Title
2021 Sustainable LA Grand Challenge Sustainability Report Card for Los Angeles County Ecosystem Health

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Sustainable LA Grand Challenge
Sustainability Report Card for Los Angeles County

UCLA Sustainable LA Grand Challenge

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Ecosystem Health • 2021

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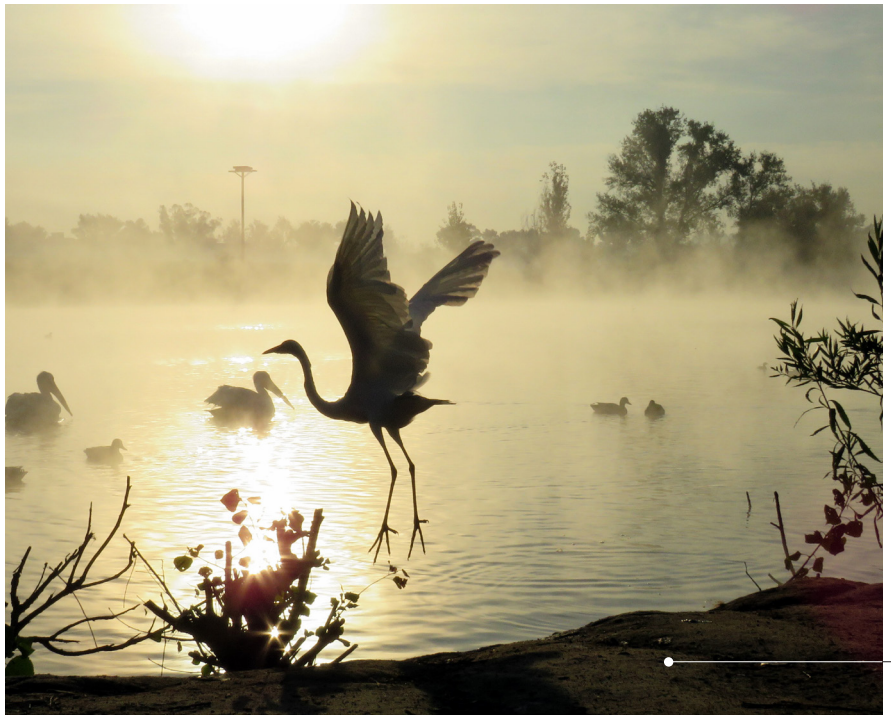

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Report Design: Susan Landesmann, Landesmann Design.

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EXECUTIVE SUMMARY

The UCLA Sustainable LA Grand Challenge (SLA GC) Sustainability Report Card (Report Card) for Los Angeles County (L.A. County) is the only comprehensive sustainability report card for a megacity in the world.

This 2021 Report Card on Ecosystem Health provides an in-depth look at the region's efforts in moving toward a more resilient environment and community for people and native wildlife. A healthy and improved ecosystem requires protecting and restoring high-quality habitats and native biodiversity; reducing ecosystem threats like wildfire and invasive species; and ensuring every Angeleno has access to nature and its benefits such as clean water, shade, and respite through policy solutions that address the region's inequities. To evaluate the region's ecosystem health, 18 indicators were assessed across four categories. Many of these indicators are new areas of assessment for the Report Card and will provide a more comprehensive picture of current conditions compared to our 2015 Report Card.[1] Grades were assigned in each category based on data availability and accuracy, compliance with regional policy targets where applicable, and historical improvements. This year's grades range from C/ Incomplete to B, and although there has been great progress in some areas, other areas still require significant improvement to raise the county's C+ average.

Photo: Nurit Katz

2021 UCLA Sustainable LA Grand Challenge Sustainability Report Card for Los Angeles County: Ecosystem Health
Summary of Grades

CATEGORY	GRADE	MAJOR FINDINGS	RECOMMENDATIONS
Land Use and Habitat Quality	C/ Incomplete	• 64.6% of land cover in L.A. County is natural area (2011) • 50.62% of natural area is protected (2018) • 57.4% of critical habitat corridors are protected (2018) • 52.8% of rare vegetation alliances are protected (2018) • Kelp canopy coverage has increased 49% from 2013-2018 • From 2015-2018 only 24% of stream-miles were likely intact	• Data: Update spatial analyses of natural area, habitat connectivity, habitat quality and protection compliance (terrestrial and marine) • Action: Setup a habitat quality monitoring program; Protect and restore critical habitat corridors and kelp beds, coastal wetlands and riparian habitat • Policy: Protect 100% of natural area and critical habitat corridors; Restrict development within 100 feet of a channelized river/stream and 300 feet of a soft bed river/stream
Biodiversity	B	• Community science has recorded over 4,200 native species in L.A. County • L.A. County is home to 38 endangered and 12 threatened species • Of the 50 endangered/ threatened species, 18 species populations are increasing, 18 are stable and 12 are decreasing (no data for remaining species)	• Data: Monitor regional species distribution and population for 100 native indicator species • Action: Restore native habitat critical for the survival of endangered and threatened native species • Policy: Prohibit development of critical habitats for endangered species
Threats to Ecosystem Health	C	• Approximately 21% of L.A. County's total area is categorized as Very High Fire Hazard, with a total of 1,959,415 residents living in this area • From 1992 to 2012 there was a significant decrease in stable nighttime light within the Santa Monica Mountain National Recreational Area and San Gabriel Mountains • 81% of land cover is pervious in L.A. County (2014) • The region experienced a significant decrease in greenness from 2000 to 2018	• Data: Monitor invasive indicator species populations and track new potential threats • Action: Place a greater emphasis on fire prevention techniques; Create a county plan to increase pervious surfaces in high need areas; Create an invasive species management plan for the county • Policy: No development or re-building in high fire hazard zones; Create standards for nighttime light in sensitive habitats; Keep the net % of impervious surfaces at or below 19% of the County; No sale of invasive species
Community Health and Wellbeing	C	• In 2018, the rate of heat-related emergency department visits in L.A. County was 13/100,000 people • 49% of the County population lives within a half-mile walking distance of a local park, regional recreation park, or regional open space (2016) • 20% of urban L.A. County is covered by tree canopy (2016)	• Data: Determine areas covered by heat-trapping surfaces; Analyze percent population that can access natural area via public transit; Collect neighborhood-scale data on urban tree health and maintenance needs • Action: Design and manage parks to reflect needs and values of sur rounding communities; Create an urban tree management plan for the county that prioritizes biodiversity • Policy: Ensure access to a public cooling center within a quarter-mile walk and/or 10-minute transit commute; Provide green space in all new parks; Allocate public funds spent on the urban tree canopy to areas with highest need first

Monarch butterflies are the only known species of butterfly to make a two-way migration to overwinter in warmer climates.

This miraculous journey takes four generations of butterflies to complete and typically results in the accumulation of thousands of butterflies at one of their many destinations along the California coast or central Mexico, depending on whether they originated west or east of the Rocky Mountains. The annual migration of the western population of monarch butterflies to their wintering grounds along the California and Baja Mexico coast has historically attracted many viewers to witness this awe-inspiring spectacle, but in recent years the number of monarchs wintering in the west has drastically declined from an estimated 4.5 million in the 1980s to approximately 1.2 million in 1997, under 30,000 in both 2018 and 2019, and only 1,914 in 2020 – less than 0.01% of the historic population size.[2,3] Beyond their extraordinary migration and natural beauty, monarch butterflies are important pollinators and have abundant cross-cultural significance.[4]

The recent precipitous population decline of the iconic monarch butterfly highlights the urgency to protect our precious ecosystems and exemplifies how climate change and other ecosystem disturbances can have a dramatic cascading effect. We know that major threats to the monarch include habitat loss and toxic pesticides.[2] Furthermore, climate change may be threatening both habitat suitability in their overwintering grounds and the predictable timing of the flowering season necessary for the monarchs' migration.[5] Another threat may be related to the introduction of an invasive non-native tropical milkweed to North American gardens, which has been shown to interrupt migration patterns and increase the likelihood of parasitic infection in the butterflies.

An important step in saving our North American monarch populations is to add them to the federal list of threatened and endangered species. This is no small task, and especially important for California monarchs because a Sacramento Superior Court judge ruled in 2020 that the California Endangered Species Act does not afford protection to insects.[6] In 2014, a petition was submitted to add the monarch to this list, but the petition was rejected in December of 2020 with the explanation that protection was "warranted but precluded" by other higher priority species, and is currently a candidate for future listing.[7] (Notably, 47 other species have gone extinct before their protection under the Endangered Species Act could be finalized.)[8] In the meantime, federal legislators introduced H.R.5920, the Monarch Action, Recovery, and Conservation of Habitat (MONARCH) Act of 2020, which would provide conservation support and establish the Western Monarch Butterfly Rescue Fund.[9]

Monarch butterflies overwintering in Pismo Beach, CA
Photo: Nurit Katz

Individuals can support the monarch's survival by planting native (not tropical) milkweed for monarch larva and nectar plants for adults to feed from, protecting existing monarch habitat and avoiding the use of pesticides or herbicides.[10] Individuals can also record observations of milkweed and monarchs on the Western Monarch Milkweed Mapper (WMMM), or volunteer to participate in community science activities like the Xerces Society's annual Western Monarch Thanksgiving Count to help estimate the population at overwintering sites.[3,11]

We chose to highlight the case of the monarch butterfly because it is truly iconic, and because its story touches on so many topics covered in this report, including threats to ecosystem health and their impacts on biodiversity; the importance of community science data to monitor species populations; the relationship between humans and the natural environment; the threat of habitat loss to biodiversity; and the critical importance of ambitious targets and policies that protect both natural area and biodiversity for future generations.

