

APPENDIX B

METHODOLOGY AND WORKFLOW

Development of Focal Species Lists

This work was based on generating maps of species from several types of species lists, with an emphasis on sensitive/special-status taxa. Current (2025) species distribution within the county, and within each SEA, was derived from available occurrence data from online databases and community-science platforms (e.g., iNaturalist) as well as from published and unpublished reports and papers. Updates to the earlier SEA species lists were necessary to address several data quality issues in the 2006 compilation. These included duplicate entries, species that were listed in error, and records that did not reflect subsequent correction or updates made to source databases such as the California Natural Diversity Database (CNDDDB). The updated list reflects current taxonomic understanding, corrected occurrence records, and the most recent available database information.

Species selected for mapping were those for which sufficient, accurate occurrence records were available and accessible for spatial analysis. Species motility was also considered, and highly mobile or migratory species were generally not mapped unless they were known to breed or overwinter within the County. The various databases and sources of information used in this analysis are summarized below.

California Natural Diversity Database (CNDDDB)

Although CNDDDB has been the main source of distributional information for sensitive species in California for many years, this database has several drawbacks. Many of the records therein appear elsewhere, such as museum/herbarium (for plants) specimen databases (which were not digitized when the CNDDDB was developed); lack of photos confirming sight records; and vague location or date information (including very old records from areas that have since been developed). Because submission to CNDDDB was historically limited to professional, permitted biologists working on projects that required permits or oversight by agencies, increasingly, the number of records of species in CNDDDB has been vastly outpaced by records in other online sources, such as iNaturalist and eBird, that pose fewer barriers for inclusion.

Appendix B | Methodology and Workflow

Four aquatic and twenty-four terrestrial natural communities recorded in the CNDDDB were characterized as occurring in Los Angeles County (see Appendix A, Table A6a). These communities represent only a subset of the many vegetation alliances and associations considered sensitive by the California Department of Fish and Wildlife (CDFW) and known to occur within the County. As such, this set necessarily reflects only those natural communities that have been submitted to and documented within the CNDDDB.

The terminology used to identify these natural communities follows Holland (1986), which is no longer the primary classification system actively used by CDFW. However, because these classifications remain embedded within the CNDDDB, they are retained and referenced in this analysis.

iNaturalist

Sightings uploaded to iNaturalist were used if they were of “Research Grade” and had reliable/accurate location data. Many protected species have their locations obscured by iNaturalist or by its users, so these observations were not used to generate location data (other than knowing an organism was detected somewhere within a 10-km-square box). However, many species considered to have special-status in Los Angeles County do not have obscured coordinates and were used.

eBird

The eBird database (www.ebird.org), while powerful, is only applicable to birds. The full dataset was downloaded in summer 2025. Because many bird species are highly-mobile, occurrence data must be vetted by people knowledgeable about migration patterns and out-of-range occurrences. For example, Swainson’s Hawks are widespread over Los Angeles County at various times of year, and a point record may not distinguish between a bird sitting at a nest and one migrating high overhead—yet these have very different connotations when analyzing point/occurrence data. The use of “safe dates” in certain cases pulled records that are relevant to the study, such as only taking breeding-season records for Marsh Wren to identify which are the localized subspecies “Clark’s Marsh Wren” (a California Bird Species of Special Concern) and which are the more widespread migratory races, which are visually indistinguishable but not so protected.

Global Biodiversity Information Facility (GBIF)

The online Global Biodiversity Information Facility platform (GBIF) was used to download records from multiple sources simultaneously, including museum specimens and Research Grade iNaturalist records, for Los Angeles County. As a note, GBIF does not contain records from CNDDDB, though considerable overlap may exist for certain species between these two databases.

Using this combination of sources, map layers of many of the special status species found in the county were then developed. Some could not be effectively mapped using any technology or data source; for example, red-diamond rattlesnake (*Crotalus ruber*) is known from the extreme southeastern corner of the County (vic. Diamond Bar-San Dimas), but is represented by just a single known (digitized) museum specimen (from north Diamond Bar), and by a handful of records in iNaturalist that have obscured coordinates. It is also mapped in CNDDDB (also in north Diamond Bar), but it was not possible to determine the source of the mapping data.

Other species, such as California Condor, have dozens of georeferenced records in eBird, and these were extracted to provide a current map of condor records that far exceeds information available in CNDDDB and museum specimens, since the species was rarely collected in the wild, and is rarely detected during the pre-development surveys and monitoring reports that provides much of the “unique” data in CNDDDB. A few special-status species were determined to be too common to map, in that they are increasing locally (e.g., Vermilion Flycatcher) and make heavy use of urban/modified habitats not appropriate for SEA consideration.

ArcGIS Pro's integrated connection to GBIF was used to retrieve specimen occurrence data. This tool, launched in September 2025, allows users to query the GBIF application programming interface (API) using a scientific name, spatial extent, and temporal range, and returns occurrence records as a point feature class containing taxonomic attributes such as scientific name, genus, species, latitude, and longitude. Additional attributes include data source, occurrence type, observation date, and fields describing data provenance and locational accuracy.

