
Central Nevada Desert Basins Total		**388,430.02**	**274,436.50**	**70.65**

Table F-1. Total Acreage of CWHR Habitat and Amount and Percentage Protected (GAP 1 or 2) in Each Basin Within the SCAG Region (Continued)

Basin	CWHR Type	Total Acres	Protected Acres	% Protected
Laguna San Diego Coastal	Agriculture	56,500.89	727.73	1.29
	Annual Grassland	61,570.24	3,742.48	6.08
	Barren	1,130.14	50.89	4.50
	Chamise Redshank Chaparral	90,970.05	22,455.79	24.68
	Coastal Oak Woodland	15,711.50	2,720.61	17.32
	Coastal Scrub	92,960.85	5,019.95	5.40
	Desert Wash	871.61	4.94	0.57
	Mixed Chaparral	127,582.45	29,383.59	23.03
	Montane Hardwood	1,038.52	187.26	18.03
	Montane Hardwood Conifer	938.25	267.57	28.52
	Sagebrush	8,839.02	518.13	5.86
	Urban	100,168.41	162.63	0.16
	Valley Foothill Riparian	4,575.20	40.61	0.89
	Water	2,444.44	25.50	1.04
Laguna San Diego Coastal Total		**565,301.57**	**65,307.67**	**11.55**
Lower Colorado	Agriculture	128,316.53	11,158.67	8.70
	Alkali Desert Scrub	4,889.30	2,381.63	48.71
	Desert Riparian	11,583.72	1,735.62	14.98
	Desert Scrub	1,759,675.11	992,191.85	56.38
	Desert Succulent Shrub	195,773.41	63,717.35	32.55
	Desert Wash	270,439.31	102,304.86	37.83
	Juniper	6,301.73	6,081.84	96.51
	Lacustrine	2,391.07	146.62	6.13
	Pinyon Juniper	3,407.40	3,369.68	98.89
	Sagebrush	32,792.39	25,334.59	77.26
	Urban	19,491.02	240.14	1.23
	Water	26,876.98	1,698.03	6.32
Lower Colorado Total		**2,461,937.96**	**1,210,360.88**	**49.16**

Table F-1. Total Acreage of CWHR Habitat and Amount and Percentage Protected (GAP 1 or 2) in Each Basin Within the SCAG Region (Continued)

Basin	CWHR Type	Total Acres	Protected Acres	% Protected
Northern Mojave	Agriculture	121,746.13	233.62	0.19
	Alkali Desert Scrub	855,629.46	241,144.82	28.18
	Annual Grassland	103,841.07	50,379.21	48.52
	Barren	144,928.11	43,027.33	29.69
	Desert Riparian	11,609.39	5,226.00	45.02
	Desert Scrub	5,069,210.34	2,039,629.64	40.24
	Desert Succulent Shrub	7,091.07	7,038.69	99.26
	Desert Wash	370.42	26.16	7.06
	Eastside Pine	14,500.45	2,076.89	14.32
	Freshwater Emergent Wetland	409.88	292.63	71.39
	Jeffrey Pine	8,946.97	5,129.28	57.33
	Joshua Tree	4,405.14	125.69	2.85
	Juniper	47,374.15	4,430.16	9.35
	Mixed Chaparral	127,850.62	8,380.87	6.56
	Montane Chaparral	3,211.49	1,549.76	48.26
	Montane Hardwood	23,057.59	1,433.61	6.22
	Montane Hardwood Conifer	27,859.08	4,562.96	16.38
	Montane Riparian	359.06	143.62	40.00
	Pinyon Juniper	83,270.00	32,604.70	39.16
	Riverine	17,017.55	2,949.43	17.33
	Sagebrush	68,752.73	36,918.30	53.70
	Sierran Mixed Conifer	27,904.84	6,564.71	23.53
	Urban	258,119.28	2,199.17	0.85
	Valley Foothill Riparian	1,634.72	17.00	1.04
	Water	9,691.57	177.21	1.83
Northern Mojave Total		**7,038,791.08**	**2,496,261.45**	**35.46**

Table F-1. Total Acreage of CWHR Habitat and Amount and Percentage Protected (GAP 1 or 2) in Each Basin Within the SCAG Region (Continued)

Basin	CWHR Type	Total Acres	Protected Acres	% Protected
Salton Sea	Agriculture	678,213.27	16,379.80	2.42
	Alpine Dwarf Shrub	17.28	17.28	100.00
	Annual Grassland	70,301.75	3,307.18	4.70
	Barren	29,845.00	19,217.66	64.39
	Chamise Redshank Chaparral	59,619.75	16,184.42	27.15
	Coastal Oak Woodland	695.30	67.13	9.65
	Coastal Scrub	9,514.24	1,158.62	12.18
	Desert Riparian	426.29	329.39	77.27
	Desert Scrub	1,793,004.94	649,019.42	36.20
	Desert Succulent Shrub	183,517.12	14,537.14	7.92
	Desert Wash	249,851.22	42,873.06	17.16
	Eastside Pine	3,196.30	1,313.13	41.08
	Jeffrey Pine	4,487.12	3,023.99	67.39
	Joshua Tree	19,159.18	6,478.51	33.81
	Juniper	36,476.07	29,097.44	79.77
	Lacustrine	330.96	170.87	51.63
	Lodgepole Pine	150.62	150.62	100.00
	Mixed Chaparral	147,643.71	84,792.20	57.43
	Montane Chaparral	6,002.92	4,267.90	71.10
	Montane Hardwood	12,559.43	7,041.73	56.07
	Montane Hardwood Conifer	9,151.90	5,406.99	59.08
	Montane Riparian	627.17	387.67	61.81
	Palm Oasis	69.14	21.66	31.32
	Perennial Grassland	24.69	24.69	100.00
	Pinyon Juniper	42,564.42	36,216.24	85.09
	Sagebrush	1,098.22	133.19	12.13
	Sierran Mixed Conifer	21,762.60	15,895.87	73.04
	Subalpine Conifer	3,015.35	2,977.29	98.74
	Urban	154,235.22	2,894.59	1.88
	Valley Foothill Riparian	1,237.05	533.04	43.09
	Water	236,030.60	127,542.56	54.04
	Wet Meadow	46.91	39.51	84.21
	White Fir	372.39	162.37	43.60
Salton Sea Total		**3,775,248.13**	**1,091,663.16**	**28.92**

Table F-1. Total Acreage of CWHR Habitat and Amount and Percentage Protected (GAP 1 or 2) in Each Basin Within the SCAG Region (Continued)