Photo: Nurit Katz

By 2050, Los Angeles County (L.A. County) will be more crowded, with an estimated population of 11.3 million residents.[12]

And, according to University of California, Los Angeles (UCLA) research, the region will also be hotter, with more frequent and dangerous heat waves, increased wildfire risk, and less snowpack to feed imported water supplies.[13,14] A hotter and more populous L.A. means increased pressure on energy, transportation, and water infrastructure, exacerbated public health problems, and stressed ecosystems and habitats.

In response to this climate emergency, UCLA formally committed to coordinating research, expertise and education around reaching ambitious sustainability goals in L.A. County with the announcement of the Sustainable LA Grand Challenge (SLA GC) in 2013. The SLA GC aims to work collaboratively with regional stakeholders to help transform Los Angeles into the most sustainable megacity by 2050.[15] Our vision is for Los Angeles to be the most livable, equitable, resilient, clean and healthy megacity in the world.

UCLA took on the task of evaluating the region's progress toward sustainability in the nation's first sustainability (formerly, environmental) report card for a major metropolitan area in 2015.[1] The 2015 Report Card evaluated 22 total indicators within L.A. County for Water (grade = C), Air (grade = C+), Ecosystem Health (grade = C-/ Incomplete), Waste (grade = B/ Incomplete), Energy and Greenhouse Gases (grade = B-) and Environmental Quality of Life (grade = C+). The 2015 Report Card established a baseline from which to measure the county's progress toward sustainability and informed research priorities for the SLA GC. It also served as a thought-provoking tool to catalyze discussions and more sustainable policies through its data-driven recommendations to improve the "grade."

For subsequent report cards, the SLA GC aimed to increase the depth of evaluation in topic-specific report cards for categories most closely aligned with the scope of the SLA GC. In 2017, the first of these topic-specific Report Cards was released with a focus on Energy & Air Quality (average grade = C).[16] In 2019, the first Water Report Card was published (average grade = C+).[17] This report card is focused on Ecosystem Health, and as with the Energy & Air Quality and Water report cards, builds upon the indicators from the 2015 Report Card and introduces a number of new indicators to provide a more comprehensive assessment of habitat quality, biodiversity and community health.

Although ecosystem health does not always receive the attention that topics like energy, air quality, and water receive, it is nonetheless critical to a community's overall wellbeing and resilience. L.A. County's 10 million people interact with its diverse landscapes and ecosystems every single day. These ecosystems span islands, beaches, coastlines, mountains and deserts – from densely populated urban areas to open natural lands. The region has the largest number of threatened and endangered plants and animals in the continental United States and lies within one of only 36 globally recognized Biodiversity Hotspots.[18]

Loss of biodiversity, or the variety of living organisms in L.A. County impacts our health, food, air quality, water resources, culture, and quality of life.[19] Unfortunately, the region's biodiversity and the environments in which they live are increasingly degraded due to urbanization and climate change. This crisis, driven largely by loss of habitat, threatens one million species worldwide, posing a profound threat to human well-being.[20] We can stop this crisis as it relates to ecosystems and biodiversity through more coordinated regional planning across jurisdictions that aims to protect existing habitat and biodiversity and prohibit further habitat destruction, so that our ecosystems can thrive as our region continues to develop.

Researchers are just beginning to understand the importance and complexity of urban ecosystems and how nature and humans coexist in these densely populated spaces. This is in contrast to the historical view of nature as separate from the city – something to be experienced and protected in natural areas only. We now know how important it is to conserve and create urban ecosystems, such as parks and open space, in order to provide gathering places for communities, gateways to exercise and healthy living, and places for children to explore, learn, and grow, while at the same time providing critical habitat for L.A.'s extensive biodiversity. These urban spaces may also serve to enhance community resilience by providing needed refuge, and access to sinks, kitchens, bathrooms, and shelter for emergencies. We must also protect parks and public lands that are located in areas that hold cultural significance for communities, such as Native American and indigenous communities.[21]

Photo: Nurit Katz

Unfortunately, these parks, green spaces, open spaces, and slivers of nature, along with the "services" or benefits that they provide, are not equitably distributed throughout the region. As a result of discriminatory land use practices and unequal public investment, low-income communities and communities of color commonly reside in areas of L.A. County that have less access to parks and recreation (among other resources such as jobs, high-quality schools and health care).[22] Disparities also exist in the quality of park space, with parks in low-income neighborhoods often having sparser vegetation and fewer amenities.[23]

Both the City and County of L.A. have made recent commitments to enhance the region's ecosystem health and improve equitable access. In 2017, L.A. City Councilmember Paul Koretz introduced the city's first-ever biodiversity motion, which was unanimously approved by the L.A. City Council, to protect and enhance L.A.'s biodiversity. This led to the establishment of a biodiversity Expert Council, on which several UCLA faculty and researchers sit, and the first assessment of L.A. biodiversity using the Singapore Index by the City of L.A.'s Department of Sanitation and the Environment (LASAN) in 2018. This work was in large part done by a a UCLA graduate intern who was advised and funded by the SLA GC and associated faculty.

This UCLA graduate (Isaac Brown) continued to work with LASAN and went on to develop an L.A. Specific Biodiversity Index Framework with guidance from UCLA's own Biodiversity Expert Group that was published in 2020.[24] That 2020 report represents the first quantification of urban biodiversity for any U.S. city. The city's commitment to urban ecosystems is further reflected in L.A.'s Green New Deal with targets for no net loss in native biodiversity, increases in tree canopy in areas of greatest need, and improved access to parks and open space, among others.[25]

Similarly, with the establishment of the first L.A. County Chief Sustainability Office and development of the first-ever L.A. County sustainability plan (OurCounty),[26] the county has also made commitments to enhance ecosystem health. The county sustainability plan was developed in partnership with the SLA GC, the California Center for Sustainable Communities in the UCLA Institute of the Environment and Sustainability, and the Emmett Institute for Climate Change and the Environment at the UCLA Law School, as well as other consultants.[27] In fact, many of the indicators and analyses presented in this and past report cards served as the basis for understanding baseline conditions and projected targets in the county plan. OurCounty was unanimously approved on August 6, 2019 by the L.A. County Board of Supervisors, and is heralded as the most ambitious sustainability plan of any major metropolitan region in the nation. [26,28] Throughout this report we reference relevant OurCounty goals, strategies and targets and evaluate trends and progress toward meeting them.

The state of California is not far behind on ambitious ecosystem protection and resiliency efforts to fight climate change. In fall 2020, Governor Newsom issued a "30x30"[30] executive order to protect 30% of our lands and waters by 2030 – the first such commitment in the nation.[29] The Biden white house followed suit in January 2021 with an executive order on "Tackling the Climate Crisis at Home and Abroad" that also committed to 30x30. These orders make the clear connection between our natural lands, biodiversity, and ecosystems, and our healthy communities and climate resiliency. As such, we can expect to see more innovative, nature-based solutions to our climate challenges, such as wildfires.

We look forward to continued collaboration with regional stakeholders to enhance ecosystem health and advance sustainability in L.A. County for a healthier, more prosperous, and more equitable Los Angeles.

Photos: Nurit Katz

INDICATORS AND DATA SELECTION

The Report Cards assess sustainability conditions across L.A. County using a comprehensive approach based on quantitative indicators. In the 2015 Report Card, eight of the 22 indicators assessed were focused on ecosystem health. This Report Card builds upon those indicators and assesses 18 total ecosystem health indicators across four categories to grade the status and trends associated with protecting and enhancing ecosystem health across L.A. County.

The ideal criteria for an indicator to be useful in the report card are that data for that indicator are collected countywide, easily obtainable, and quantifiable; published by agencies, universities, or non-profit organizations; and updated on at least an annual basis. However, as with the 2015, 2017, and 2019 Report Cards, we found that such data is often difficult to come by and many of the factors critical to assessing environmental conditions are not regularly measured and/or the data is not accessible.

Some data that did not meet our indicator criteria, but that we deemed important, are presented as "breakouts" throughout the report under the most relevant category. Conversely, we acknowledge that some indicators, although accessible and regularly updated, do not represent the most important measures of progress in their respective areas, but are included due to the lack of data availability on more critical metrics. We have addressed this issue through recommendations for improved data collection and monitoring and/or by using an "Incomplete" designation as part of our grading.

It is important to note that compared to other topic areas that we have evaluated, there is a general lack of data for ecosystem-related indicators at the county scale. As such, some of the data used is outdated, and for some indicators, more extensive analyses were necessary to piece together data sets from multiple sources to perform a comprehensive evaluation. However, we are confident that the historic trends and comparisons with the 2015 Report Card data provide a strong and compelling basis for evaluating the state of Ecosystem Health in L.A. County today.

Photo: Nurit Katz

GRADING

We faced challenges in developing an objective grading system for previous report cards. Our ideal approach is to base grades on compliance with sustainability-related laws or progress toward accepted policy targets. This may be feasible for some indicators, but many are not tied to any sustainability standard or legal requirement. There are also some indicators that pose an assessment challenge. For example, we have presented data on percentage of natural area, but do not have any trend data to evaluate yet.