Initial queries were limited to records from the year 2000 onward; however, where no records were available within this timeframe, the temporal range was expanded to include

Appendix B | Methodology and Workflow

records dating back to 1900 in order to evaluate historical species distributions and occurrences. These expanded datasets were subsequently filtered to retain records from 2000 onward for analytical use.

Locational accuracy was reduced for records classified under Creative Commons licenses, which largely reflect community-science observations (e.g., iNaturalist), with coordinates spatially generalized within an approximately 10-kilometer radius of the observation. Only a small number of preserved specimen records returned unaltered coordinates, most of which dated to the early twentieth century.

GIS Workflow

Following the species-by-species evaluation described above, occurrence data from multiple sources—including CNDDDB, iNaturalist, eBird, museum specimen databases, and expert-delineated polygons—were translated into a consistent set of spatial layers suitable for application under SEA Criteria A – C. These datasets vary widely in spatial precision, temporal relevance, data structure (points versus polygons), and ecological meaning. In addition, special-status species differ substantially in detectability, mobility, and the extent to which individual observations meaningfully represent areas of use or ecological function. As a result, no single spatial representation was appropriate for all taxa.

To address these differences, a tiered GIS translation framework was applied to ensure that each species or species group was mapped using the best available evidence from spatial datasets, given the quality of the underlying data and the analytical purpose of the SEA criteria. Rather than forcing all data into a uniform format, this framework explicitly recognizes that different spatial representations are appropriate for different ecological questions. The goal was to balance biological realism, analytical consistency, and transparency, while avoiding false precision or misleading representations of species distributions.

Under this framework, three general mapping approaches were used: hand-digitized polygons, verified point-based localities, and generalized richness-based hexagon layers. The selection of mapping approach was guided by the spatial reliability of available data, the ecological characteristics of the species, and the scale at which the SEA criteria are intended to operate.

1. Hand-digitized polygons

This approach was applied to species with extremely localized or well-defined areas of use, or where occurrence data were too sparse, obscured, or unreliable to support point-based mapping. In these cases, expert knowledge and contextual information were better suited to delineating biologically meaningful boundaries than individual point records. Polygons were manually digitized using recent aerial imagery, habitat descriptions from recovery plans and species accounts, known nesting or foraging locations, CNDDDB contextual text, and expert consultation. These polygons represent generalized biological “areas of use” rather than formal habitat suitability models. Examples include El Segundo blue butterfly habitat, southern steelhead stream reaches, Belding’s savannah sparrow marsh habitats, and mountain plover foraging areas.

2. Verified point-based localities

Point-based mapping was used for species where individual occurrences were ecologically meaningful and supported by reliable spatial data. This approach was applied when multiple high-quality observations were available and locations were photo-verified, not obscured, and spatially precise. Data sources included Research Grade iNaturalist observations, museum specimen records accessed through GBIF, recent CNDDDB occurrences with documented spatial accuracy, and eBird records filtered using species-appropriate temporal criteria (e.g., breeding-season or “safe date” windows). These data were cleaned, reprojected, and retained as discrete point features in ArcGIS Pro.

3. Generalized richness-based hexagon layers

For species or species groups with numerous observations but variable spatial precision, generalized richness-based hexagon layers were used to characterize landscape-scale patterns of co-occurrence rather than individual locations. This approach was applied where the analytical objective was to identify areas supporting multiple special-status species, even when some records were obscured or imprecise. Hexagon-based layers smooth spatial inconsistencies, reduce the influence of uneven sampling density, and highlight biologically meaningful patterns

Appendix B | Methodology and Workflow

that persist across datasets. These layers were particularly useful for evaluating species assemblages and ecological context under SEA Criteria B and C.

Generalized richness layers were constructed using a countywide 1-kilometer hexagonal grid to provide a uniform analytical surface across Los Angeles County. Occurrence points were spatially joined to the grid, and unique species richness was calculated for each hexagon, ensuring that repeated observations of the same species did not inflate richness values. Where relevant, species lists were also retained at the hexagon level to document which taxa contributed to identified hotspots. Resulting layers were symbolized using graduated color schemes to visualize spatial gradients in special-status species concentration.

Together, these three mapping approaches form a flexible but internally consistent spatial translation framework that allows disparate biological datasets to be evaluated coherently within the SEA Program. By matching spatial representation to data quality and ecological relevance, the framework supports evidence-based analysis under Criteria A – C while maintaining transparency about the limitations and appropriate interpretation of each layer.

CALVEG-Derived Habitat Groupings

Raster layers representing broad habitat groupings aligned with SEA Selection Criteria A, B, and C were derived from the CALVEG vegetation dataset. The CALVEG data were clipped to the study area and used to aggregate specific Wildlife Habitat Relationships (WHR) vegetation types into two composite raster layers corresponding to SEA criteria groupings applied in the broader ecological characterization.