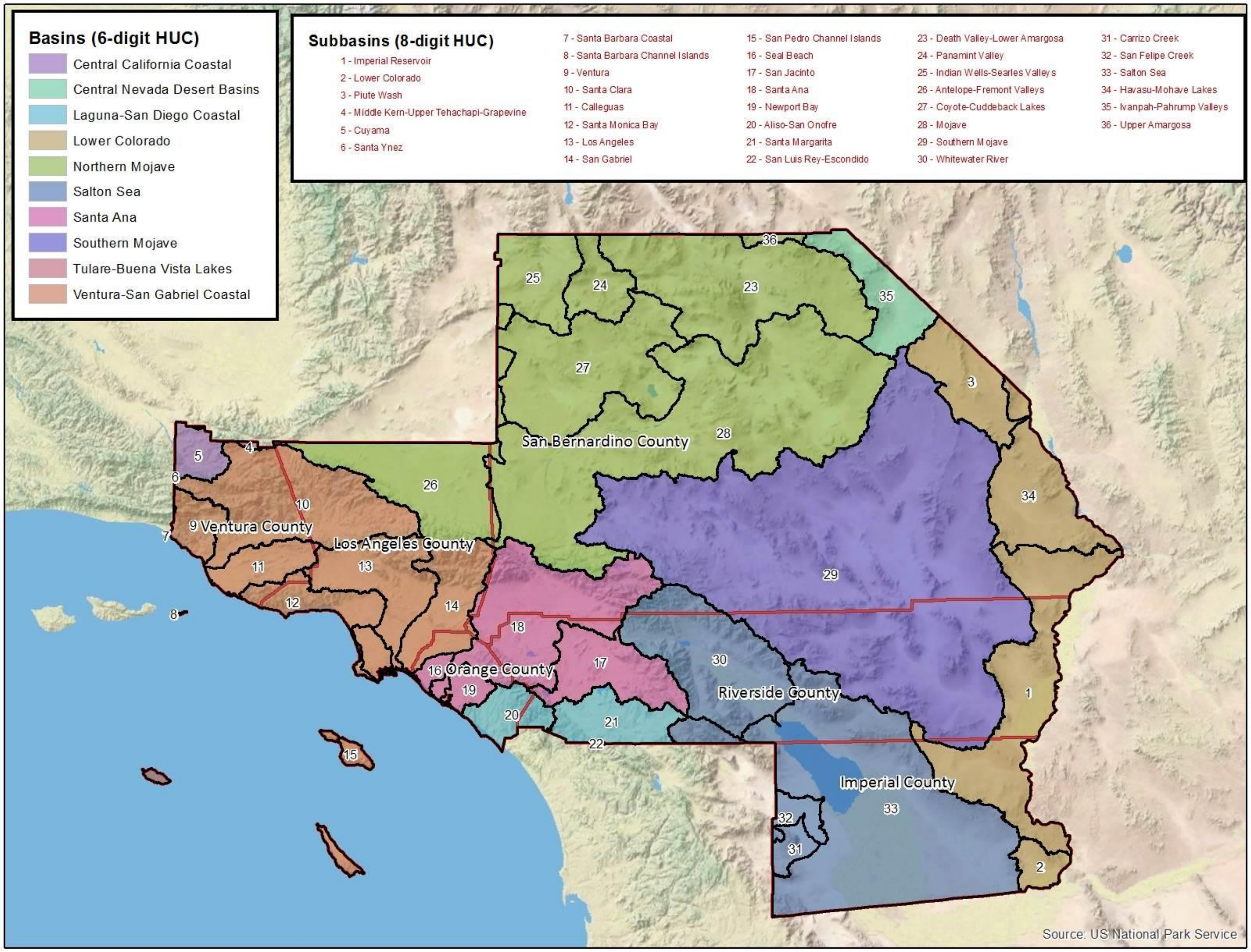
Basin	CWHR Type	Total Acres	Protected Acres	% Protected
Santa Ana	Agriculture	168,369.46	3,624.81	2.15
	Alpine Dwarf Shrub	4.94	4.94	100.00
	Annual Grassland	126,951.39	12,552.55	9.89
	Barren	15,863.66	2,351.75	14.82
	Chamise Redshank Chaparral	91,345.44	5,533.96	6.06
	Closed Cone Pine Cypress	1,316.07	327.69	24.90
	Coastal Oak Woodland	8,276.47	788.23	9.52
	Coastal Scrub	177,094.61	6,943.50	3.92
	Desert Scrub	13,703.82	603.11	4.40
	Desert Wash	1,012.37	60.24	5.95
	Eastside Pine	19,583.02	411.25	2.10
	Eucalyptus	744.72	12.35	1.66
	Freshwater Emergent Wetland	602.52	119.60	19.85
	Jeffrey Pine	8,776.23	2,203.43	25.11
	Juniper	885.95	40.98	4.63
	Mixed Chaparral	289,785.01	20,284.50	7.00
	Montane Chaparral	13,660.20	6,285.21	46.01
	Montane Hardwood	42,464.84	6,620.18	15.59
	Montane Hardwood Conifer	36,043.29	8,737.24	24.24
	Montane Riparian	1,866.72	88.85	4.76
	Pinyon Juniper	8,098.78	30.30	0.37
	Ponderosa Pine	552.75	58.64	10.61
	Sagebrush	6,420.16	194.83	3.03
	Saline Emergent Wetland	627.13	572.60	91.30
	Sierran Mixed Conifer	68,513.23	30,217.91	44.11
	Subalpine Conifer	8,956.67	7,936.33	88.61
	Urban	584,331.57	2,473.66	0.42
	Valley Foothill Riparian	11,062.28	305.92	2.77
	Water	19,472.69	1,594.96	8.19
	White Fir	205.12	131.66	64.19
Santa Ana Total		**1,726,591.10**	**121,111.18**	**7.01**

Table F-1. Total Acreage of CWHR Habitat and Amount and Percentage Protected (GAP 1 or 2) in Each Basin Within the SCAG Region (Continued)

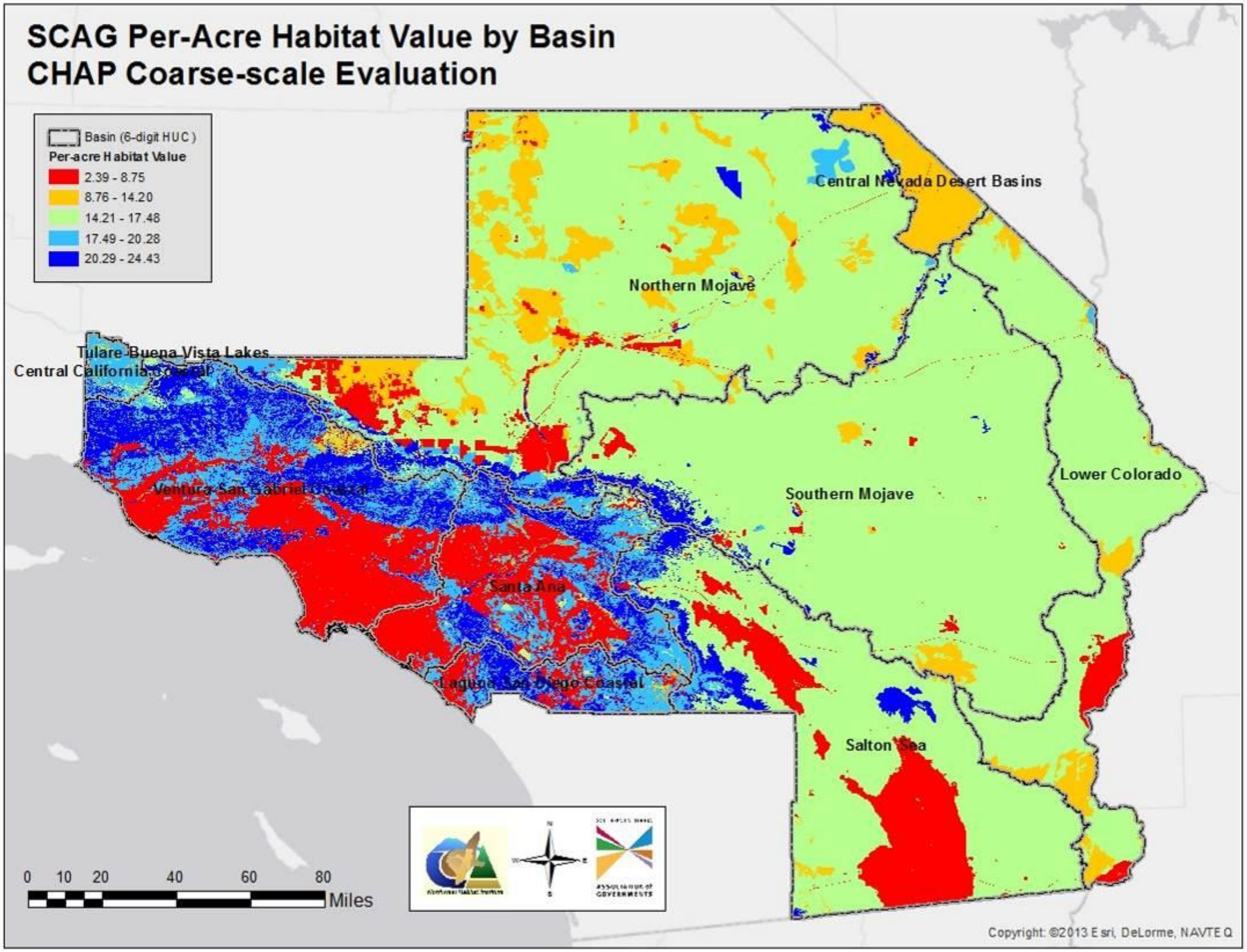
Basin	CWHR Type	Total Acres	Protected Acres	% Protected
Southern Mojave	Agriculture	30,308.20	46.25	0.15
	Alkali Desert Scrub	226,247.27	24,958.97	11.03
	Annual Grassland	2,933.56	437.20	14.90
	Barren	101,114.75	72,811.56	72.01
	Bitterbrush	2.47	2.47	100.00
	Coastal Scrub	66.67	14.03	21.05
	Desert Riparian	1,940.98	2.47	0.13
	Desert Scrub	4,669,956.36	2,428,351.24	52.00
	Desert Succulent Shrub	17,612.19	12,176.40	69.14
	Desert Wash	335,912.17	197,524.10	58.80
	Eastside Pine	3,703.19	123.29	3.33
	Joshua Tree	20,460.65	11,328.05	55.37
	Juniper	34,109.08	23,052.02	67.58
	Mixed Chaparral	26,521.49	8,555.43	32.26
	Montane Chaparral	264.73	57.15	21.59
	Montane Riparian	22.22	13.34	60.01
	Palm Oasis	3,006.55	2,984.96	99.28
	Pinyon Juniper	98,248.03	52,304.96	53.24
	Sagebrush	65,317.74	52,050.94	79.69
	Urban	31,653.54	2,469.13	7.80
	Valley Foothill Riparian	187.65	9.28	4.95
	Water	2,205.67	151.93	6.89
Southern Mojave Total		**5,671,795.18**	**2,889,425.15**	**50.94**
Tulare Buena Vista Lakes	Annual Grassland	2,362.65	4.73	0.20
	Jeffrey Pine	983.99	45.25	4.60
	Montane Chaparral	498.30	11.15	2.24
	Pinyon Juniper	5,013.40	0.02	0.00
	Sierran Mixed Conifer	1,002.57	18.83	1.88
	Subalpine Conifer	4.08	4.08	100.00
Tulare Buena Vista Lakes Total		**9,865.00**	**84.06**	**0.85**