The first-ever sustainability plan for L.A. County has clear targets associated with ecosystem health. However, even where associated targets are identified, a grading rubric must still be developed to characterize conditions when targets are not being met (i.e., if an "A" represents 100% of natural area is protected, what percentage protected is associated with grades B through F?).[26]

Furthermore, as we assembled indicators across a wide range of environmental dimensions, we recognized there are combinations of "cause" and "effect" indicators that have varied sustainability implications. As such, the weighting of different indicators in determining the final category grades were not always equal. For example, for the category of "Land Use and Habitat Quality," percentage natural area was weighted higher than kelp canopy because kelp canopy is a single parameter within one ecosystem, whereas percentage natural area covers all terrestrial ecosystems. Furthermore, a lack of critical data was severe enough in some cases to warrant an "Incomplete" notation, as in the case of Land Use and Habitat Quality, because there is currently a lack of regional data on habitat quality and connectivity for multiple species.

In an attempt to standardize all of these factors we created a grading rubric for this Ecosystem Health Report Card that allowed us to calculate percentage grades for every indicator and chapter. You can find the details of how each grade was assigned in the Appendix. We will continue to improve our choice of indicators and grading system based on additional data availability as well as feedback from government agencies, NGOs, academics, business leaders, and the community. With an objective grading rubric like this, we hope that it becomes easier to identify how to improve a grade moving forward.

Photo: Nurit Katz

GRADE: C/ Incomplete

Los Angeles County has long been known for its sprawling suburbs outside a thriving urban center, but what is less known is that a majority of the county has remained natural.

The County is home to a diverse collection of ecosystems and microclimates spanning 10,000 feet in elevation from the coast to the mountains. It is considered a Mediterranean climate, but rainfall and snowfall vary significantly across the region creating a diversity of habitats that foster endemic species that depend on the continued existence of these critical habitats. Unfortunately, much of the county's land has been significantly degraded by its human inhabitants, while extreme temperatures are increasing and precipitation patterns are shifting due to climate change. This has resulted in changes to natural vegetation and fragmentation to habitats that dramatically impact the region's wildlife and public health.[31]

KEY FINDINGS

- **64.6% of the land cover in L.A. County is natural area (2011)**
- **50.62% of the natural area falls within a California Protected Area (2018)**
- **57.4% of critical habitat corridors fall within a California Protected Area (2018)**
- **52.8% of rare vegetation alliances fall within a California Protected Area (2018)**
- **Kelp canopy coverage has increased 49% from 2013-2018**
- **From 2015-2018 only 24% of stream-miles were likely intact**

RECOMMENDATIONS

Data:

- Updated spatial analysis of natural area (both terrestrial, coastal and marine) at the county scale that includes information on the spatial distribution of habitat alliances.
- Monitoring and reporting of protection compliance on an annual basis on quality of protected areas (terrestrial and marine).
- Update and analyze habitat connectivity data for different taxa groups (i.e., mammals, birds, reptiles, amphibians, fish, insects) at county scale. Update linkage identification regularly based on species needs and development.

Action:

- A spatial analysis of terrestrial natural area by vegetation alliance should be conducted every five years.
- Protect all habitat linkages as well as existing large patches of habitat and prevent development that causes further fragmentation.
- Invest in the restoration of kelp beds, coastal wetlands and riparian habitats across the county to ensure their ecological services are maximized.

Policy:

- 100% of identified natural area, including all missing linkages, should be protected against development and assessed for degradation to determine where restoration efforts are most needed.
- All public development should be restricted in the Significant Ecological Areas (SEAs) and funding should be dedicated to monitor SEAs across all jurisdictions.
- Completely restrict development within 100 feet of a channelized river/ stream and 300 feet of a soft bed river/ stream.

GRADING

Updated data on land use and habitat quality for the entire county is necessary for a complete evaluation – specifically data on habitat quality across all vegetation types, and habitat connectivity data for multiple types of taxa. The data that is available shows a consistent decrease in natural area and habitat quality over time. Protection of these remaining natural areas and restoration of degraded land are essential to prevent further loss of native biodiversity and build a sustainable natural landscape.

Egret
Photo: Nurit Katz

OURCOUNTY GOALS AND STRATEGIES

Goal 5: Thriving ecosystems, habitats, and biodiversity

Strategy 5A: Increase ecosystem function, habitat quality, and connectivity, and prevent the loss of native biodiversity in the region

Strategy 5B: Preserve and enhance open space, waterways, and priority ecological areas

INDICATORS

Land Cover and Natural Area, Protected Areas, Connectivity and Fragmentation, Riparian Habitat Condition, Kelp Canopy Coverage

BREAKOUTS

Rare Vegetation, Endangered Species Habitats, Liberty Canyon Wildlife Crossing, Rim of the Valley National Park Survey, Ventura County Habitat Connectivity and Wildlife Corridor Ordinance, Historical Wetland Habitat, State of the Bay Report, Restoration Recommendations

UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

Photo: Nurit Katz

OurCounty Targets:

2025: Increase to 55% the percentage of protected natural area

2035: Increase to 65% the percentage of protected natural area

2045: Increase to 70% the percentage of protected natural area

INDICATOR

Land Cover and Natural Area

Despite L.A. County's reputation as a concrete jungle, beyond the urban center, the region supports extensive natural areas.

These natural areas are the foundation of the region's ecological resilience and diversity and provide a multitude of ecosystem services to the community, including air and water purification, food security, pest and disease control as well as mental and physical wellbeing. Many critical habitats have been studied over time, but there has not been a collective assessment at the county scale. In addition, land use development including urban sprawl, widespread channelization of watersheds, and creation of impervious surfaces have significantly degraded these natural areas over time.

To ensure future generations benefit from the critical ecosystem services these natural areas provide, it is important to identify best management practices and establish land use prioritizations that protect and preserve our natural resources. To do this, we must identify land areas in need of protection and measure change over time.

DATA AND METHODS

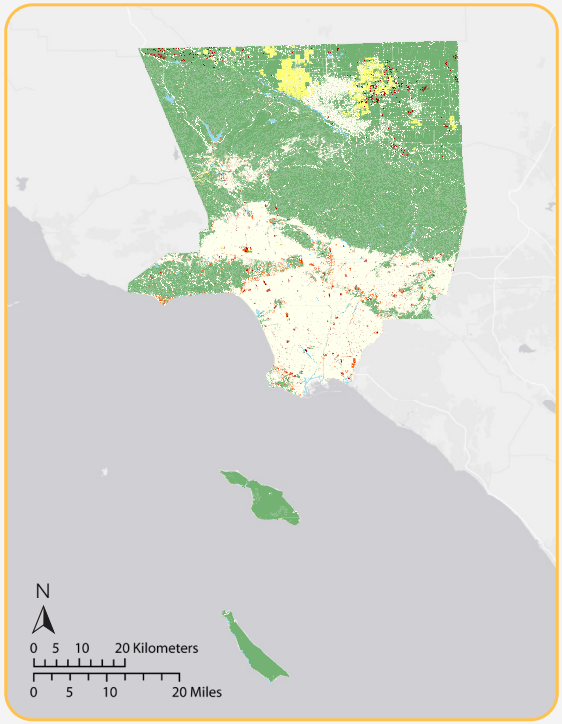
To quantify a baseline percentage of natural areas and other land use types that cover all of L.A. County, we manipulated and merged multiple datasets. The ultimate output resulted in one vector dataset derived from several CALVEG datasets (South Coast and South Interior, 2004) and the USGS GAP land cover data (2011) categorized by vegetation dominance type. These vegetation classifications were grouped into seven generic land use categories as defined by the City of L.A.'s Department of Sanitation and the Environment's 2018 Biodiversity Report: agriculture, bare soil, non-native grasses, non-native shrubs and trees, natural area, urban developed and water.[32] Non-native vegetation and agriculture were not included in the natural area category because they do not provide the same ecosystem services and habitats that native vegetation does.[33]

From this original assessment of land cover, we assessed the percent natural area protected as reported by the California Protected Areas Database (CPAD, 2018).[34] In addition, we assessed the percent natural area data layer categorized as a Significant Ecological Area (SEA) by L.A. County (2018).[35]

We also roughly assessed access to natural areas by determining the percentage of census tracts within L.A. County that have at least one natural area. We then used U.S. Census data (2017), which estimates L.A. County population at 10,272,648, to determine the census tracts that contained at least one polygon of Natural Area fragment within 100 meters and with a minimum area of 1,000 square meters. This method was used to calculate the percentage of census tracts that contained natural area and the corresponding percentage of L.A. County residents that live within those census tracts.

For a more detailed description of methods, please reference Appendix 1: Extended Methodology for Indicator Analyses, Chapter 1.