- Habitats associated with Criterion A, representing areas supporting core populations of endangered or threatened species, included Alkali Desert Scrub, Desert Wash, Estuarine, Joshua Tree, Montane Riparian, Riverine, Saline Emergent Wetland, and Wet Meadow vegetation types.
- Habitats associated with Criteria B and C, representing native communities that are uncommon or regionally restricted, or uncommon within Los Angeles County boundaries, included Blue Oak Woodland, Blue Oak-Foothill Pine, Chamise-Redshank Chaparral, Closed-Cone Pine-Cypress, Desert Riparian, Fresh Emergent

Appendix B | Methodology and Workflow

Wetland, Jeffrey Pine, Montane Hardwood-Conifer, Perennial Grassland, Pinyon-Juniper, Ponderosa Pine, Sierran Mixed Conifer, Subalpine Conifer, Valley Foothill Riparian, Valley Oak Woodland, and White Fir.

For each habitat grouping, a binary raster was produced with cells coded as present where the associated habitat types occurred and absent elsewhere.

Identification of Sensitive Local Native Resources

Sensitive Local Native Resources represent native species that appear to be rare, uncommon, declining, or otherwise vulnerable within Los Angeles County, but that are not formally listed under state or federal endangered species statutes or conservation rankings. These species may be locally significant due to restricted distribution within the County, declining populations, association with declining habitat types, or occurrence near the edge of their geographic range.

Identification of these locally uncommon species helps capture biological values that may not be reflected in statewide conservation rankings or regulatory listings. Locally rare populations may also contribute disproportionately to genetic diversity and long-term species resilience, particularly where they occur in isolated landscapes or at range margins.

The analysis presented here identifies species that appear to be locally uncommon or infrequently recorded within Los Angeles County based on available biological datasets and literature sources. The resulting preliminary list provides a screening-level identification of species that may warrant consideration in SEA planning and resource evaluation.

The finalized species list is provided in Appendix A, Table 8.

Screening Criteria

Species were evaluated using the following guiding principles:

- Focus on native species that are rare, uncommon, declining, or infrequently recorded within Los Angeles County
- Exclude species already listed or proposed for listing under state or federal endangered species statutes
- Exclude migratory, vagrant, or transient species for which local rarity is not ecologically meaningful

Appendix B | Methodology and Workflow

- Apply transparent and repeatable screening criteria for taxonomic groups with sufficient data coverage

Data Sources and Taxonomic Screening

Multiple biological data sources were used to evaluate species rarity and occurrence patterns within Los Angeles County.

- Birds: Bird species considered locally uncommon were identified using the Los Angeles County Sensitive Bird Species list (Los Angeles County Sensitive Bird Species Working Group 2009) and cross-referenced with current occurrence data.
- Plants: Native plant taxa rarely collected or infrequently observed within Los Angeles County were evaluated using historical specimen records, community science datasets, and existing rare plant compilations. Species lacking formal state or federal protection but represented by few verified observations were considered candidates for the Sensitive Local Native Resources list.
- Butterflies: Butterfly occurrence data were derived from Research Grade community-science observations. Species represented by fewer than 0.1 percent of total countywide observations were classified as locally uncommon.
- Amphibians, Reptiles, and Mammals: For vertebrate groups with sufficient data coverage, similar community-science datasets were evaluated. Species represented by fewer than 0.1 percent of total countywide observations were considered locally uncommon.

Interpretation

These screening thresholds were intended to identify species that are genuinely rare or infrequently observed within Los Angeles County while minimizing the inclusion of species that appear rare only because of incomplete sampling or limited observer effort.

The resulting list represents a preliminary assessment based on currently available datasets and is expected to evolve as additional observations, survey data, and taxonomic updates become available.

Rare Plant Mapping

Records of uncommon native ("rare") plant species were compiled from multiple sources, including a dataset assembled in 2018 by Los Angeles County Senior Biologist Joe Decruyenaere. This dataset includes native plant specimen records collected within Los

Appendix B | Methodology and Workflow

Angeles County between approximately 1968 and 2018 and is limited to species represented by five or fewer documented collections. The list excludes state- and federally listed Threatened or Endangered species, as well as species ranked as California Rare Plant Rank 1 or 2 by the California Native Plant Society. Accordingly, the species included are not rare in a regulatory sense but are relatively uncommon within Los Angeles County.

Although not legally protected, these species can serve as indicators of localized or unique microhabitats that may not be captured by analyses focused solely on state- or federally rare taxa. The dataset was reviewed to remove non-native species; however, a small number of likely planted native species remain (e.g., *Justicia californica*), which are native to other regions of California but not naturally occurring in Los Angeles County.

A list of “iNaturalist rare” plant taxa was compiled in 2025 for this analysis. This list includes native, naturally occurring taxa recorded five or fewer times on iNaturalist within Los Angeles County since 2022 (i.e., from 2023 through mid-2025), indicating empirical rarity based on observer data. The list includes both special-status and non-special-status taxa; inclusion was based solely on infrequent observation frequency rather than regulatory designation. In this way, the dataset functions as an update to the earlier mentioned uncommon plant list compiled by Decruyenaere.

