ACE DATASET FACT SHEET

Terrestrial Native Species Richness

DS2703

DATA BY TAXONOMIC GROUP

DS2704 – Native Plant Richness
DS2705 – Native Bird Richness
DS2706 – Native Mammal Richness
DS2707 – Native Amphibian Richness
DS2708 – Native Reptile Richness

SUBSET SUMMARIES BY STATUS OR MANAGEMENT

DS2701 – Terrestrial Climate Vulnerable Species
DS2702 – Terrestrial Native Game Species

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INTENT AND PURPOSE

Native species richness is a measure of species biodiversity, and is one measurement used to describe the **distribution of overall species biodiversity in California** for the California Department of Fish and Wildlife (CDFW) Areas of Conservation Emphasis Project (ACE). Other measures of terrestrial species biodiversity included in the ACE terrestrial biodiversity summary are rare species richness and terrestrial endemism. Here, native species richness represents a count of the total number of native terrestrial species potentially present in each hexagon based on species range and distribution information. This dataset depicts the distribution of richness of **all native species in the state, both common and rare**. The data can be used to **view patterns of species diversity**, and to **identify areas of**

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highest native richness across the state and in each ecoregion. Users can **view a list of species** that contribute to the richness counts for each hexagon.

The **native species richness summary** depicts relative diversity within each ecoregion across the state, so that areas of highest diversity within each ecoregion are highlighted. To achieve this, the data in the summary layer was normalized by taxonomic group and by ecoregion (see Data Sources and Models Used, below). The **native species richness by taxonomic group** layers give a statewide overview of richness for each individual taxonomic group, showing counts of species per hexagon for amphibians, birds, mammals, and reptiles; and counts of species per Jepson ecoregion for plants. In addition to overall native species richness, separate counts of **native game species** and **climate vulnerable species** are available.

BACKGROUND INFORMATION

The differences between this native species richness dataset and the previous version of ACE (ACE-II) are: 1) this dataset only includes terrestrial species; fish are now included in a separate aquatic native species richness dataset; and, 2) this dataset used species predicted habitat distribution maps to identify the hexagons in which a species may potentially occur, while ACE-II had used species range maps. In addition, this dataset includes separate counts of native game species and climate vulnerable species.

The previous version of ACE (ACE-II) included two different native richness maps: statewide richness and richness by ecoregion. The new viewer displays only native richness normalized by ecoregion, since this dataset is the scale most relevant for most planning processes in California. The statewide native richness summary not normalized by ecoregion (highlighting high richness areas on a statewide basis, not by ecoregion) is not shown in the ACE viewer but is still available as a separate layer in BIOS (ds1332), and the statewide values are available in the ACE native richness GIS attribute table.

DATA SOURCES AND MODELS USED

For ACE version 3, native species richness was based on distribution data for amphibians (n=59), birds (n=360), mammals (n=167), and reptiles (n=78). Distribution data for plants (n=4960) was summarized statewide, but due to data resolution was not included in the native species richness summary (see below).

Data Sources

Terrestrial vertebrate distribution data was based on California Wildlife Habitat Relationships (CWHR) Predicted Habitat Suitability models for amphibians, birds, mammals, and reptiles. These models represent potential suitable habitat within the range of each species based the CWHR species range, CWHR species habitat relationship table (CDFW 2014), and the best available habitat/landcover map, FVEG15_1 (Calfire 2015). All native terrestrial vertebrate species for which a CWHR Predicted Habitat

Suitability Model was available were included in the counts. If any potentially suitable habitat for a species was mapped within a hexagon, the species was counted as potentially present in the hexagon. Terrestrial vertebrate counts were based on full species only; counts did not consider subspecies or varieties because range maps were generally not available at the subspecific level. The CWHR Predicted Habitat Suitability Models for each species are available in BIOS.

Plant distribution data was based on Jepson ecoregion designations as published in the Jepson Manual and provided by the Jepson Herbarium, UC Berkeley. All native plants in the Jepson manual were included. Although plant information was available at the subspecies level, we merged these to full species during processing to be consistent with terrestrial vertebrate distribution data. The Jepson ecoregion designations are equivalent to plant ranges, where the range is defined by the boundaries of the Jepson ecoregions in which the species occurs. This results in every hexagon within a given ecoregion having the same native plant count (every plant species that occurs in the ecoregion is counted across the entire ecoregion), and therefore the native plant richness data could not be normalized to identify the highest richness areas within each ecoregion. Because of this, the plant data was not included in the ecoregional native richness summary. However, rare and endemic plant data is available at a finer resolution and was included in the overall ecoregional terrestrial species biodiversity summary.