Land Cover in Los Angeles County (using data from 2004 & 2011)



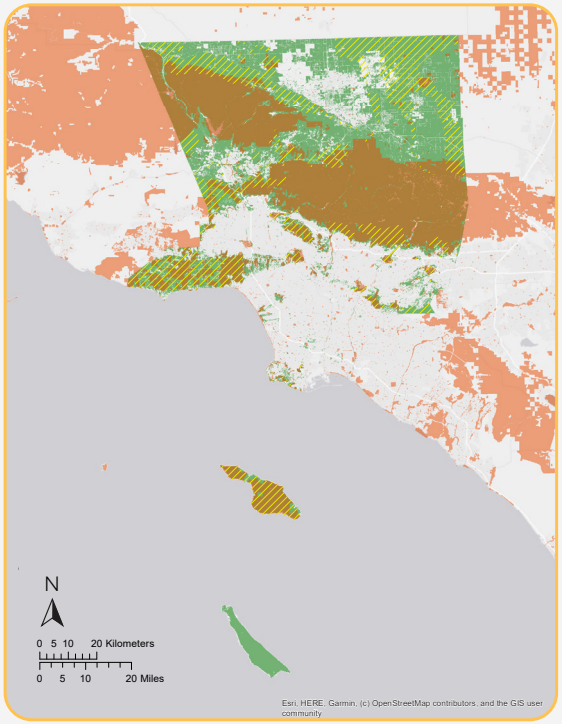
Area Classifications (% of County Area)

- Natural (64.6%)
- Urban, Developed (28.4%)
- Agriculture (2.9%)
- Bare Soil (1.5%)
- Non-Native Grasses (1.1%)
- Non-Native Shrubs and Trees (1.0%)
- Water (0.5%)

Data Sources: CalVeg, CA USDA-Forest Service Pacific Southwest Region (2004), U.S. Geological Survey Gap Analysis Project, Los Angeles County Census Tracts (2011)

Cartography by Porter Margolis

Protected Natural Area in Los Angeles County (2018)



Natural Area (2004 & 2011)

SEA (2018)

CPAD (2018)

Data Sources: CalVeg, CA USDA-Forest Service Pacific Southwest Region, U.S. Geological Survey GAP Analysis Project, California Protected Areas Database, Los Angeles County Significant Ecological Areas

FINDINGS

- Using data from 2004-2011, 64.6% of the land cover in L.A. County was classified as natural area. This percentage does not include bare soil, non-native grasses, or non-native trees and shrubs.
- In L.A. County's natural area, 137 unique vegetation dominance types were identified. The Lower Montane Mixed Chaparral at 1,469 km alliance was the largest in size, whereas the San Gabriel Ranges area had the highest number of unique habitat alliances, classified as rare due to their limited occurrence across the county.
- In 2018, 50.62% of natural area (as determined by 2004-2011 data) was protected according to the California Protected Area Database (CPAD).
- 33.23% of natural area was recognized as a Significant Ecological Area (SEA) by L.A. County.
- 13.32% of natural area falls within both a CPAD area and a SEA.
- As of 2017, a total of 1,005 census tracts out of 2,803 (36%) contained a natural area fragment within L.A. County. Both islands (Catalina and San Clemente) were considered natural area. There is an estimated 3,422,756 people, or 33% of the county population, who live within a census tract that contains at least one polygon of natural area. The urban core including East and South L.A. as well as a large section of the San Fernando Valley have the least access to natural areas.

RECOMMENDATIONS

Data: Updated spatial analysis of natural area at the county scale that includes information on the spatial distribution of habitat alliances.

Action: A spatial analysis of natural area by vegetation alliance should be conducted every five years.

Policy: 100% of the natural areas identified should be protected against development and assessed for degradation to determine where restoration efforts are most needed.

DATA LIMITATIONS

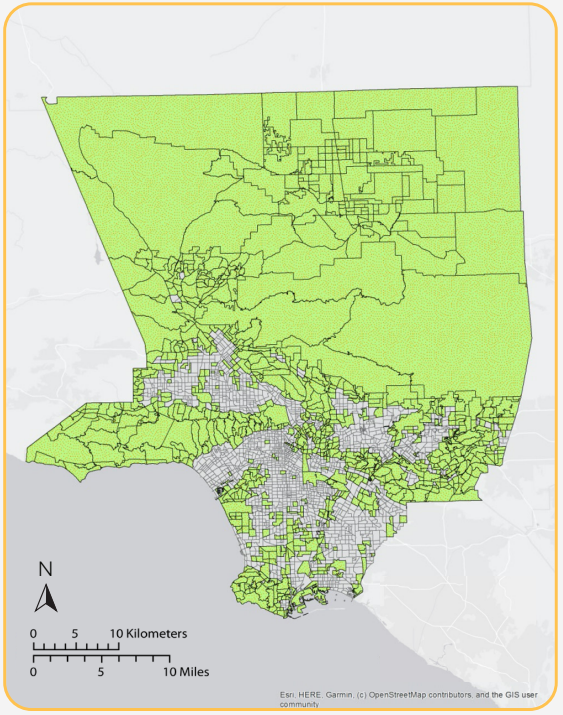
2004-2011 is the most current spatial data available for assessing land use and natural area. Thus, although this gives us a baseline to better understand the percentage and distribution of these areas, we cannot measure change over time without an updated spatial dataset.

There were data limitations with the raster-to-vector data conversion performed in the ArcGIS software. The pixelated nature of the output map unavoidably altered the geographic boundaries. While the merged datasets allowed us to develop comprehensive coverage across the county, this data manipulation may have led to classification overlapping that affected the accuracy of counts in coverage of vegetation types. This analysis also does not identify sensitive natural communities with high rarity rankings at the state and global scale.

Our analysis of protected natural areas did not include conservation easements because these easements were not included in the CPAD layer.

As census tract square meters vary widely, measuring the percentage of census tracts that contain some natural area is a rough estimate of access to natural area. This does not standardize the distance that a community member would have to travel to access that natural area, nor does it account for the direct mode of travel.

Census Tracts (2017) in Los Angeles County with Natural Area (2004 & 2011)



Data Sources: CalVeg, CA USDA-Forest Service Pacific Southwest Region (2004), U.S. Geological Survey Gap Analysis Project (2011), Los Angeles County Census Tracts (2017)

BREAKOUT: RARE VEGETATION

Rare Vegetation Alliances in Los Angeles County (2004 & 2011)					
Vegetation Alliance	Total Area (km^2)	Not Protected (%)	Significant Ecological Areas (%)	California Protected Areas	
				Agency Type	(%)
Alpine Grasses and Forbs	0.004	0.0	100	-	0.0
Intermittent Lake or Pond	0.051	2.3	85.6	Federal	69.1
				State	12.0
Subalpine Conifers	0.109	0.0	0.0	Federal	100
California Buckeye	0.130	0.0	100	Federal	92.1
Tule - Cattail	0.258	32.0	64.3	Special District	3.7
Saltbush	0.306	15.1	72.9	Federal	12.0
				Special District	21.0
Coastal Bluff	0.387	42.6	55.9	State	15.1
				County	0.2
				Non-profit	1.4
Perennial Lake or Pond	0.397	4.6	0.0	Federal	95.4
Wet Meadows	0.513	28.0	46.2	Federal	19.6
				State	6.3
Dune	0.545	66.6	7.7	State	23.4
				Non-profit	9.1
Pickleweed - Cordgrass	0.795	8.7	67.4	State	73.0
				Special District	16.6
Total	3.495	25.4	45.7	Federal	22.3
				State	23.0
				County	0.0
				Special District	5.9
				Non-profit	1.6

Los Angeles County encompasses diverse natural habitats and is home to a great number of rare species.

To better assess the rare plant communities present in the county, an undergraduate researcher, supervised by Dr. Thomas Gillespie, analyzed natural area spatial data to determine the vegetation types that had the lowest total area, or the most rare vegetation.

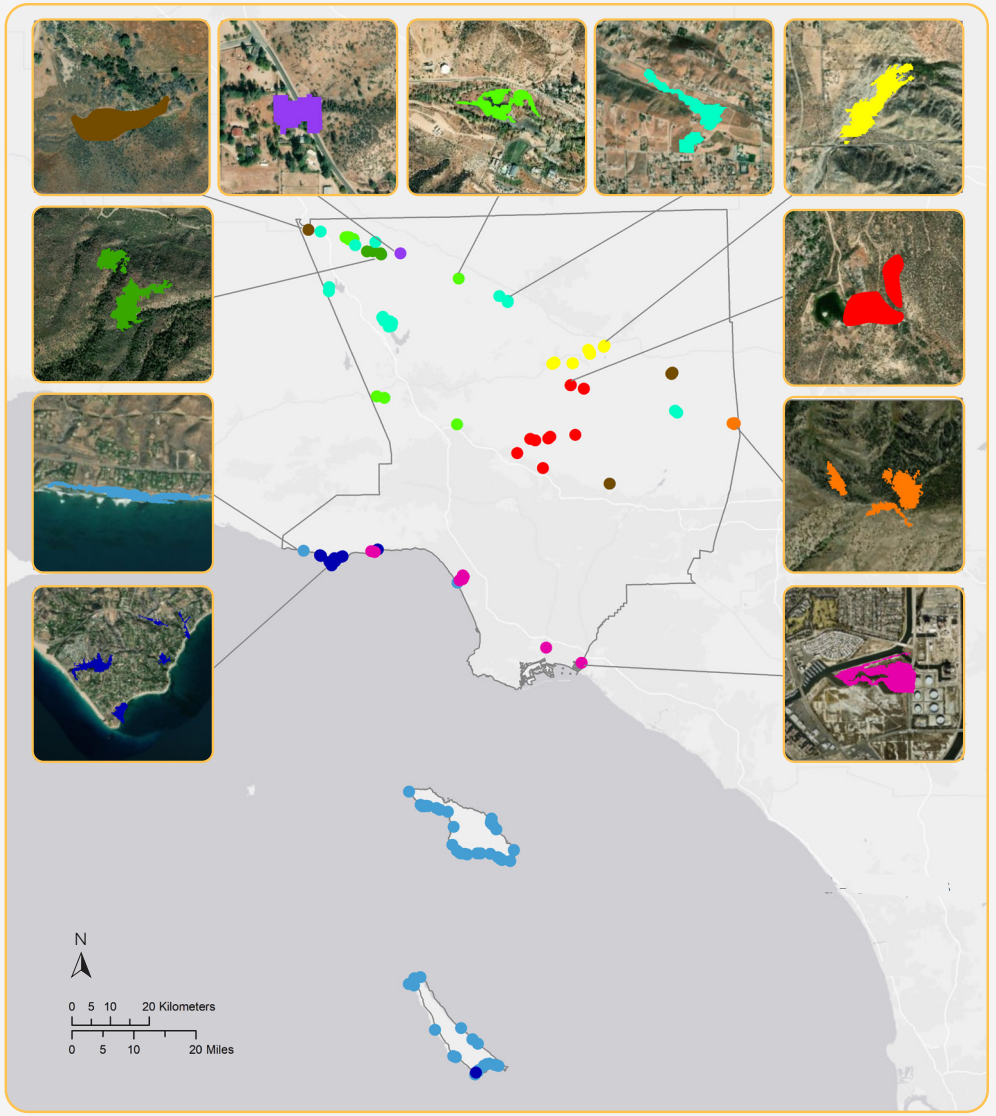
A rare vegetation type was defined as anything with less than 1-square-kilometer area across the entire county. Exceptions to this classification were vegetation alliances that were naturally rare within the county limit, but are not rare within Southern California. Using this definition, they identified 11 rare vegetation alliances at the county level.[33]

While this analysis provides some insight into rare vegetation across the county, it is important to acknowledge the limitations of a spatial analysis based on data that is over a decade out of date. As regional biologists will note, some of these vegetation alliances are more common than this analysis would indicate, such as the saltbrush, which collectively is common within the county, but appears to be rare as reported by the underlying datasets, probably because it is referring to a specific species. In addition, some critically rare vegetation alliances were not included, including the vernal pools in Santa Clarita and others that are identified by the California Department of Fish and Wildlife. Future analyses should combine spatial data, management priority areas and on the ground field observations to more accurately assess all rare vegetation alliances in the region.