Because iNaturalist automatically obscures the locations of many sensitive species, observations with obscured or imprecise coordinates were excluded to ensure spatial accuracy. The resulting dataset represents both a list of taxa and a spatial database of occurrences (n = 412 taxa).

The rare plant datasets were combined and processed in RStudio using the *tidyverse* package to filter records, remove obscured or non-wild observations (e.g., planted specimens such as *Romneya* spp.), and merge sources into a single dataset. The finalized dataset was then mapped in ArcGIS to support spatial analysis.

GIS Processing in ArcGIS Pro

After quality checks were completed, all rare plant records with usable coordinates were imported into GIS and mapped as point features. The final dataset contained 13,552 spatially valid records, each representing an observation of a sensitive plant species. All

points and related layers were projected into NAD 1983 (2011) California (Teale) Albers (EPSG 3310) to ensure consistent spatial measurement across analyses.

Rare Plant Richness and Hotspot Analysis

Rare plant occurrence data were synthesized to characterize spatial patterns of rare and uncommon native plant diversity across Los Angeles County at a consistent spatial scale. Occurrence points from the finalized rare plant dataset were intersected with a countywide hexagonal grid to summarize species richness while minimizing bias from uneven sampling density and duplicate records. A 1-kilometer hexagonal grid was generated to cover the county and offshore islands, with each hexagon representing approximately 0.68 square kilometers. All rare plant observations were assigned to a single hexagon based on spatial intersection.

Species richness was calculated as the number of unique rare or uncommon plant taxa present within each hexagon, rather than the total number of records. This approach ensures that hexagons with repeated observations of the same species do not appear artificially species-rich. Hexagons without plant records were assigned a richness value of zero. In addition to a numeric richness value, each hexagon retained a text attribute listing the unique species present, allowing both quantitative analysis and qualitative review of species composition.

To support hotspot analysis and web-based visualization, a companion centroid dataset was derived from the hexagonal grid. Each centroid inherited the species richness value and species list from its corresponding hexagon. This point-based representation provided a computationally efficient input for spatial density analysis while preserving the underlying richness calculations. The centroid layer also serves as a lightweight alternative to the full grid for interactive mapping applications, including ArcGIS Online heatmaps and clustering tools.

Landscape-scale patterns of rare plant diversity were evaluated using kernel density analysis applied to the centroid dataset. Species richness values associated with each centroid were used as the population field to generate a smoothed density surface, highlighting areas where high-richness hexagons cluster spatially. Kernel density parameters included a 200-meter output cell size and a 1.5-kilometer search radius, selected to

balance local detail with broader landscape context. The resulting raster surface was clipped to the county boundary and classified into relative density categories (Very Low through Very High) based on the distribution of values.

Together, these analyses provide a multi-scale depiction of rare plant diversity across Los Angeles County. The hexagonal grid captures fine-resolution patterns of species richness, the centroid dataset supports efficient visualization and spatial modeling, and the kernel density surface identifies broader areas of concentrated rare plant diversity. These complementary products support site-scale assessment, regional pattern recognition, and countywide conservation planning within the SEA framework.

Rare Butterfly Occurrence Mapping

Butterfly occurrence data were synthesized to evaluate spatial patterns of butterfly diversity and rarity across Los Angeles County while explicitly accounting for uneven sampling effort inherent in community-science data. The analysis was based on an iNaturalist dataset ("All_iNat_butterflies"), consisting of all butterfly observations (superfamily Papilionoidea) recorded in Los Angeles County through mid-2025. To reduce strong spatial sampling bias associated with concentrated survey activity around the Natural History Museum and Exposition Park Butterfly Pavilion, observations from that complex were excluded prior to analysis. This was accomplished by mapping the relevant parcels, applying a 100-meter buffer, and removing all butterfly records falling within the buffered area. This filtering step removed 1,339 records, resulting in a dataset of 51,365 observations for countywide analysis. The filtered dataset was projected to NAD 1983 UTM Zone 11N for spatial processing.

Butterfly observations were summarized within a consistent spatial framework using a countywide 1-kilometer hexagonal grid. All observations were spatially intersected with the grid so that each record was assigned to a single hexagon. Species richness was calculated as the number of unique butterfly species per hexagon, rather than the total number of observations, to avoid inflating richness values in heavily sampled areas dominated by repeated records of the same species. This produced a baseline richness surface illustrating where overall butterfly diversity is concentrated across the County.

Because iNaturalist observations are strongly influenced by observer behavior, sampling effort was explicitly quantified to support interpretation of richness and rarity patterns. For

Appendix B | Methodology and Workflow

each hexagon, observer effort was calculated as the number of unique observer-day combinations, representing how many distinct observers reported butterflies on distinct dates within that cell. This metric reduces bias associated with single observers submitting large numbers of records on a single day. Observer-day counts were log-transformed to create a log-effort variable. Exploratory analysis confirmed a positive relationship between log-effort and species richness, indicating that much of the apparent variation in richness reflects differences in sampling intensity rather than underlying biological patterns. Effort metrics were therefore retained for subsequent rarity analyses.