Table F-1. Total Acreage of CWHR Habitat and Amount and Percentage Protected (GAP 1 or 2) in Each Basin Within the SCAG Region (Continued)

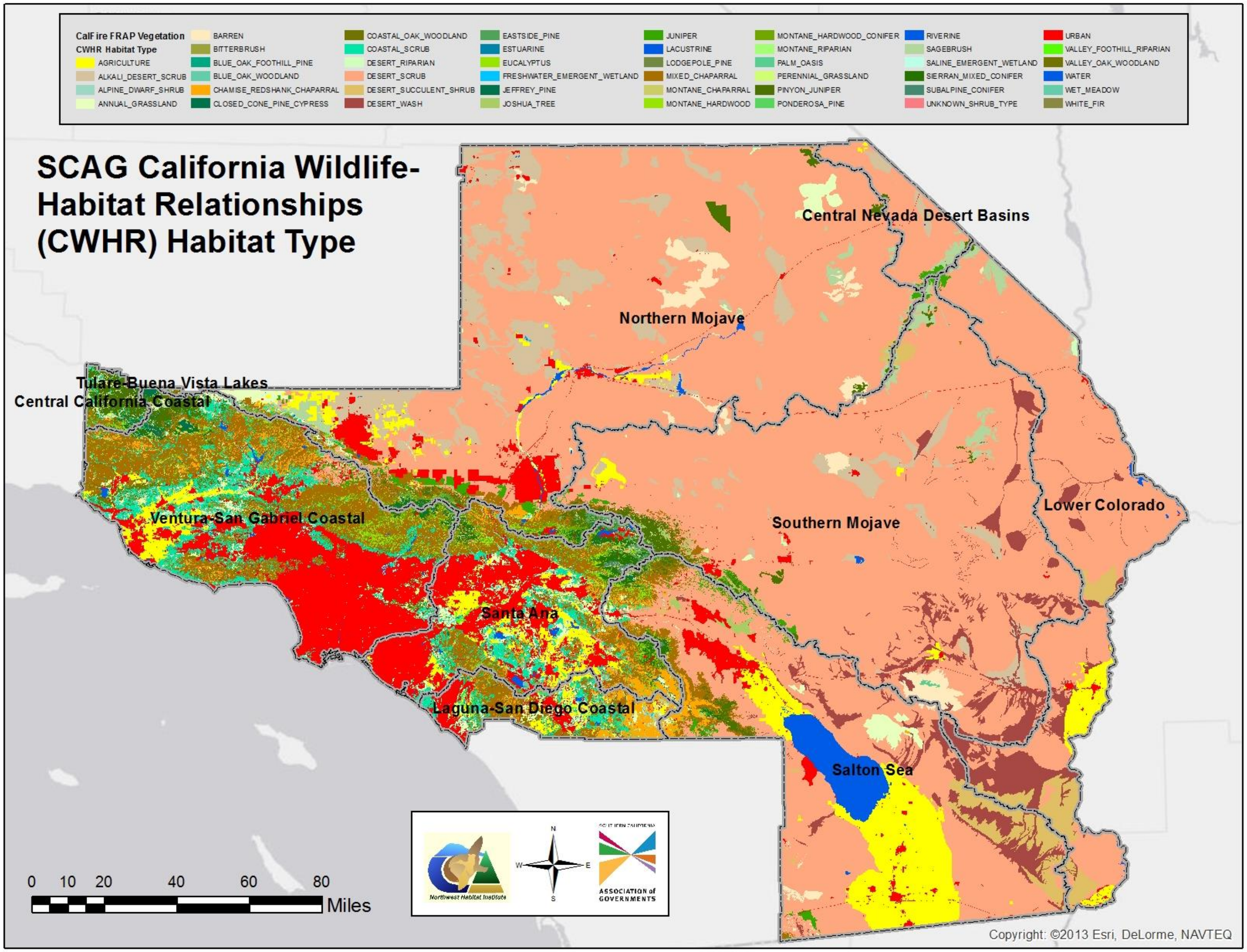
Basin	CWHR Type	Total Acres	Protected Acres	% Protected
Ventura San Gabriel Coastal	Agriculture	127,722.51	793.33	0.62
	Annual Grassland	107,722.64	6,416.20	5.96
	Barren	27,333.60	6,829.57	24.99
	Blue Oak Woodland	344.03	54.36	15.80
	Chamise Redshank Chaparral	75,324.27	16,851.94	22.37
	Coastal Oak Woodland	86,387.77	8,348.34	9.66
	Coastal Scrub	381,068.91	44,543.49	11.69
	Desert Scrub	30,815.86	1.15	0.00
	Desert Wash	1,435.41	12.57	0.88
	Eastside Pine	963.10	316.94	32.91
	Eucalyptus	577.93	3.38	0.59
	Jeffrey Pine	34,854.82	19,113.58	54.84
	Mixed Chaparral	713,206.78	241,010.64	33.79
	Montane Chaparral	19,116.92	13,839.19	72.39
	Montane Hardwood	60,488.94	23,363.28	38.62
	Montane Hardwood Conifer	46,885.40	24,157.90	51.53
	Montane Riparian	22,873.14	5,782.09	25.28
	Pinyon Juniper	57,389.07	3,302.83	5.76
	Ponderosa Pine	399.70	47.00	11.76
	Sagebrush	8,941.42	76.66	0.86
	Saline Emergent Wetland	1,226.87	223.53	18.22
	Sierran Mixed Conifer	26,290.93	20,960.93	79.73
	Subalpine Conifer	132.34	87.49	66.12
	Urban	938,007.09	2,811.20	0.30
	Valley Foothill Riparian	3,258.48	499.43	15.33
	Valley Oak Woodland	2,623.84	187.59	7.15
	Water	18,700.61	712.65	3.81
Ventura San Gabriel Coastal Total		**2,794,092.35**	**440,347.27**	**15.76**