Terrestrial climate vulnerable species was a count of species indicated as climate vulnerable in the State Wildlife Action Plan (SWAP; CDFW 2015) Species of Greatest Conservation Need (SGCN) list, and is based on the same distribution data as the full native species richness dataset.

Terrestrial native game species was a count of large game, upland game, and waterfowl managed for hunting by the CDFW Wildlife Branch's Game Management Program, and is based on the same distribution data as the full native species richness dataset.

Data Processing Steps and Ranking Criteria

Data normalization by taxonomic group corrected for any bias caused by differences in the number of taxa per taxonomic group. Due to large differences in total numbers of species between taxonomic groups (e.g., 59 total native amphibians, 4960 total native plants), the sum of total species richness based on raw counts of species resulted in richness maps highly skewed toward the taxonomic group(s) with the largest numbers of species. In order to give each taxonomic group equal weight in the final model output, the species counts were normalized (scaled from zero to one): The count in each hexagon for a given taxonomic group was divided by the maximum value for that taxonomic group. To identify and highlight areas of greatest richness within each ecoregion, the count for each taxonomic group was divided by the maximum value for that taxonomic group within each ecoregion (ecoregional normalization). Note that native plant richness was not normalized ecoregionally (see Plant Distribution Data above). The ecoregionally normalized values identify the areas of greatest species richness within each ecoregion, and were summed to create the Native Species Richness Summary. Statewide normalized values (the count for each taxonomic group was divided by the maximum value

for that taxonomic group across the state) were also produced, and are available in the GIS attribute table for reference.

Data processing steps:

1. **Native species richness counts**: The number of species per hexagon was counted by taxonomic group: **amphibians, birds, mammals, plants, and reptiles**.
2. **Normalized richness:** The counts by taxonomic group per hexagon were normalized (scaled from zero to one) statewide [statewide richness] and ecoregionally [ecoregional richness].
3. **Native species richness summary**: The ecoregional richness values were summed across taxonomic groups to produce the Native Species Richness Summary**.** Statewide richness values are provided in the attribute table for reference, and a summarized version of these datasets is available separately in BIOS (ds1332).
4. **Final ranking**: To display the relative richness values, the native species richness summary was ranked from 1-5 using 5 quantiles by ecoregion. The 20% of hexagons with the highest scores in each ecoregion were given a 5 (highest score), the 20% of hexagons with the lowest scores in each ecoregion were given a 1, etc. Note that due to differences in size between ecoregions, and differences in the number of species potentially occurring in each ecoregion, the number of hexagons ranked in each category (1-5) differs across ecoregions, and the number of species present in the hexagons with those scores also varies across ecoregions.

HOW TO USE THE DATA LAYER

The native species richness maps can be used to view and explore how species diversity, including common and rare species, is distributed across the state and within each ecoregion. The user can choose the view that best meets their needs: whether that be patterns of overall diversity shown by the species richness summary, diversity by individual taxonomic group, statewide biodiversity, or diversity by ecoregion. By selecting a hexagon in the viewer, the user can see the number of terrestrial vertebrate species with potential habitat in the hexagon, the relative rank of the hexagon compared to the rest of the ecoregion, and view a list of species potentially present.

Frequent uses of this group of datasets include:

- Identify the number of species potentially present within a hexagon based on species distribution information (using the Identify Features tool or GIS attribute table)
- Obtain a list of those potential species (using 'Identify Features' on Species List dataset in ACE viewer)
- Overlay Predicted Habitat Distribution model BIOS layers for individual species based on the species list, to obtain a finer-grain view of species distributions in the landscape
- View relative richness across the state for a given taxonomic group (viewing Native Richness by taxonomic group)

- Identify the highest richness areas in an ecoregion for a given taxonomic group (using the Identify Features tool or GIS attribute table to obtain ecoregionally normalized values and ranks for each taxonomic group)
- View relative overall native richness within each ecoregion (viewing Native Richness Summary)
- Identify the highest overall native richness areas within each ecoregion (Rank 5 hexagons in Native Richness Summary)

Field Definitions

Using the *Identify Features* or *Select* tool in the ACE viewer, users can obtain a table of information (i.e., attribute table) for a hexagon or area of interest. The ACE viewer allows the user to print the table or save as a spreadsheet (.csv file). The definitions below describe the attribute table fields for this dataset.