Such an assessment of the rare vegetation alliances in L.A. County would aide in the prioritization of habitat preservation measures. Together, with data on the most critical habitat corridors, managers could utilize this data to select specific areas to preserve and ensure the most vulnerable species are given the protection needed to survive.

Top: Pickleweed Pacific Glasswort
Bottom: California Buckeye
Photos: Dan Horowitz
Courtesy of iNaturalist

Location of Rare Vegetation Alliances in Los Angeles County (2004 & 2011)



Data Source: CalVeg (2004) and USGS GAP Analysis (2011), Porter Margolis.

BREAKOUT: U.S. FISH AND WILDLIFE SERVICE CRITICAL HABITAT

Palos Verdes Blue butterfly (*Glaucopsyche lygdamus palosverdesensis*)
Photo: Travis Longcore

A recent report on biodiversity, released in 2019 by the United Nations, lists loss of habitat as the number one threat to biodiversity, exceeding the impacts associated with climate change.

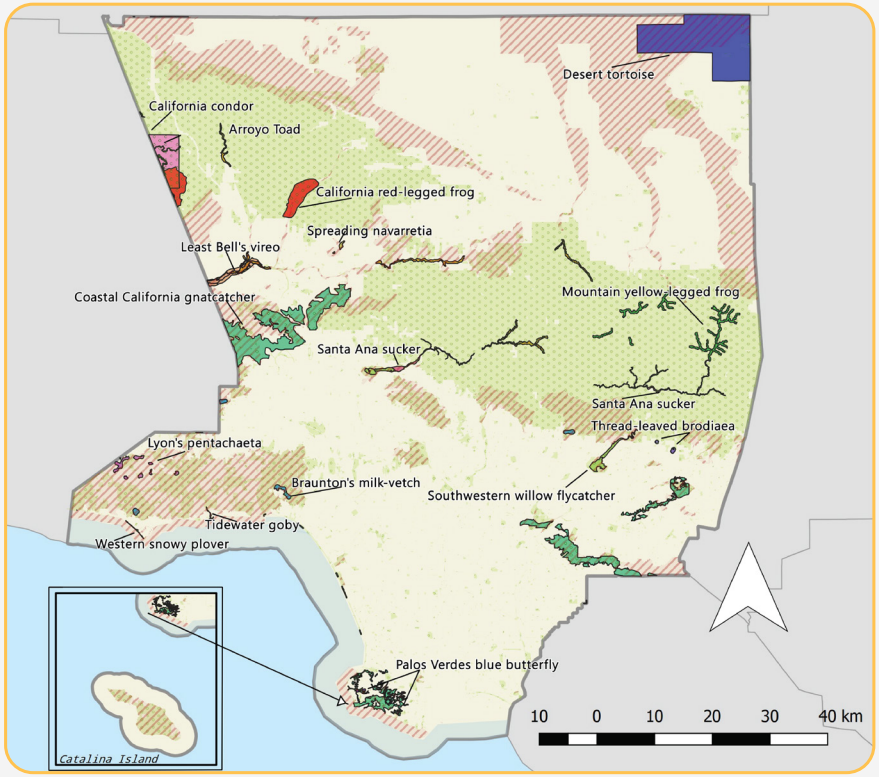
Critical habitats refer to areas that provide resources that endangered or threatened species rely on to survive.[36]

A recent report on biodiversity, released in 2019 by the United Nations, lists loss of habitat as the number one threat to biodiversity, exceeding the impacts associated with climate change.[20] Thus, if we want to preserve native biodiversity, we need to effectively manage and protect our critical habitats.

A UCLA undergraduate researcher under the guidance of Dr. Thomas Gillespie assessed geospatial data of endangered species populations from the U.S. Fish and Wildlife Service (USFWS) and mapped the distribution of some of the most vulnerable and unique wildlife areas in L.A. County. Using the Palos Verdes Blue Butterfly as an example, one can see the heightened need for protection of our most vulnerable species. The Palos Verdes Butterfly is endemic to the Palos Verdes Peninsula and has been threatened due to habitat fragmentation associated with development.[37]

However, USFWS does not map critical habitats for all endangered species and the habitat identified is preferentially designated federal land. So while this data is an important component for designating critical habitats across the county, it should be integrated with state and local management data and field data to ensure the information is as accurate as possible. Such an assessment of the critical habitats in L.A. County would provide direct recommendation for allocating protection of these important natural resources.

Critical Habitats of Endangered Species in Los Angeles County (2018)



SEA
CPAD
L.A. County

USFWS Critical Habitat

- Arroyo Toad
- Braunton's Milk Vetch
- Three-leaved brodiaea
- Santa Ana Sucker
- Western Snowy Plover
- Southwestern Willow Flycatcher
- Tidewater goby
- Palos Verdes Blue Butterfly
- Desert Tortoise
- California Condor
- Spreading Navarretia
- Lyon's Pentachaeta
- Coastal California Gnatcatcher
- California Red-Legged Frog
- Mountain Yellow-Legged Frog
- Least Bell's Virea

Sources:
California Natural Resources Agency-California Protected Areas Database (CPAD; 2018), USFWS Critical Habitat (2019), Data.ca.gov, L.A. Department of Regional Planning-Significant Ecological Areas (SEA; 2018).

California Red-Legged Frog
Photo: Santa Monica Mountains National Recreation Area

Griffith Park
Photo: Joscha Beninde

OurCounty Targets:

2025: Increase to 55% the percentage of protected natural area

2035: Increase to 65% the percentage of protected natural area

2045: Increase to 70% the percentage of protected natural area

INDICATOR

Protected Areas

Protected areas in L.A. County are not only crucial in conserving natural resources, but also act as essential recreational areas for more than 10 million county residents.

In October 2020, California's Governor Gavin Newsom signed an Executive Order (EO N-82-20) setting a goal to conserve at least 30 percent of California's land and coastal waters by 2030 and noting the importance of climate-smart management of natural and working lands.[29]

The California Protected Areas Database (CPAD) consists of various types of land that are preserved for open space in California. They vary from large-scale national parks to small neighborhood parks. The land is currently owned and managed by government agencies, non-profit organizations, and private organizations.[34] While natural areas discussed in the previous indicator are based on groundcover data, protected areas as discussed here have a political boundary component: the lands included in the database have some varying degree of protection from development. The database is updated annually and is thus ideal for monitoring change in protected lands over time.

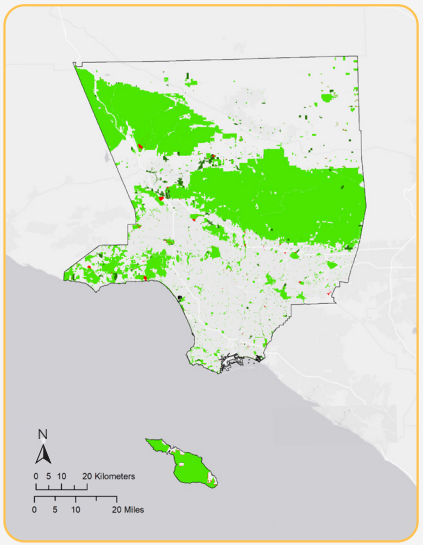
The Significant Ecological Areas (SEA) program is a component of the Conservation/ Open Space category under the L.A. County General Plan. The L.A. County Department of Regional Planning oversees the program, which officially designates areas within L.A. County that contain irreplaceable biological resources as SEAs.[35] SEAs are designed to closely monitor and regulate anthropogenic growth to ensure that its impact on natural resources is minimized, but are not protected areas and do allow development that is consistent with natural resource protection regulations.[35] SEA restrictions apply to any activity classified as development, but have numerous exemptions.[38] Management of SEAs is determined by the respective local governing body, including county managed unincorporated area, respective city departments, land conservancies and private property owners.

Santa Susana Mountains
Photo: Joscha Beninde

DATA AND METHODS

We compared quantitative and spatial data from 2014 (the year of data evaluated in the 2015 Environmental Report Card for Los Angeles County) and 2018 (the most recent year of data available at the time of this analysis) to determine the change in land area and spatial distribution of protected lands included in CPAD for L.A. County. We also identified the percent of land held or protected by each type of responsible agency (federal, state, county, city, special district, nonprofit, private, or a combination of these). Although SEAs are not protected areas, because of their (namesake) ecological significance, we also compared quantitative and spatial change in the land area and spatial distribution of SEAs between 2014 and 2018 to illustrate the differences due to program revisions between 2014 and 2018 under the L.A. County General Plan. These revisions involved expanding the boundaries of SEAs and increasing regulations over activities within these areas.