To focus on butterflies of greatest conservation interest, species were classified based on their overall frequency of observation within Los Angeles County. Species with ten or fewer total records were classified as rare, while species with eleven to fifty records were classified as uncommon. Observation frequencies were calculated from the full dataset, and separate point subsets were created for rare and uncommon species. These subsets were intersected with the 1-kilometer hexagonal grid to calculate the number of unique rare species and unique uncommon species present in each hexagon. These counts were joined back to the main hex grid, which also retained total richness and observer-effort attributes.

To distinguish areas of biological significance from areas that simply reflect high sampling intensity, an Effort-Adjusted Rarity Priority Index was developed. This index integrates three components: the number of rare species in a hexagon (weighted double), the number of uncommon species not already classified as rare (weighted single), and observer effort expressed as the log-transformed observer-day metric. The combined rarity score is divided by log-effort, increasing index values in areas where multiple rare species have been documented despite limited survey activity and reducing values in areas that appear species-rich primarily because they are heavily sampled. As a result, hexagons score highly when they support disproportionately high rarity relative to effort, rather than simply high observation density.

The final butterfly products included in the SEA Study consist of two complementary representations of the Effort-Adjusted Rarity Priority Index. One is a polygon layer based on the 1-kilometer hexagonal grid, symbolized to show countywide gradients and landscape-scale patterns of butterfly rarity. The second is a centroid-based point layer carrying the

same index values, optimized for visualization at broader extents and for highlighting concentrated rarity hotspots when viewed at smaller scales. Both layers are derived from the same underlying index and differ only in their spatial representation, together supporting interpretation of butterfly rarity patterns in relation to connectivity, landscape context, and conservation planning objectives.

Land Cover Stability

Land-cover change was analyzed to evaluate how patterns of development and landscape persistence have changed across Los Angeles County and within existing SEAs over the past two decades. Two complementary analyses were conducted: (1) an assessment of long-term land-cover stability to identify areas where natural or semi-natural habitats have remained persistent through time, and (2) an analysis of land-cover conversion to quantify where undeveloped land has transitioned to developed uses.

Together, these analyses provide context for understanding the degree to which SEAs have retained ecological landscape conditions relative to the broader county and help identify areas experiencing the greatest amount of change.

To evaluate change and stability in land cover across the county and within SEAs, patterns of land cover classification were assessed annually from 2000 to 2024 using the National Land Cover Database (NLCD) annual land-cover datasets. Class counts were converted to proportional area within each SEA. SEA polygon areas were calculated in square meters and used to generate area-weighted mean habitat proportions across all SEAs for each year.

In parallel, countywide land-cover composition was calculated annually by summarizing pixel frequencies across the land-clipped county extent.

Temporal trends in land-cover composition were evaluated using ordinary least squares regressions of proportional area versus year. Trends were assessed at multiple spatial scales, including countywide, mean SEA values (area-weighted), individual SEA summaries, and SEA-type (e.g., coastal, inland, incorporated) summaries. Slope estimates, standard errors, and 95% confidence intervals were extracted for each habitat class. Trends were considered statistically significant when confidence intervals did not overlap zero.

Note: The NLCD dataset consistently mis-classifies solar fields as agricultural or grassland. Both calculations of land cover conversions and stability therefore underestimate the amount of change due to solar field installations.

Undeveloped to Developed Land-Cover Conversion

To characterize net land-cover conversion from undeveloped to developed over the study period, a two-timepoint transition raster was constructed using the 2000 and 2024 NLCD annual land cover data layers. Pixels were classified into a small set of interpretable transition categories representing major pathways of development, including forest-to-urban, shrub/grassland-to-urban, wetland-to-urban, agriculture-to-urban conversion, and urban intensification (e.g., developed open space to higher-intensity development). Transition rasters were masked to the land-clipped county extent, assigned categorical legends, and summarized by total area.

Data Layer description:

LA County (2000 – 2024): Undeveloped-to-Developed Land-Cover Conversion.

Categorical raster summarizing land-cover transitions to developed classes between 2000 and 2024 based on the National Land Cover Database (NLCD). Category values are defined as follows:

- 1 = forest to any development (NLCD 41, 42, 43);
 - 2 = shrub/grass to any development (NLCD 52, 71);
 - 3 = wetland to any development (NLCD 90, 95);
 - 4 = agriculture to any development (NLCD 81, 82);
 - 5 = developed open space to low, medium, or high-intensity development (NLCD 21);
 - 6 = low-intensity to medium or high-intensity development (NLCD 22);
 - 7 = medium-intensity to high-intensity development (NLCD 23).
- (land_cover_conversion_2000_2024.tif)*

Multi-Year Land-Cover Stability

Multi-year land-cover stability was quantified using an aligned annual NLCD raster stack spanning 2000 – 2024. Pixel-level stability was calculated as the proportion of consecutive year pairs with no change in land-cover class, providing a measure of temporal consistency in classification through time. Because urbanization represents a largely absorbing land-

Appendix B | Methodology and Workflow

cover state, pixels classified as developed in any year of the time series were excluded from the analysis.