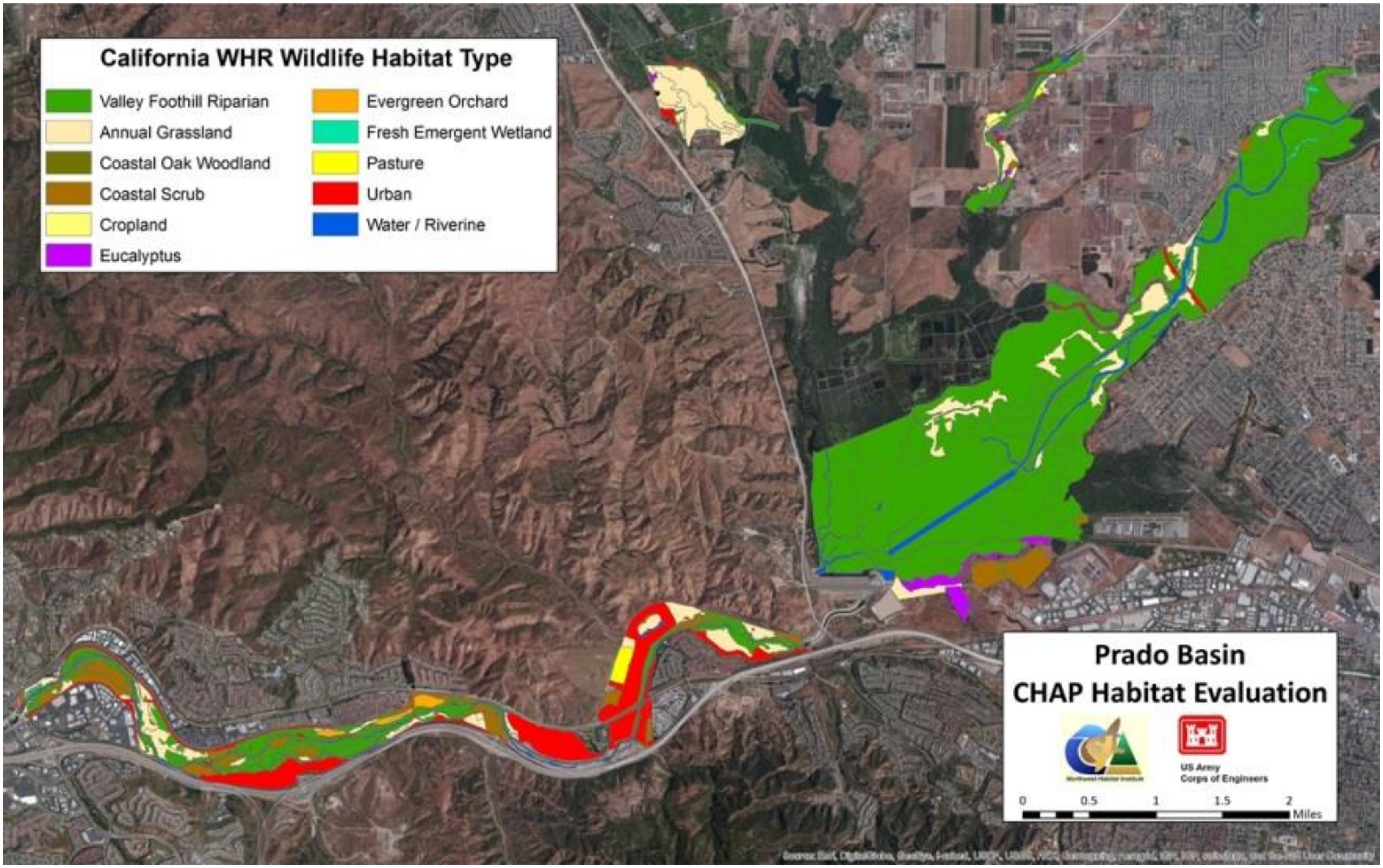
Map F-1. Basins and Subbasins in the SCAG Region



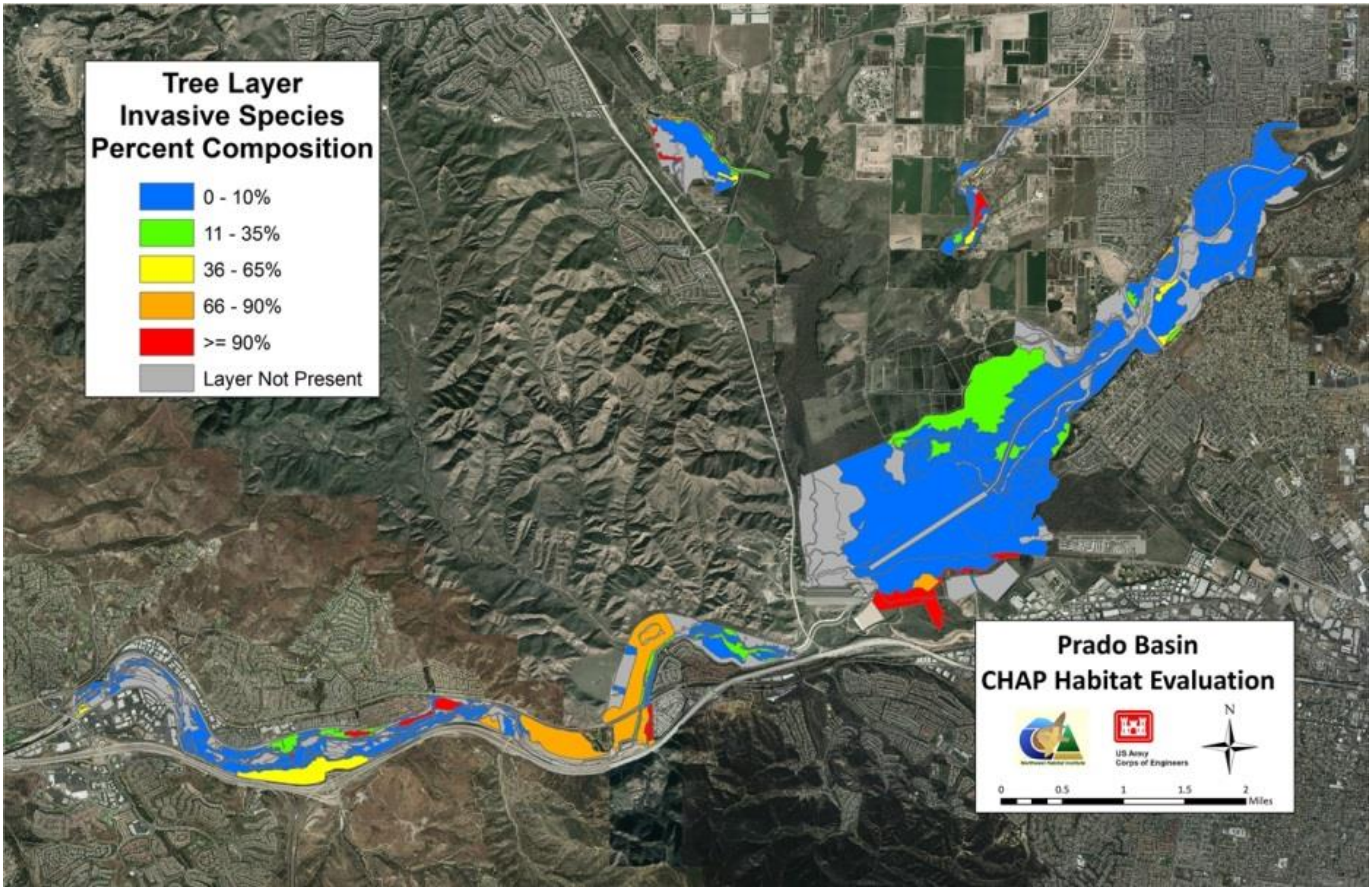
Map F-2. Per-acre Habitat Value from CHAP Coarse-scale Evaluation



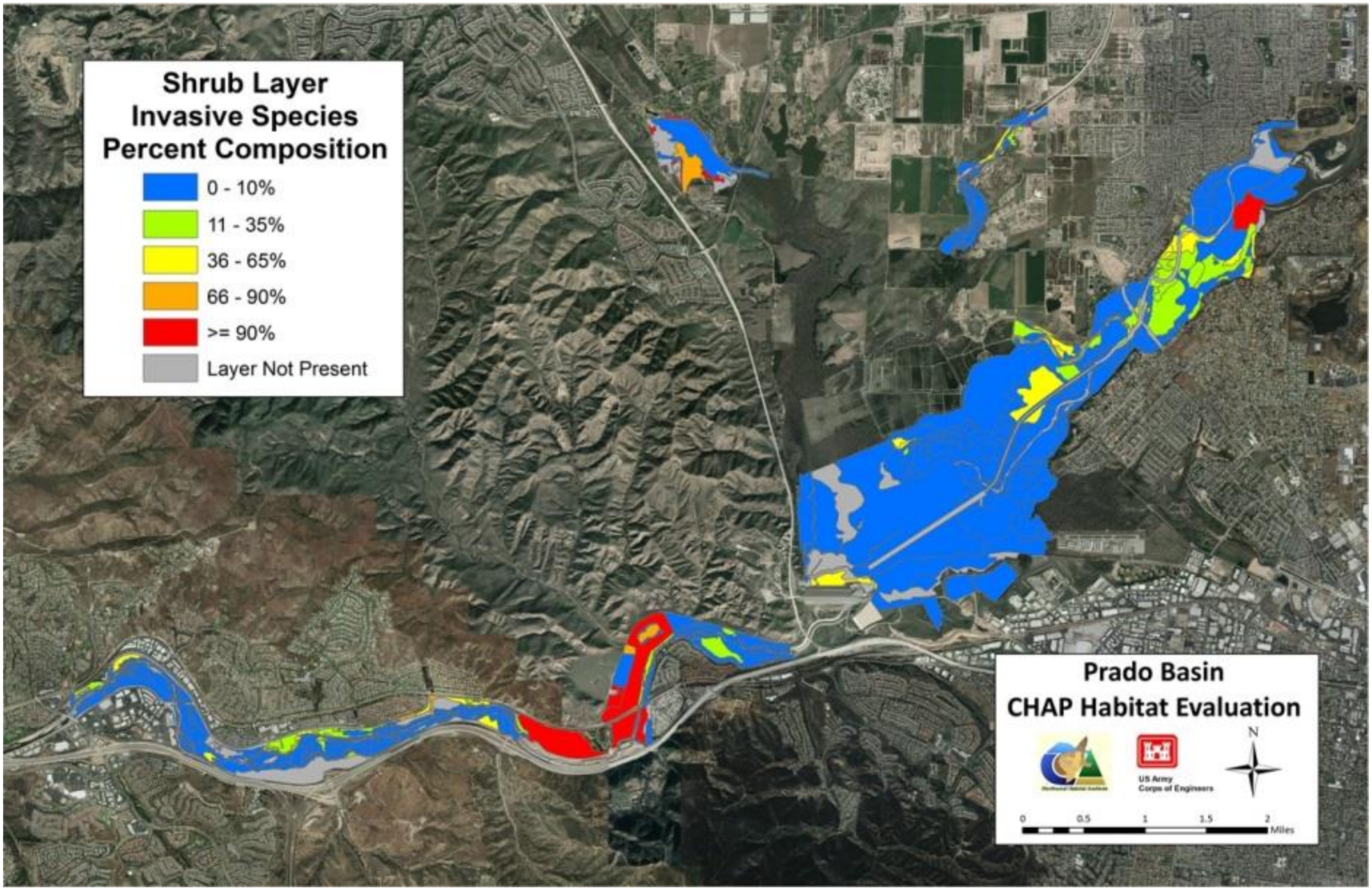
Map F-3. CWHR Habitat Types in the SCAG Region