Change in Protected Area, Los Angeles County (2014-2018)

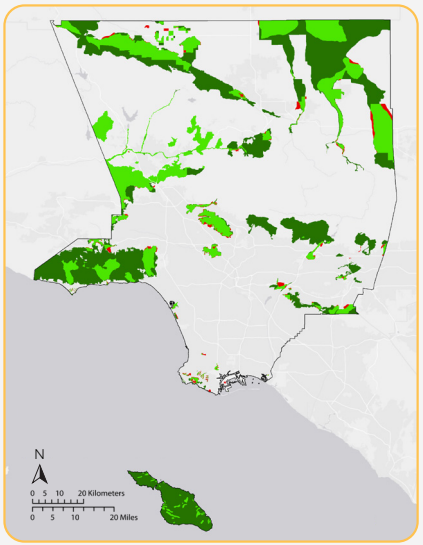


CPAD maintained 2014-2018
CPAD gained 2014-2018
CPAD lost 2014-2018

San Clemente Island did not include any protected area as listed in the California Protected Areas Database.

Source:
California Protected Areas Database

Change in Significant Ecological Areas, Los Angeles County (2014-2018)

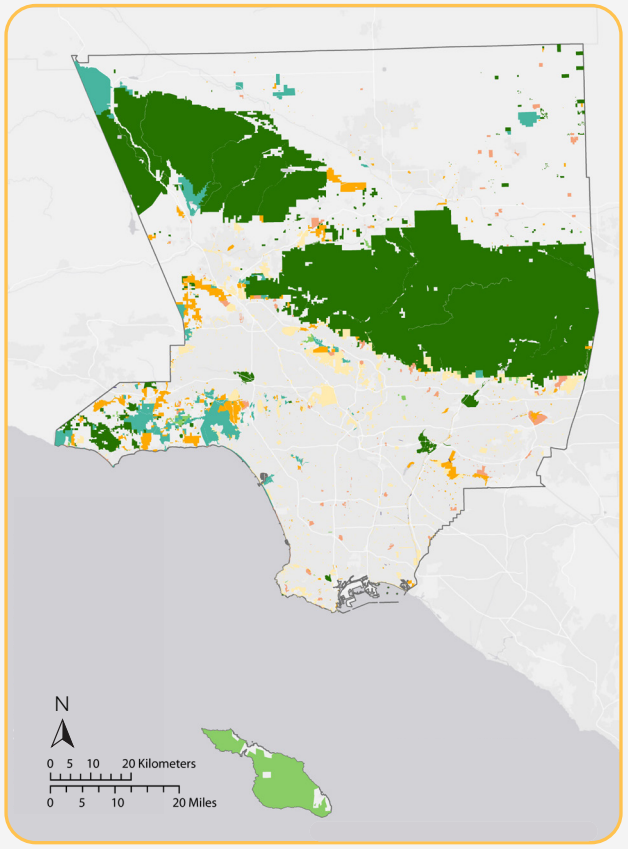


SEA maintained 2014-2018
SEA gained 2014-2018
SEA lost 2014-2018

San Clemente Island did not include any SEAs. Ocean Coastal Resource Areas along the Malibu and Palos Verdes coasts are excluded due to this indicator's focus on protected terrestrial area.

Sources:
Los Angeles County Department of Regional Planning Significant Ecological Areas Program

Protected Areas by Responsible Management Agency, Los Angeles County (2018)



CPAD Managing Agency

- Federal
- State
- County
- City
- Special District
- Non Profit
- Private
- Joint

San Clemente Island did not include any protected area as listed in the California Protected Areas Database.

Source:
California Protected Areas Database

FINDINGS

- In 2014, there were 886,197 acres of protected area in L.A. County, constituting 34.1% of the county's total land area. In 2018, 34.9% of the land in L.A. County, or 905,903 acres, was in CPAD areas. The county maintained over 99% of this protected area between 2014 and 2018. The county gained 25,001 acres of protected land over that four-year period, and appeared to lose 5,295 acres. This perceived reduction was not a result of actual loss in protected land, but a result of improvements in the measurement and management of spatial data.[39]
- In 2018, government agencies were the dominant administrators of protected areas, managing 95% of the land documented in CPAD. Among government agencies, federal agencies managed approximately 76% of protected land.
- In 2014, 10.0% of L.A. County, or 260,645.6 acres, was identified as a terrestrial SEA, and in 2018, 23.2% of L.A. County, or 603,787 acres, was identified as a terrestrial SEA. Although there was a net gain of 13.7% or 356,954 acres in SEA acreage from 2014 to 2018, 0.5% or 13,812.6 acres were lost during that same time. The gain was a result of revisions to the SEAs program under the L.A. County General Plan, which expanded SEA boundaries and increased their regulation.
- In 2018, 15% of SEAs fell within an incorporated city. This makes coordination and cooperation with the respective city planning departments essential for SEAs to be effectively managed because the county does not have jurisdiction.

RECOMMENDATIONS

Data: Monitoring and reporting of protection compliance on an annual basis would provide more site-specific information on quality of protected areas.

Action: Local governments should manage compliance with SEAs across all governing bodies. Their management, including monitoring and updates, should be on a set schedule with annual updates to ensure that the program objectives are being met. Updating SEAs in incorporated cities is important to recognize the importance of those areas at the county level.

Policy: Local governments should restrict all public development in the SEAs and dedicate funding to monitor SEAs across all jurisdictions

DATA LIMITATIONS

While the CPAD fulfills a critical role of centralizing information on protected areas, the database relies on land management agencies and organizations to report land acquisitions, and therefore some public lands may not be currently included.

While we have presented total area metrics here, there are varying levels of protection within both the large protected areas included in CPAD and within the SEAs.

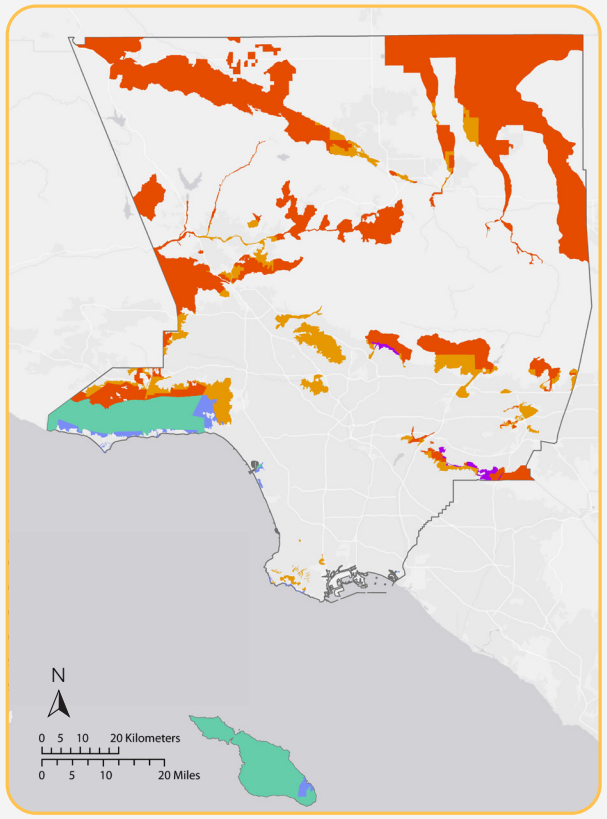
SIGNIFICANT ECOLOGICAL AREAS BY TYPE (2018)

Coastal Resource Area and Ocean (CRAs): include biological resources equal in significance to SEAs, but, since they occur in the coastal zone, they fall under the authority of the California Coastal Commission. Ecological resources of CRAs are protected by specific provisions within an area's certified local coastal program.

Incorporated City: These areas fall within the jurisdiction of a city governing body and are therefore not directly managed by the L.A. County Department of Regional Planning.

Conceptual SEA: The Conceptual SEAs were proposed additions to the SEAs. They have since been adopted by the L.A. County Board of Supervisors on December 19, 2019 and were enacted on January 20, 2020.

Significant Ecological Areas by Type, Los Angeles County (2018)



SEA Type

- Significant Ecological Area
- Coastal Resource Area
- Signifcant Ecological Area (Incorporated City)
- Coastal Resource Area (Incorporated City)
- Conceptual SEA

San Clemente Island did not include any SEAs. Ocean Coastal Resource Areas along the Malibu and Palos Verdes coasts are excluded due to this indicator's focus on protected terrestrial areas.

Source:
Los Angeles County Department of Regional Planning Significant Ecological Areas Program

Mountain Lion (*Puma concolor*)
Photo: Santa Monica Mountains National Recreation Area

OurCounty Targets:

2025: Increase the percentage of protected wildlife corridors to 75%

2035: Increase the percentage of protected wildlife corridors to 100%

INDICATOR

Habitat Connectivity and Fragmentation

Habitat connectivity refers to the degree of contiguousness between areas of habitat suitable for certain terrestrial wildlife.

Structures like buildings or roads can be barriers to wildlife movement, thus effectively breaking up their habitat into distinct patches, or fragments. A habitat with sufficient space for activities like hunting or finding food and a mate is critical for the survival of populations of native species. Habitat size and connectivity vary for different species, so understanding the specific needs of local species is important for making urban sustainability and land management decisions.[32,40] While a complete assessment of regional habitat connectivity was beyond the scope of this report card, we examined two metrics of connectivity: protection of key wildlife linkages and habitat fragmentation.