The resulting stability metric ranges from 0 to 1, where 1 indicates that land cover remained unchanged across all available years, 0 indicates that land cover changed between every consecutive year, and intermediate values represent partial stability (e.g., 0.80 indicates no class change across 80% of year-to-year transitions).

This stability surface identifies locations where natural or semi-natural land cover has persisted over multiple decades and highlights areas subject to repeated transitions among vegetation, such as shrubland and grassland classes. By capturing long-term consistency in land-cover classification, the metric provides a spatially explicit indicator of landscape persistence versus ecological dynamism across Los Angeles County.

Data Layer description:

LA County (2000 – 2024): Undeveloped Land-Cover Stability (0 – 1).

Continuous raster measuring the temporal stability of undeveloped land cover based on annual NLCD data. Values range from 0 to 1, where 1 indicates no change across all years and 0 indicates change in every consecutive year. Pixels classified as developed in any year were excluded.

(undeveloped_land_cover_stability_2000_2024.tif)

Wildlife Movement/Connectivity Methodology

Landscape connectivity across Los Angeles County was modeled using Omniscape, an omnidirectional, circuit-theoretic connectivity model designed to estimate spatial patterns of potential wildlife movement across heterogeneous landscapes. Landscape connectivity across Los Angeles County was modeled using Omniscape, an omnidirectional, circuit-theoretic connectivity model designed to estimate spatial patterns of potential wildlife movement across heterogeneous landscapes (Landau 2021; McRae et al. 2016).

Connectivity models were parameterized using percent impervious surface from the 2024 National Land Cover Database (NLCD). The imperviousness raster was cropped and masked to the Los Angeles County mainland and a 5-km buffer, constrained to values between 0 and 100, and modified to better reflect contemporary land-cover conditions. Specifically, mapped solar energy facilities identified using OpenStreetMap (OSM) were

Appendix B | Methodology and Workflow

assigned a minimum impervious-equivalent value of 50%. This adjustment accounts for the fact that many solar installations are not fully captured by NLCD impervious surface classifications, likely because panel arrays and associated infrastructure can be difficult to detect in satellite-derived land cover products due to their reflectance properties and panel rotation. As a result, imperviousness was increased within mapped solar facilities to better represent their influence on landscape permeability. Hydro features derived from 3D Hydrography Program (3DHP) flowlines and waterbodies (U.S. Geological Survey 2023) were used to locally reduce imperviousness values by 50%. This adjustment reflects the fact that many streams and rivers across the county occur within engineered or concrete-bottom channels that still provide limited opportunities for wildlife movement. The raster was also restricted to the largest connected terrestrial landmass to exclude offshore or disconnected fragments. Edge cells were smoothed to reduce spurious habitat values along the coastline and raster boundary. The resulting surface represents a generalized terrestrial wildlife community that is sensitive to urban development rather than species-specific movement behavior.

Percent imperviousness (0 – 100%) was transformed into two spatial inputs required by Omniscape: source strength and landscape resistance. Source strength represents the relative contribution of each pixel as a potential origin of movement and was scaled between 0 and 1. Resistance represents the relative cost of movement through each pixel and was derived using a logistic transformation of imperviousness, bounded between 1 and 100, with an inflection point at 50% impervious cover to reflect nonlinear increases in movement cost with urbanization.

These inputs were supplied to Omniscape, which simulates movement using overlapping moving windows across the landscape to estimate cumulative current flow. The resulting cumulative current surfaces represent the relative intensity of modeled movement through each pixel, integrating contributions from all source locations.

Omniscape was run using a moving-window radius of 100 pixels (3 km) and a block size of 11. Raw cumulative current and source-normalized cumulative current outputs were generated. Preliminary analyses were conducted to evaluate sensitivity to alternative source and resistance formulations; results presented here are based on the final parameterization described above.

Appendix B | Methodology and Workflow

Connectivity outputs were post-processed to facilitate standardization and visualization of connectivity across the county. Cumulative current maps were clipped to the land-clipped county extent and projected to EPSG:4326. Both the raw and normalized cumulative