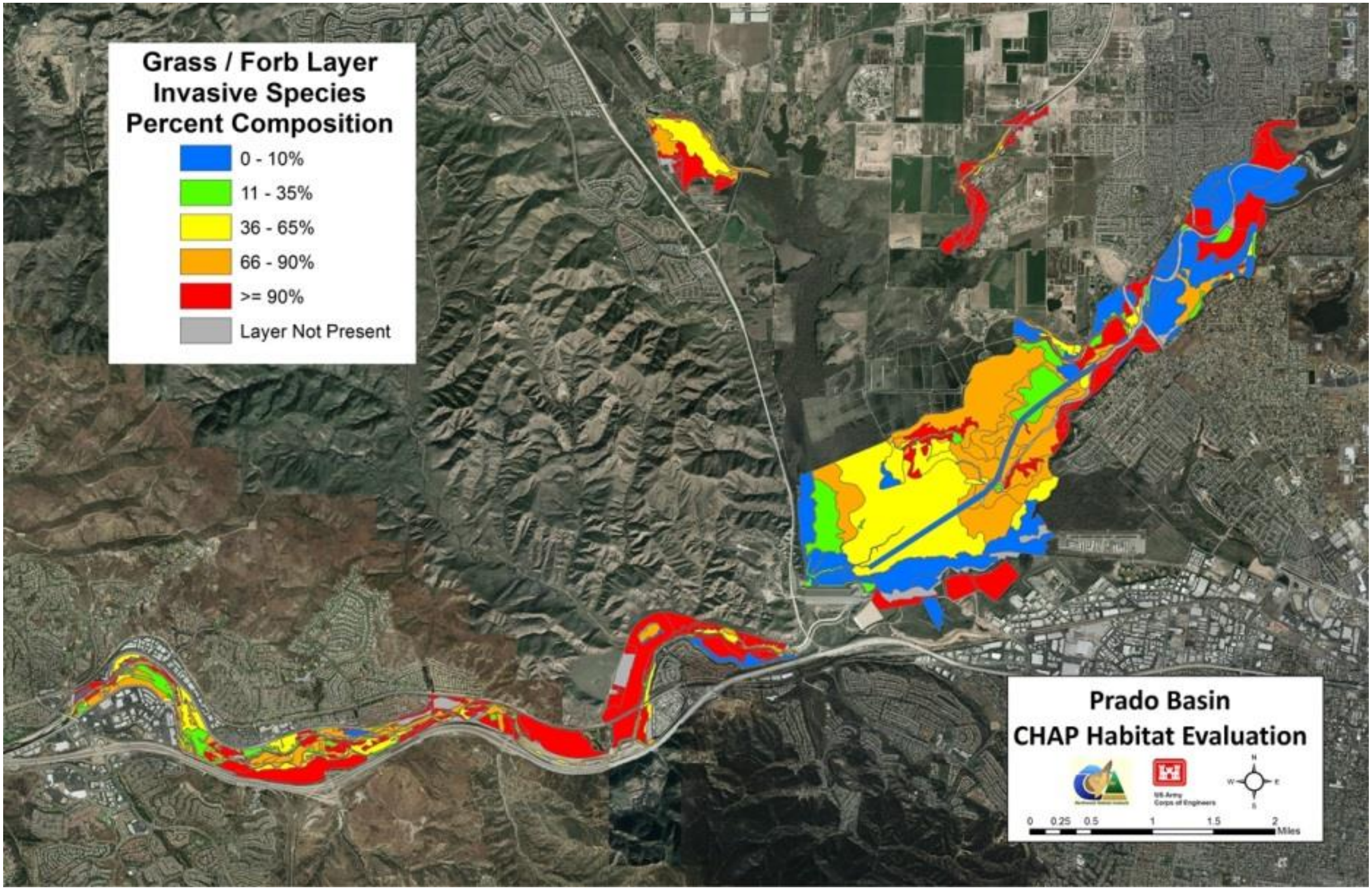
Map F-4. CWHR Habitat Types in the Prado Basin Project Area Based on Aerial Photo and Field Delineation



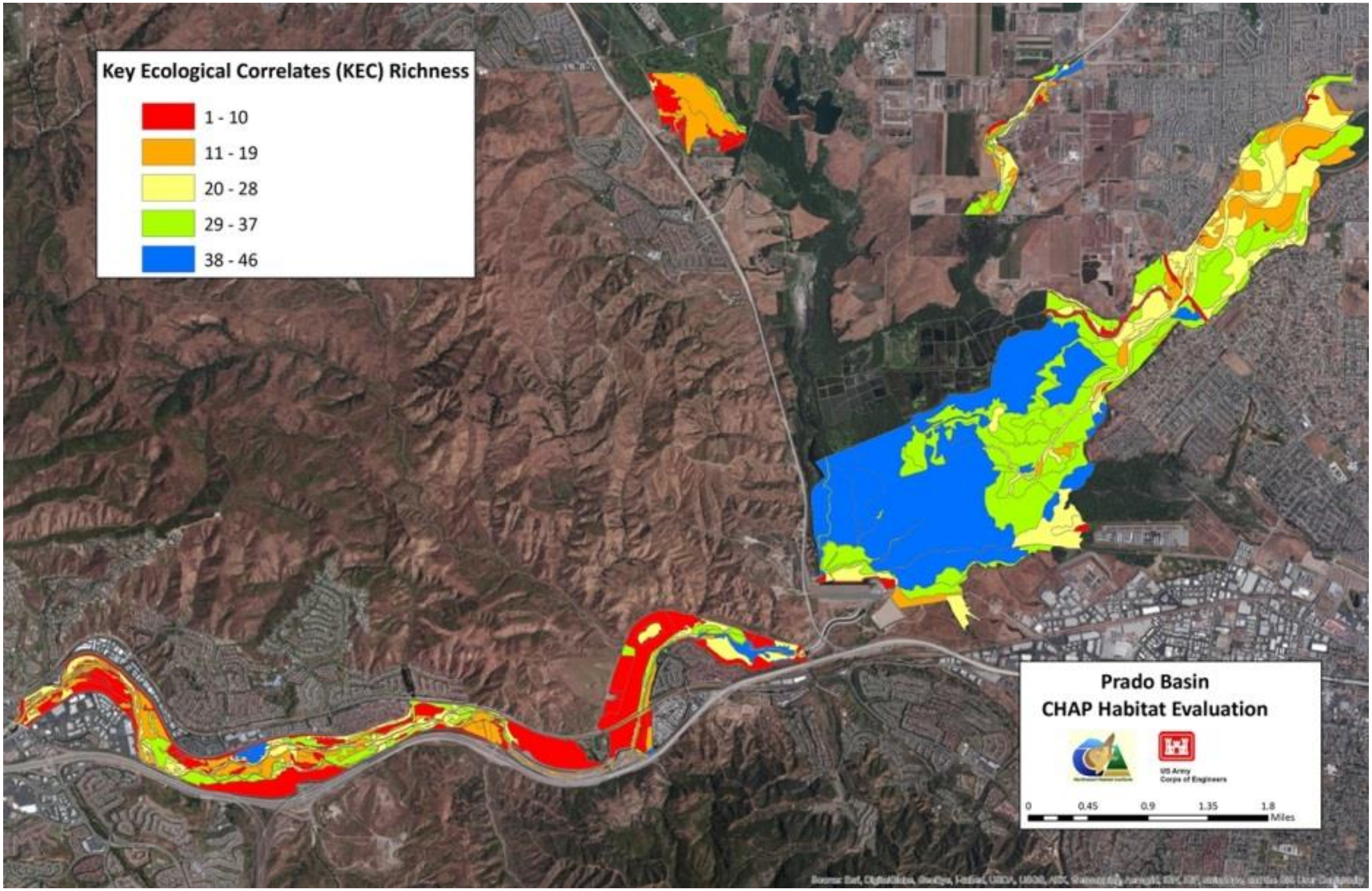
Map F-5. Percent Composition of Invasive Tree Species in the Prado Basin Project Area