Habitat linkages are specific areas that act as a pathway for terrestrial species between larger patches of habitat. Generally, the linkages include enough food, water and shelter to support species as they make their way from one patch to another, although they vary in size and quality depending on the species served.[35] Identifying places that are missing linkages between natural areas, or patches, and assessing the existing habitat protections in the area can help guide land-use decisions to ensure these critical segments of connective habitat are prioritized for protection.

Habitat fragmentation refers to the process of losing original habitat, decreasing habitat patch size, and increasing habitat patch isolation, all of which contribute to loss of the habitat's biodiversity.[41]

DATA AND METHODS

Habitat Connectivity: We used the missing linkages located in L.A. County identified in the *South Coast Missing Linkages: A Wildland Network for the South Coast Ecoregion report* from 2008.[42] The report identifies the following linkages based on landscape permeability analyses and the needs of 109 focal species: San Gabriel – Castaic; San Gabriel – San Bernardino; Santa Monica – Sierra Madre; Sierra Madre – Castaic; and Tehachapi. We combined the missing linkages map with a map of protected parks and open space areas from the 2018 California Protected Areas Database (CPAD). This created a single map of open space and habitat linkages in L.A. County, and allowed us to find the percentage of linkages that fell within already-protected areas.

Habitat Fragmentation: We used the land cover dataset created for the Land Cover and Natural Areas Indicator, which combined the U.S. Department of Agriculture Forest Service CALVEG[43] vegetation cover data (2004) with the U.S. Geological Survey's Gap/ LANDFIRE National Terrestrial Ecosystems vegetation and land cover data (2011) to create a map of natural area at the county scale. For more detail, please refer to the Land Cover and Natural Areas Indicator in this report.

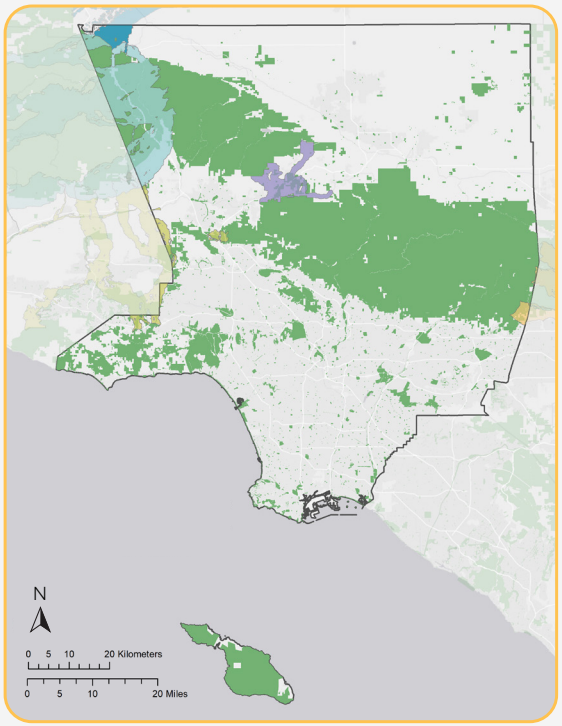
To determine the number and size of distinct habitat patches we consolidated the natural areas layer by setting the aggregation distance to 100 m with a minimum area of 1,000 m^2. This process resulted in a new layer of 1,389 polygons. The aggregation method was repeated with alternate parameters: one representing an aggregation distance of 50 m, and a minimum area of 100 m^2, resulting in a layer with 4,268 polygons, and another representing an aggregation distance of 1 m and no minimum area, resulting in a layer with 10,516 polygons.

Finally, we identified the number of resulting fragments, or patches, of natural area, as well as the mean patch sizes and area covered by the patches of natural area. This tells us approximately how many distinct, isolated areas of habitat exist in L.A. County, and how small or large they tend to be. In the future, we hope to compare this to new land cover data and see fewer distinct patches and larger patch areas within the same or a larger amount of natural area countywide, which could roughly indicate an increase in connectivity.

Street Plants
Photo: Evan Meyer

Fragmentation: Habitat Patches in Los Angeles County*				
Aggregation Distance (m)	Minimum Patch Size (m^2)	Mean Patch Size (km^2)	Total Area (km^2)	Total Number of Patches
100	1000	5.13	7,119	1,389
50	100	1.63	6,964	4,268
1	none	0.65	6,855	10,516
*Based on the previous natural area data analysis, which was comprised of data from CALVeg (2002, 2003, 2009) and USGS GAP Analysis (2011)				

Habitat Linkages (2011) and California Protected Areas (2018) in Los Angeles County



Linkages

- San Gabriel - Castaic
- San Gabriel - San Bernardino
- Santa Monica - Sierra Madre
- Sierra Madre - Castaic
- Tehachapi

- Caliornia Protected Areas
- Los Angeles County

Note: There was no protected area or linkage area on San Clemente Island.

Sources:
South Coast Wildlands; California Protected Areas Database; Los Angeles County Significant Ecological Areas

FINDINGS

- Based on the 2008 study that identified 136,697 acres of missing linkages in L.A. County, 57.4%, or 78,421 acres, fell within the 2018 boundaries of CPAD's protected areas. This is a slight decrease from 2014, when 58%, or 78,943 acres, of the 2008 missing linkages were protected.[1]
- Based on the aggregation distance of one meter and no minimum patch area, there were 10,516 independent patches (fragmented habitat) of natural area in L.A. County. The mean patch size was 0.65 km^2, and the total area covered was 6,855 km^2.
- Based on the aggregation distance of 50 m and a 100 m^2 minimum patch size, there were 4,268 independent patches (fragmented habitat) of natural area in L.A. County. The mean patch size was 1.63 km^2, and the total area covered was 6,964 km^2.
- Based on the aggregation distance of 100 m and a 1,000 m^2 minimum patch size, there were 1,389 independent patches (fragmented habitat) of natural area in L.A. County. The mean patch size was 5.13 km^2, and the total area covered was 7,119 km^2.
- We included the three different calculations because the habitat patch size impacts different species in different ways. For example, small patches are important in urban areas because they allow for the movement of birds, insects and small mammals through the urban center. However, large mammals such as mountain lions require much larger patches of habitat. A generalized fragmentation score such as this does not directly fit a single species' needs. It can only provide a baseline that, when compared to land cover data over time, may help illustrate whether or not large patches of habitat are being broken up.

RECOMMENDATIONS

Data: Update and analyze habitat connectivity data for different taxa groups (i.e., mammals, birds, reptiles, amphibians, fish, insects) at county scale. Update linkage identification regularly based on species needs and development.

Action: Protect all habitat linkages as well as existing large patches of habitat and prevent development that causes further fragmentation.

Policy: Classify remaining and any new-designated missing linkages as protected or Significant Ecological Areas (SEAs) in accordance with the SEA program goal of reducing fragmentation and preserving connectivity.

DATA LIMITATIONS

Evaluating habitat connectivity presents many challenges, including but not limited to the different spatial needs of different species or taxa groups, assessing land cover data for a large area and quantifying spatial cover in a meaningful manner that captures the nuance of habitat quality broadly across species, and accounting for the dynamic nature of the ever-evolving urban landscape. While such analyses are in progress for the L.A. region, no such data was available to us at the appropriate scale at the time of composing this report card. We hope to include this work in future report cards.

In the process of combining the CALVEG and GAP data, they were converted from raster to vector data. While the merged datasets allowed us to develop comprehensive coverage across the county, this data manipulation may have led to classification overlapping that affected the accuracy of counts in coverage of vegetation types, particularly due to different minimum mapping units. For more information on this land cover dataset, please see the Land Cover and Natural Areas Indicator in this report.

Neon Skimmer
Photo: Nurit Katz

BREAKOUT: LIBERTY CANYON WILDLIFE CROSSING

The Liberty Canyon Wildlife Crossing is the proposed freeway crosswalk for mountain lions and other wildlife arching over US-101 (the Ventura Freeway) in Agoura Hills.[44]

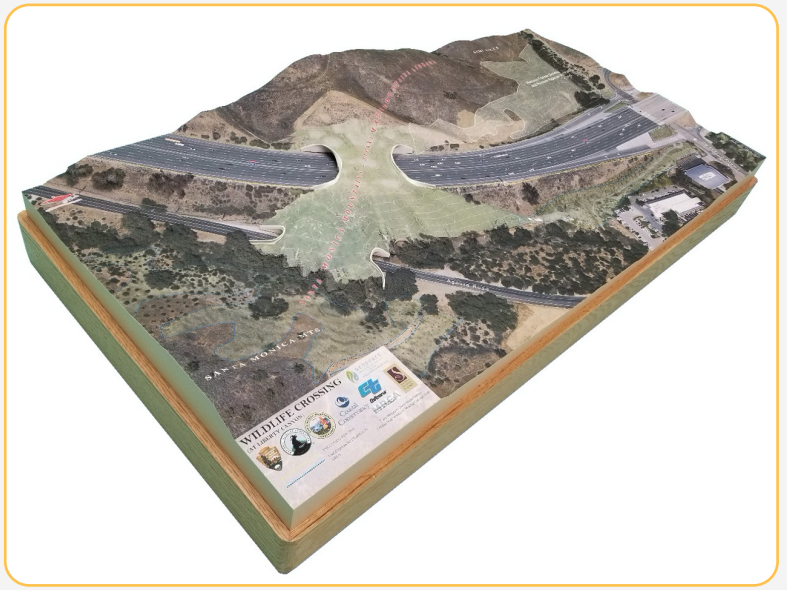
Habitat connectivity allows for the migration necessary to maintain genetic diversity, which supports local populations and makes them more resilient to threats.[45] Bridging habitat patches is particularly critical for large species that require large ranges of habitat, such as the mountain lion. Risk of local extinction is higher for small, isolated populations. Roads act as barriers to population dispersal over an area and genetically isolate populations of carnivores, as exemplified in a 2006 study of bobcats and coyotes over the Ventura Freeway (US-101).[46]