Field	Definition
Native Count	Count of native species (not including plants) with potential habitat in each hexagon.
Game Species Count	Count of game species with potential habitat in each hexagon.
Climate Vulnerable Species Count	Count of climate vulnerable species (not including plants) with potential habitat in each hexagon.
Native Amphibian Count	Count of native amphibian potential habitat models that intersect the hexagon.
Native Reptile Count	Count of native reptile potential habitat models that intersect the hexagon.
Native Bird Count	Count of native bird potential habitat models that intersect the hexagon.
Native Mammal Count	Count of native mammal potential habitat models that intersect the hexagon.
Native Plant Count	Count of native plant ranges that intersect the hexagon.
Statewide Native Species Weight	Aggregated statewide normalized values for all native taxa for each hexagon, re-normalized statewide.
Ecoregion Native Species Weight	Total of aggregated ecoregionally normalized values for all native taxa for each hexagon, re-normalized ecoregionally.
Statewide Native Species Rank	Ranks of 1-5 assigned to the statewide normalized native species richness values, with all zero values removed and remaining values broken into 5 quantiles, each containing the same number of hexagons.
Ecoregion Native Species Rank	Ranks of 1-5 assigned to the ecoregionally normalized native species richness values, with all zero values removed and remaining values broken into 5 quantiles, each containing the same number of hexagons.

DATA PRECISION AND LIMITATIONS

ACE provides data to help guide and inform conservation priorities in California. All ACE data layers are limited by the accuracy, scale, extent of coverage, and completeness of the input data at the time they were run. We highly recommend reviewing available metadata and ACE Factsheets prior to interpreting these data. The ACE maps do not replace the need for site-specific evaluation of biological resources and should not be used for regulatory purposes.

This dataset is meant to represent broadscale patterns of species richness and diversity in the landscape, and is limited by the accuracy and scale of the input data. Because the range and distribution data used are coarse-scale and have been designed to prioritize commission error (predicting presence when the species is absent) over omission error (predicting absence when the species is present), we expect the result will tend to *overestimate* species richness. The native richness values are best interpreted as a general representation of the distribution of diversity throughout the state, but the values for any individual hexagon should be interpreted with caution. The list of potential species in each hexagon includes those species that, based on our best-available information, could potentially occur within the hexagon, but it is unlikely that all of those species would be found in the hexagon at a given point in time.

The CWHR predicted habitat models were based on expert-opinion species-habitat relationship tables, which may vary in accuracy based on the how well-studied a species is. The species-habitat relationship tables were made spatial by applying the information to the "best available" vegetation map. This data was represented in raster format with a pixel size of 30 meters. In the case of species that rely on habitat types that are difficult to map at this scale, such as riparian or wetland habitat types, the amount of representative habitat may be underestimated or inaccurately mapped due to aggregation into pixels with a majority type not used by the species. In addition, the vegetation datasets used to develop FVEG2015 vary in age and accuracy. (See the Terrestrial Significant Habitats fact sheet for a full discussion of data limitations for vegetation and landcover maps.) The predicted habitat models were based on landcover only, and did not consider other variables such as patch size and distance to water that may influence where a species occurs in the landscape.

The native plant richness values were based on Jepson ecoregion designations, and therefore represent the total count of plants potentially occurring in the ecoregion in which the hexagon is located. The plant richness data is best viewed at a statewide scale to represent statewide patterns of plant diversity. The native plant count should not be interpreted as the number of plants present within any given hexagon.

DATA ACCESS

All datasets are available for viewing and download in BIOS.

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Factsheet: Melanie Gogol-Prokurat

SELECTED PUBLICATIONS

Baldwin, B.G., D.H. Goldman, D.J. Keil, R. Patterson, T.J. Rosatti, and D.H. Wilken, Editors. 2012. *The Jepson Manual: vascular plants of California, second edition.* University of California Press, Berkeley, CA.

California Department of Fish and Game (CDFG). 2010. Areas of Conservation Emphasis (ACE-II) Project Report. Sacramento, California.

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

California Department of Forestry and Fire Protection (CALFIRE). 2015. FRAP Vegetation (FVEG15_1). http://frap.fire.ca.gov/data/frapgisdata-sw-fveg_download

California Department of Fish and Wildlife (CDFW). 2014. California Habitat Relationships Program (CWHR) version 9.0., personal computer program. California Department of Fish and Wildlife and California Interagency Wildlife Task Group, Sacramento, CA. https://www.wildlife.ca.gov/Data/CWHR/Wildlife-Habitats

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

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

For additional information and a full list of ACE 3 Factsheets, see the ACE3 Technical Report.
Areas of Conservation Emphasis, CA Dept of Fish and Wildlife, www.wildlife.ca.gov/Data/Analysis/Ace