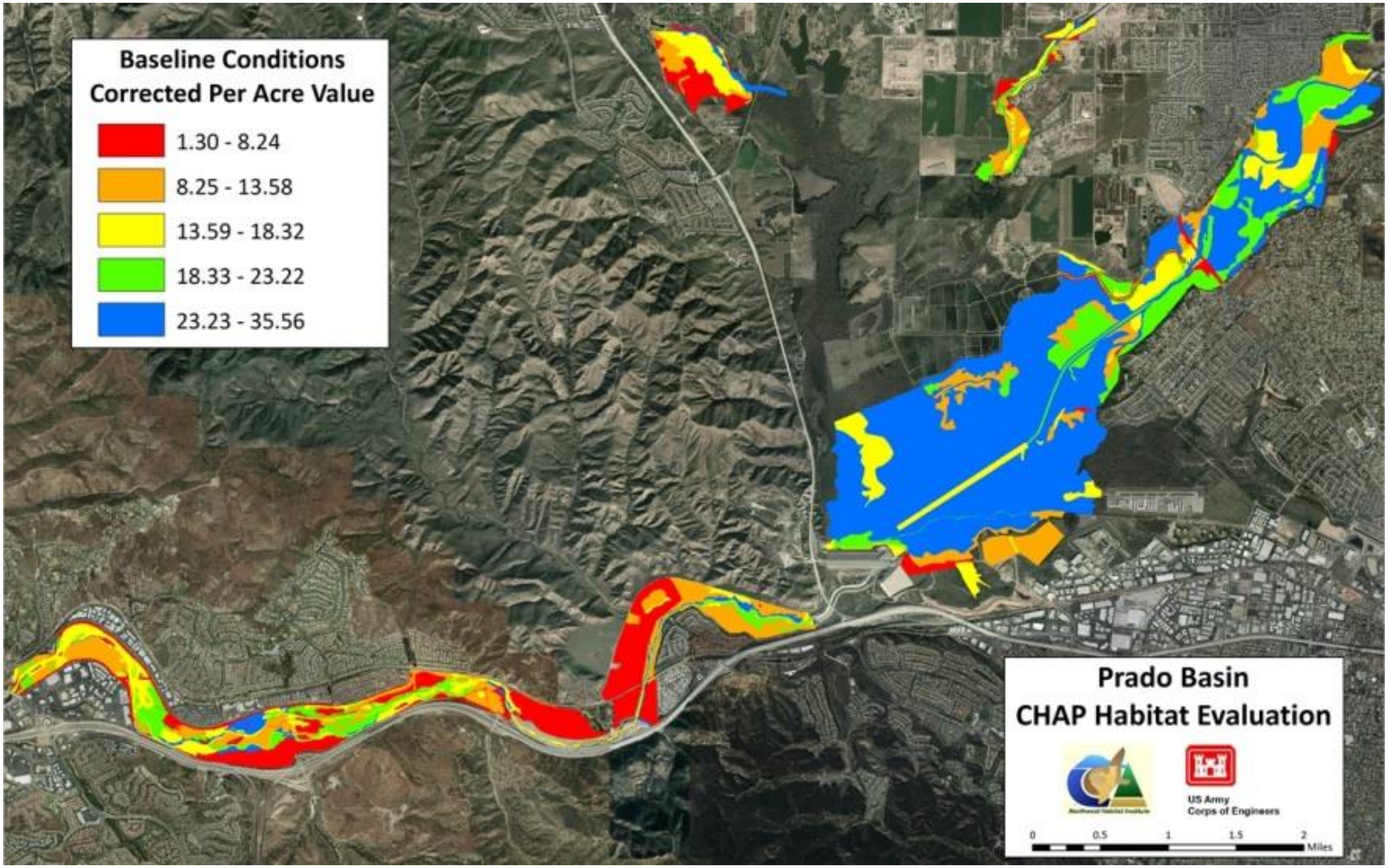
Map F-6. Percent Composition of Invasive Shrub Species in the Prado Basin Project Area



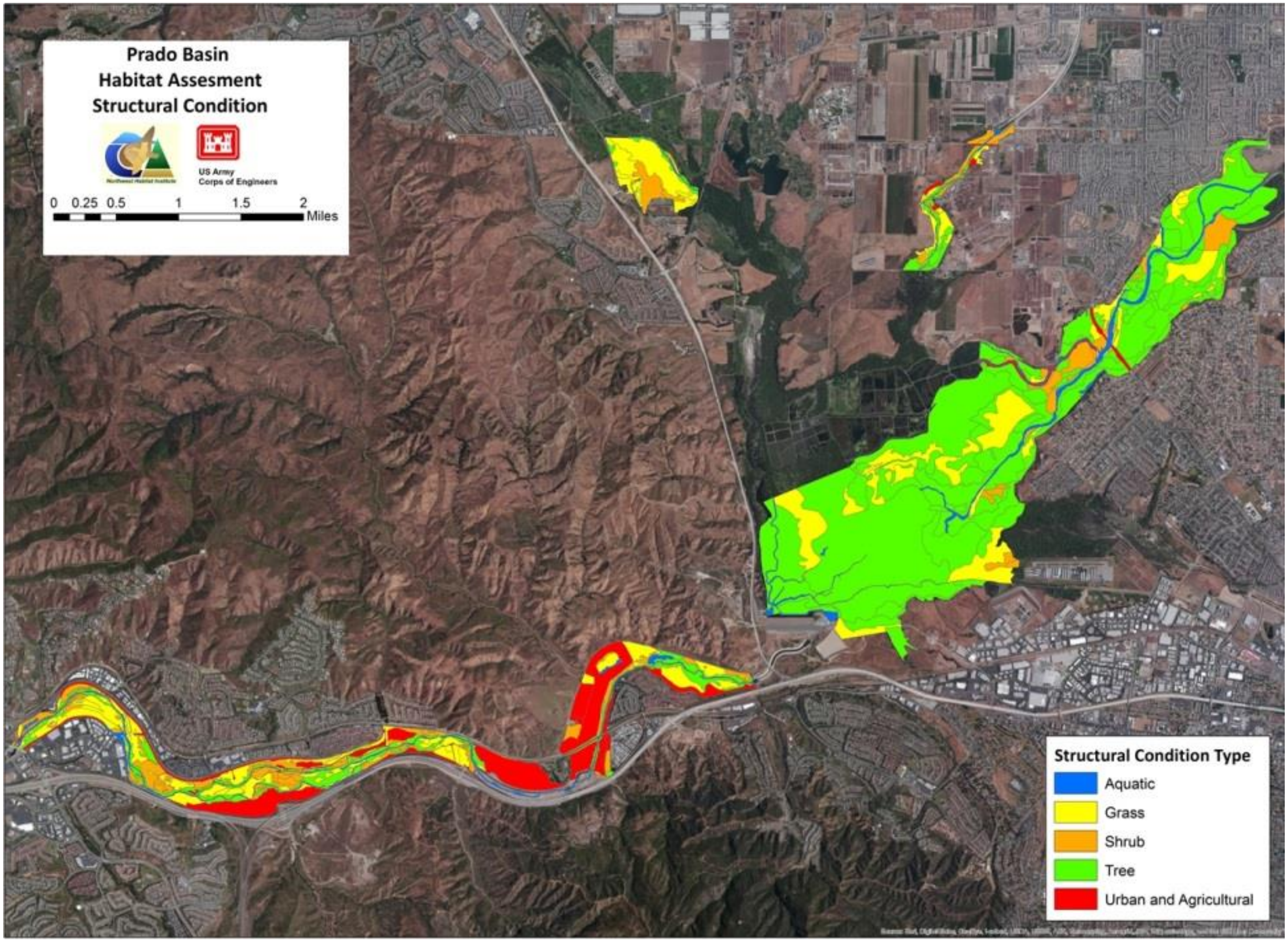
Map F-7. Percent Composition of Invasive Grass/Forb Species in the Prado Basin Project Area