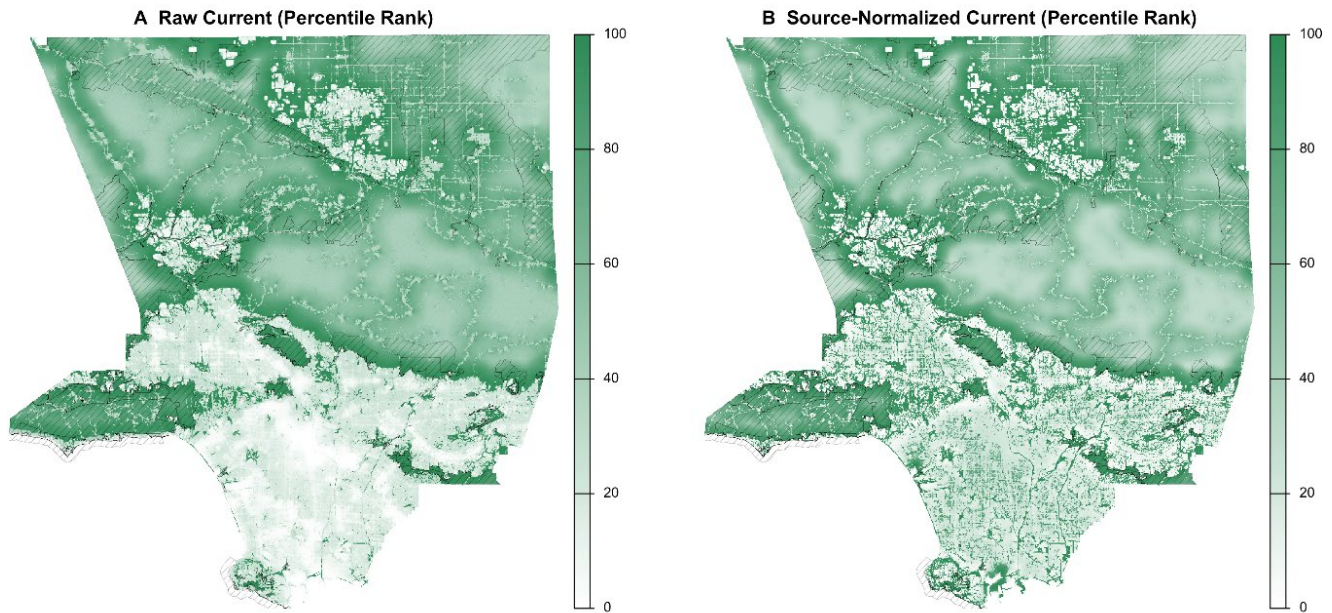


Figure B1. Percentile-ranked cumulative current surfaces for Los Angeles County. (A) Raw cumulative current and (B) source-normalized cumulative current, each converted to percentile rank (0–100) based on the countywide distribution of modeled current values. Percentile scaling standardizes the outputs by representing the relative position of each pixel within the distribution of connectivity values across the county. Diagonal hatching indicates the boundaries of Significant Ecological Areas (SEAs).

current maps were converted to percentile-scaled surfaces (0–100) based on pixel rank (Figure B1). This transformation represents the relative position of each pixel within the countywide distribution of current values and was used to generate standardized output rasters for analysis and mapping.

To illustrate movement potential, values above a threshold (75) were capped to reduce the influence of extreme values and emphasize the spatial pattern of connectivity. This transformation compresses the highest current values while leaving lower values unchanged, allowing the map to highlight where connectivity occurs across the landscape rather than simply reflecting the magnitude of movement. This distinction is important because different processes operate at different spatial scales across Los Angeles County:

Appendix B | Methodology and Workflow

some regions contain large expanses of natural habitat that generate high cumulative current due to the large number of possible movement pathways, while other regions contain very little habitat where even small amounts of movement may represent important connections.

Connectivity classes were derived from the percentile-scaled normalized cumulative current surface. Pixels with normalized current percentiles ≥ 95 were classified as Channeled, pixels with percentiles ≥ 75 and < 95 were classified as Intensified, and pixels below the 75th percentile were classified as background connectivity. A separate raster of habitat patch area was used to identify Core Habitat, defined as natural habitat patches ≥ 1 km². In the final connectivity class map, Core Habitat was overlaid on the normalized current classes, and all remaining non-core pixels below the 75th percentile were classified as Impeded.

The resulting datasets identify spatial patterns of modeled wildlife movement under contemporary (2024) land-use conditions, highlighting areas of concentrated flow, persistent movement pathways, and fine-scale bottlenecks. The connectivity surfaces presented here represent a snapshot of modeled movement potential for Los Angeles County under contemporary land-use conditions. Because circuit-theory connectivity is inherently relative to the surrounding landscape, modeled patterns of connectivity reflect the spatial configuration of habitat and barriers at the time the input datasets were generated. Changes to land use, infrastructure, or habitat condition will therefore alter modeled connectivity over time. In addition, the results depend on underlying spatial datasets—including land cover, hydrography, and mapped infrastructure—that contain inherent classification and mapping uncertainties. Despite these limitations, the modeling framework provides a robust representation of landscape-scale connectivity patterns because it integrates information across the entire landscape rather than relying on individual corridors or isolated features. As a result, the outputs are most appropriately interpreted as indicators of relative connectivity and areas where movement pathways are likely to concentrate, rather than precise predictions of species movement at specific locations.

Data Layer descriptions:

1. **LA County (2024): Raw cumulative current (percentile rank, 0 – 100).**

Values represent within-year percentile rank of raw cumulative current, where 0 = lowest and 100 = highest relative movement intensity. (*current_raw_pct_2024.tif*)

2. **LA County (2024): Normalized cumulative current (percentile rank, 0 – 100).**

Values represent within-year percentile rank of source-normalized cumulative current, where 0 = lowest and 100 = highest relative movement intensity.