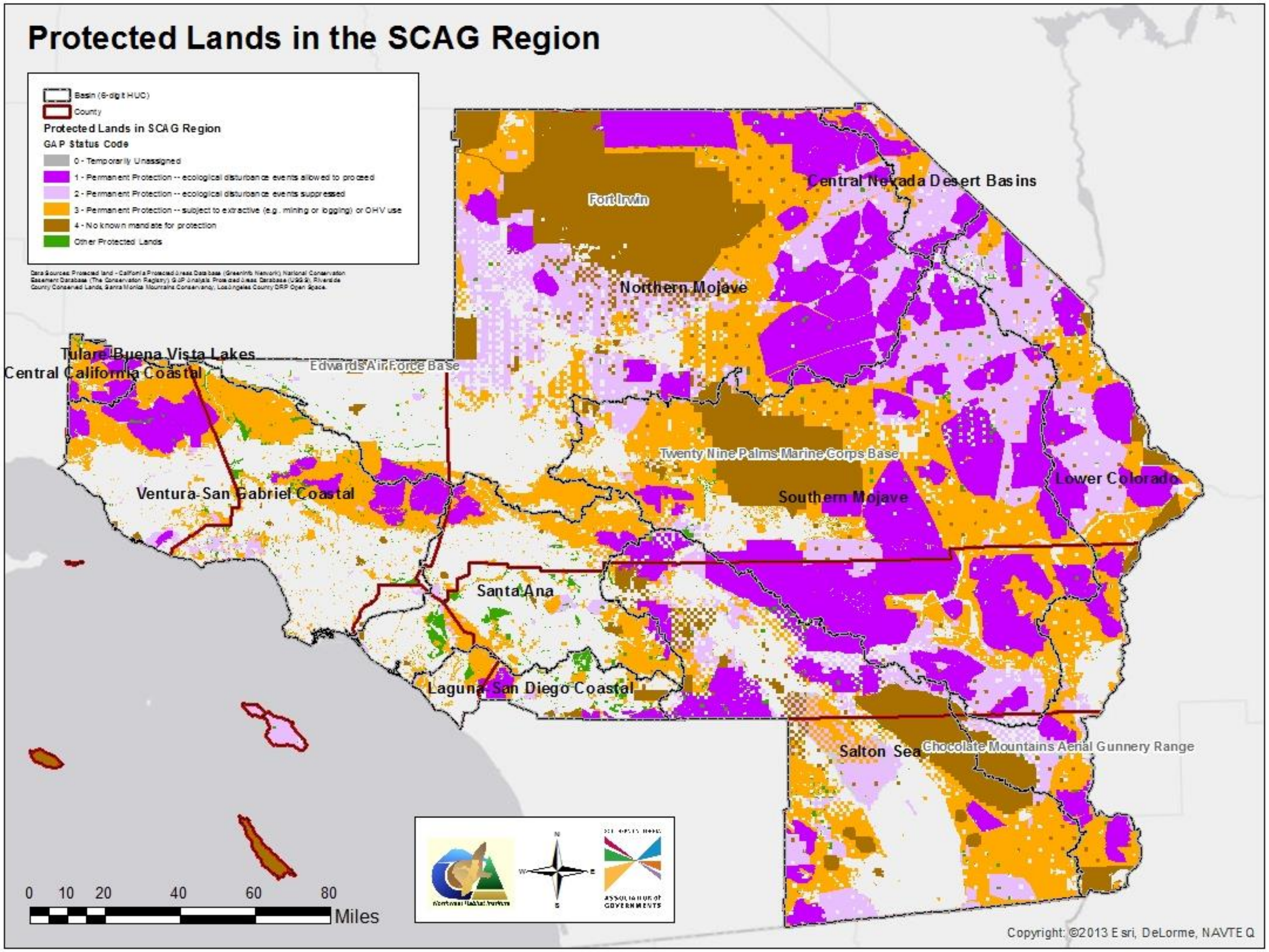
Map F-8. KEC Richness (Number of Key Environmental Correlates in Each Habitat Polygon) in the Prado Basin Study Area



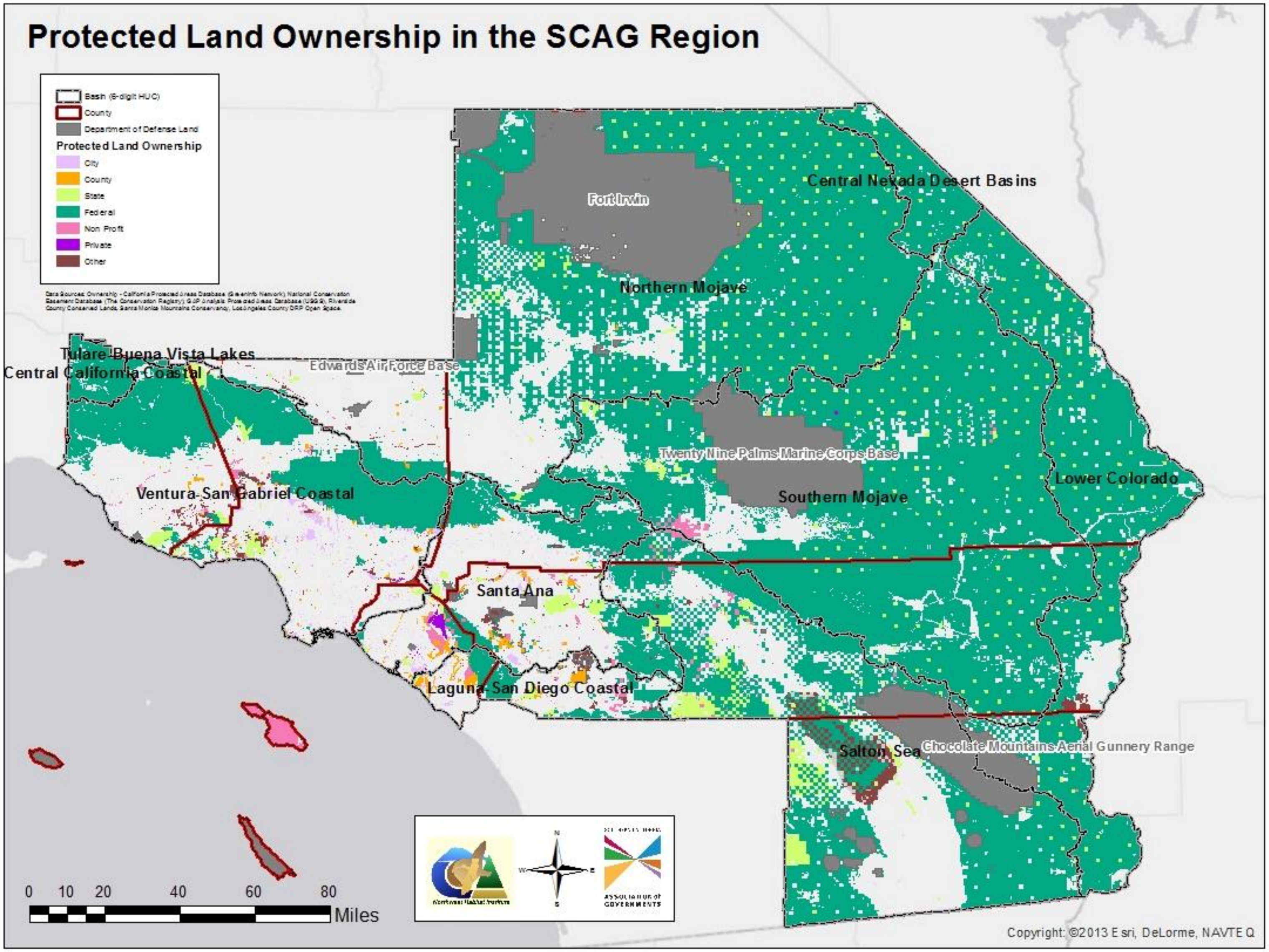
Map F-9. Corrected (Adjusted for Invasive Species Presence) Per-acre Habitat Values in the Prado Basin Project Area