(current_norm_pct_2024.tif)

3. **LA County (2024): Connectivity classes.**

Categorical raster with values defined as: 3 = Channeled (source-normalized cumulative current percentiles ≥ 95 , representing areas where movement is concentrated into narrow pathways due to surrounding barriers); 2 = Intensified (source-normalized cumulative current percentiles ≥ 75 and < 95 , representing areas where movement becomes increasingly concentrated due to partial barriers or rising landscape resistance); 1 = Core Habitat (contiguous natural habitat patches ≥ 1 km², where movement is unrestrained and therefore diffuse); 0 = Impeded (areas not classified as core habitat and with source-normalized cumulative current percentiles < 75 , where high resistance limits movement and current flow remains low).*(connectivity_classes_2024.tif)*

SEA Boundary Adjustments (including new SEAs)

Proposed SEA boundary changes were developed through an iterative process that integrated expert judgment, spatial analysis, field verification, and available data as of the project data freeze. The objective was to refine and expand the SEA network to support ecological integrity, maintain continuity with existing SEAs, minimize unintended gaps or overlaps, and enhance landscape connectivity. The resulting boundary recommendations are intended to provide a transparent, well-supported foundation for planning, while acknowledging that future data updates, field verification at the parcel scale, or changing landscape conditions may warrant refinement over time.

Preliminary recommendations for SEA boundary adjustments, including refinements, expansions, consolidations, realignments, and new SEAs, were initially developed through expert review using ArcGIS Pro, ArcGIS Online, and Google Earth. These draft polygons were informed by iterative evaluation of biological, ecological, and landscape datasets relevant to the SEA Program, as well as targeted field verification where feasible. Draft polygons were subsequently consolidated into a single geospatial dataset for further processing and refinement. During this stage, polygons were cleaned to remove overlaps, slivers, and topological inconsistencies, and were standardized for compatibility with other project

Appendix B | Methodology and Workflow

datasets. Fragmented or overlapping features were dissolved or merged to create coherent, analytically meaningful units appropriate for countywide comparison.

Throughout the process, priority was given to maintaining the existing boundaries of current SEAs where possible. No existing SEA boundaries were reduced, as all were determined to continue supporting the habitats and species for which they were designated. Proposed changes focused on expansions, refinements, and additions intended to improve ecological representation and connectivity.

Boundary adjustments were evaluated through a multi-layer review process comparing each proposed change against datasets associated with the SEA designation criteria. These datasets included documented occurrences of sensitive or special-status species; mapped vegetation communities and land cover; connectivity modeling outputs; protected lands and conservation designations; land use and development patterns; and physical landscape features such as ridgelines, drainage patterns, geologic boundaries, and major transportation corridors.

Placement of polygon edges was guided by a combination of ecological, topographical, and practical mapping considerations. Where feasible, boundaries were aligned with discernible changes in habitat type, vegetation cover, or natural community composition. In more developed or transitional landscapes, boundaries were drawn to reflect logical breaks in land use, such as roadways, urban edges, or areas of intensive development that function as barriers to ecological processes.

To distinguish between developed and undeveloped landscapes, a consistent standard for development intensity was applied across the County. Areas characterized as "wildland-urban intermix" were generally included where ecological resources remained intact, while areas characterized as "wildland-urban interface" were typically excluded unless they represented critical connectivity areas meeting Criterion G. This approach allowed for consistent treatment of partially developed landscapes while retaining ecologically important habitats.

In all cases, proposed boundaries were based primarily on the presence of ecological resources meeting SEA criteria, rather than relying solely on visually apparent landscape features. This ensured inclusion of important habitats even where transitions were subtle or not easily identifiable in remote imagery. In portions of the County where topographic

Appendix B | Methodology and Workflow

boundaries were indistinct, mapping decisions relied more heavily on sensitive species occurrences and associated habitat data.

Boundary refinements were further evaluated to ensure spatial coherence and appropriate planning-scale precision. Polygons were reviewed to avoid unnecessary complexity, excessive fragmentation, or artificial precision that could imply a level of certainty not supported by available data. The resulting boundaries represent reasonable landscape-scale delineations rather than fine-scale habitat edges best assessed during project-level review.

Near-final boundary adjustments were then reviewed through an “exceptionality” lens to confirm that proposed additions represented areas of ecological significance relative to the broader County landscape. Subareas that did not independently meet SEA criteria or lacked strong ecological justification were refined or removed. Where appropriate, boundary adjustments were coordinated with the SEA Connectivity Overlay to reflect functional relationships between core habitat areas and surrounding landscapes supporting movement and ecological processes.

The resulting SEA boundary adjustments reflect a synthesis of expert judgment, spatial analysis, and available data as of the project data freeze. The resulting boundaries are intended to represent reasonable landscape-scale delineations rather than fine-scale habitat edges that would be more appropriately assessed during field-level or project-level review. This approach is consistent with habitat boundaries delineated through other County planning efforts, such as the Santa Monica Mountains Coastal Zone and North Area Plan. To reflect this planning-scale intent and avoid implying a level of precision not supported by available data, SEA boundaries should be viewed and shared at no finer than approximately 1:20,000 scale.