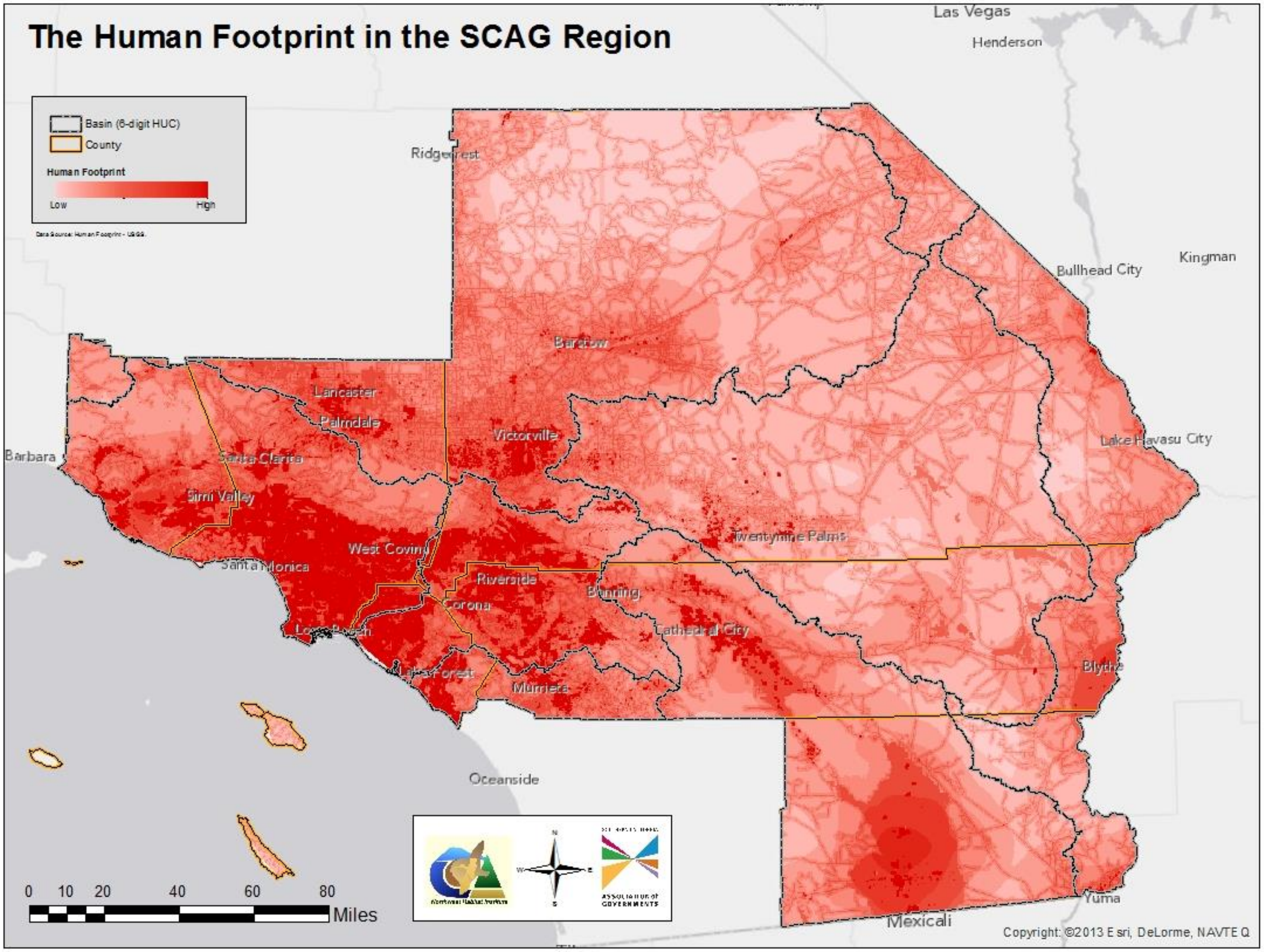
Map F-10. General Structural Condition Types in the Prado Basin Project Area.



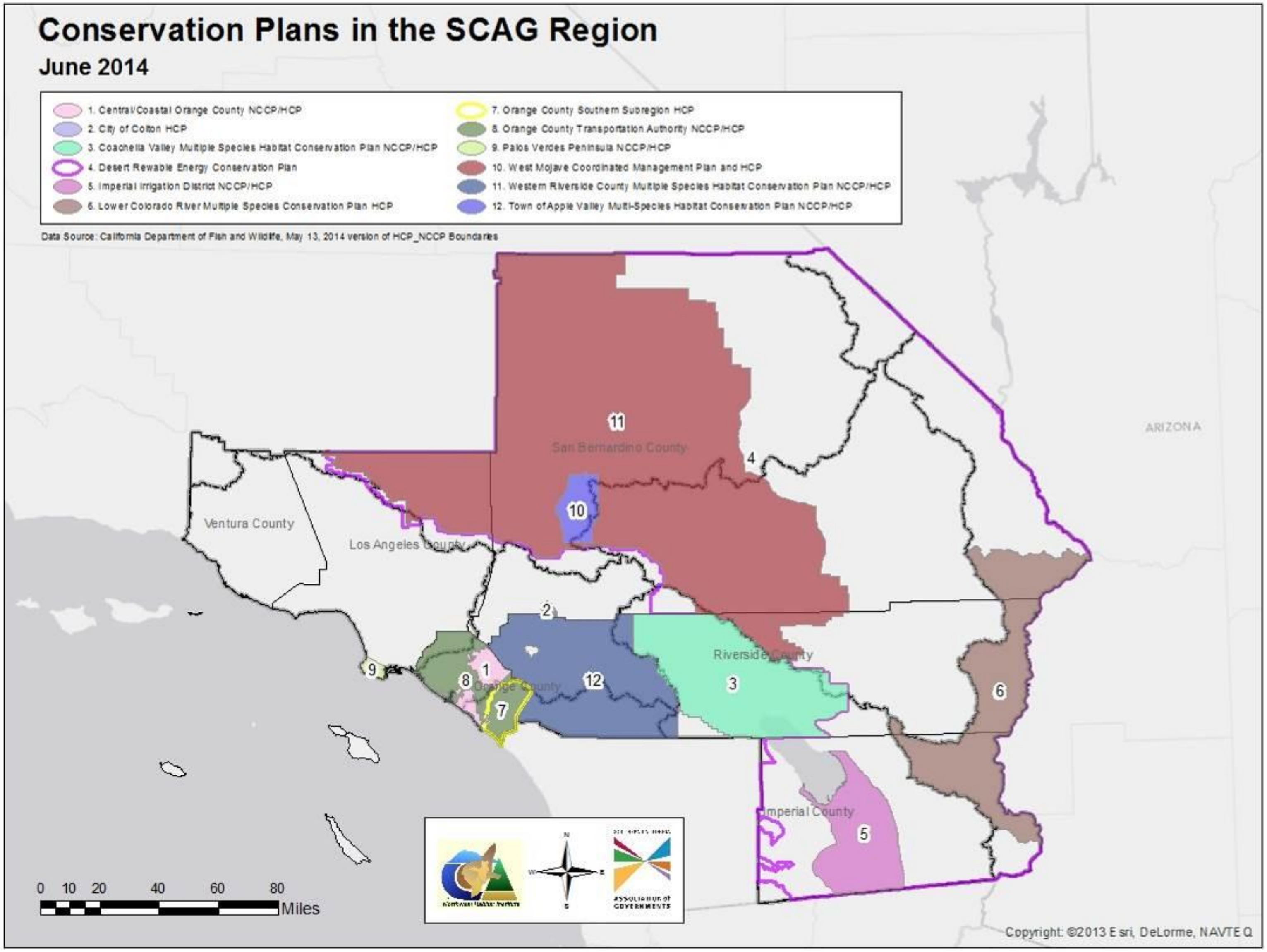
Map F-11. Existing Protected Lands by GAP Status Code in the SCAG Region



Map F-12. Land Ownership of Protected Lands in the SCAG Region



Map F-13. The Human Footprint (USGS) in the SCAG Region



Map F-14. Conservation Plans (HCPs and NCCPs) in the SCAG Region

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