In addition to the ecological benefits, wildlife crossings like the Liberty Canyon project are important for public safety. Wildlife-vehicle collisions are a serious safety hazard, typically resulting in vehicle occupant injury, costly vehicle damage, and the animal's death. A 2008 report to the U.S. Congress found that nationwide, reported wildlife-vehicle collisions were the cause of over 200 human fatalities and over 26,000 injuries each year, in addition to the deaths of an estimated 1-2 million large animals and a nationwide cost of over $8 billion.[47] Constructing wildlife crossings has been determined to be the most effective method of reducing wildlife vehicle collisions, and despite the significant financial investment upfront, have been proven to be more cost-effective than not addressing the problem.[47]

The Liberty Canyon project site was selected after significant study from the National Park Service. Although there are wildlife crossings elsewhere in the U.S. and the world, this project is unprecedented in size at approximately 200 feet long and 165 feet wide: the freeway overpass will stretch over 10 lanes of traffic on the 101 freeway, as well as an access road.[44] More than a dozen mountain lions were struck and killed by vehicle traffic in this area of Highway 101 between 2002 and 2019; thus, a significant number of potential crashes will be mitigated.[48]

This project has seen significant community involvement, with contributions from both public and private sectors. The Liberty Wildlife Corridor Partners is a group of five organizations that share primary responsibility, including the California Department of Transportation (Caltrans), the National Park Service, the Santa Monica Mountains Conservancy and Mountains Recreation and Conservation Authority, the Resource Conservation District of the Santa Monica Mountains, and the National Wildlife Federation (NWF).[44] For this project, 80% of funding comes from private sources, including a donation campaign from the NWF, while the remaining 20% will come from public funding sources.[49] Because the project crosses a freeway, the Caltrans is overseeing design and production.[49] The August 2019 cost estimate for the project was $87 million.[50]

In July 2019, the project entered its final design phase, and at the time was on track to break ground within two years and be completed in 2023.[51] The hope is that it will support the coexistence of wildlife and a megacity, serving as a model for integrated urban sustainability around the world.



Wildlife Crossing at Liberty Canyon
Source: Resource Conservation District of the Santa Monica Mountains.[52]

BREAKOUT: RIM OF THE VALLEY

The Rim of the Valley refers to an area stretching across western L.A. County and into Ventura County along the northern edge of the Santa Monica Mountains National Recreation Area (SMMNRA).

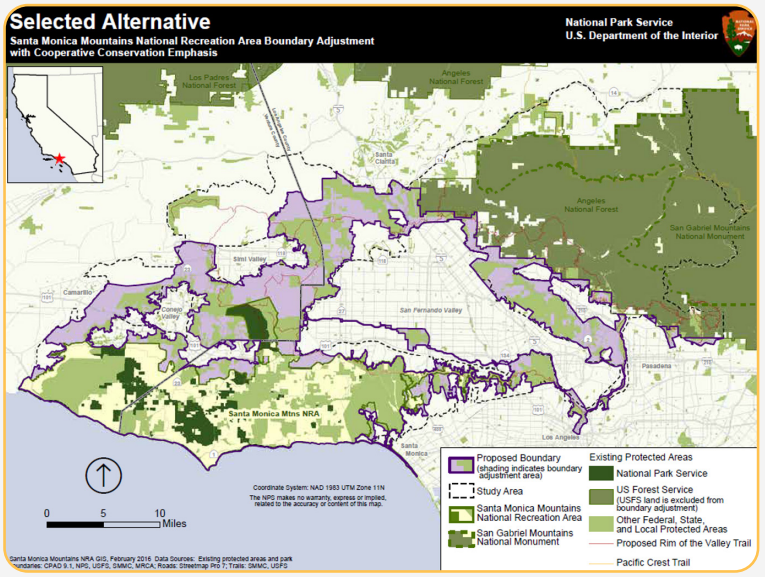
It connects the mountainous borders of the San Fernando, La Crescenta, Santa Clarita, Simi, and Conejo Valleys.[53] It is home to wildlife such as mountain lions, bobcats, foxes, badgers, coyotes, deer, and endangered species such as the California red-legged frog.[53] The area has the potential to serve as a significant habitat corridor for plants and animals, providing connected natural areas that will improve resiliency to climate change.[53] The area also has the potential to provide expanded recreational access to more Angelenos, addressing a significant inequity in the region. As a recreational area, the Rim of the Valley would incorporate extensive trails alongside existing parks and important historical and cultural sites, including Griffith Park, Hansen Dam Recreation Area, Sepulveda Basin, Los Encinos State Historic Park, Debs Park, El Pueblo de Los Angeles Historical Monument, and Los Angeles State Historic Park.[45]

The process of establishing a Rim of the Valley protected unit began approximately 45 years ago with Marjorie "Marge" Feinberg's 1976 master's thesis at California State University, Northridge.[54] Following California's Assembly Bill 1516 (1989-1990), the 1990 Rim of the Valley Trail Corridor Master Plan was prepared by Dangermond & Associates for the Santa Monica Mountains Conservancy and the state of California.[55] It covered plans for the Rim of the Valley Trail, which connects the San Fernando and La Crescenta valleys, among other trails and major wildlife areas. In recognition of Feinberg's effort toward advancing this project, the Rim of the Valley Trail in the Santa Monica Mountains Conservancy was renamed the Marge Feinberg Rim of the Valley Trail in her memory in 2000.[55]

In 2008, Congress passed Representative Adam Schiff's (D-Burbank) Rim of the Valley Corridor Study Act, which commissioned a special National Park Service (NPS) resource study of the Rim of the Valley corridor.[53] The study commenced in 2010, incorporated public input, and released final results in 2016. It recommended that a considerable allocation of the study area be added to the existing SMMNRA.

In 2017, Schiff introduced a bill to add over 191,000 acres of the Rim of the Valley Corridor to the existing 154,000 acres of the SMMNRA; Senators Dianne Feinstein (D-CA) and Kamala Harris (D-CA) introduced companion legislation in the Senate. The bill passed the House with bipartisan support on February 12, 2020, and passed out of the Senate Energy and Natural Resources Committee shortly after on a bipartisan basis.[56]

The new designation for the Rim of the Valley Unit will allow the NPS to participate in land management and provide administrative and maintenance support. It will not place any new requirements or restrictions on current property owners within the area, nor will it allow for land acquisition through eminent domain.[53] As of February 2021 the addition of the Rim of the Valley Unit to the SMMNRA is awaiting legislative finalization. Its inclusion will allow NPS and local partners to collaborate and manage the area to optimize the benefits for both the ecosystem and the community.



Rim of the Valley Corridor Special Resource Study
Source: National Park Service[57]

BREAKOUT: VENTURA COUNTY WILDLIFE CORRIDOR ORDINANCE

Juvenile mountain lion, Santa Monica Mountains
Photo: U.S. National Park Service

Wildlife corridors are natural areas that connect larger areas of habitat, providing wildlife with a pathway through developed areas that would otherwise inhibit their movement and ability to forage for food and propagate.[58]

In an effort to prioritize these crucial connective pieces of habitat, Ventura County passed Ordinances No. 4537 and No. 4539 in March of 2019.[59] These ordinances updated the county's General Plan to designate Habitat Connectivity and Wildlife Corridors (HCWC), Critical Wildlife Passage Areas (CWPA) and established regulations for development within these zones.[59]

The corridors were selected based on the spatial needs of a wide variety of animals and plants, as identified in the 2008 report *South Coast Missing Linkages: A Wildland Network for the South Coast Ecoregion* from the South Coast Wildlands organization.[42,58] The new regulations require private property owners within a HCWC to limit outdoor night lighting; acquire special permission for development near surface water or identified wildlife crossings; limit the amount of wildlife-impermeable fencing; and not plant invasive plants outside of commercial agriculture cropland or commercial nurseries.[58] Within the HCWCs, three areas are designated as CWPAs based on criteria such as current level of development, presence of native habitat, or proximity to important features such as roadway crossings, ridgelines, or bodies of water.[58] In addition to complying with HCWC regulations, property owners in CWPAs must also ensure that any new construction meets compact siting standards.[58] This means that structures and other potential wildlife barriers must be grouped compactly instead of spread throughout the property in order to maintain undeveloped space for wildlife passage.[58]

While these ordinances govern an area beyond the L.A. County focus of this report card, the interconnected nature of open space means that these ordinances affect the connectivity of habitats and wildlife that cross political boundaries. Notably, the same South Coast Wildlands 2008 report provided L.A. County linkage data for this report card's Habitat Connectivity indicator. Furthermore, the ordinances provide a model for enacting similar policies in L.A. County. In 2018, the L.A. Department of City Planning initiated the Wildlife Pilot Study in the eastern Santa Monica Mountains to identify potential Protection Areas for Wildlife (PAWs), which included understanding the state of biotic resources in the area and determining the need for development standards or regulations in the interest of protecting wildlife habitat.[60,61] While the study area is a fraction of the county, it is an important step toward establishing stronger local protections for habitat connectivity.

Both Photos: Malibu Creek
Photo: U.S. National Park Service, Santa Monica Mountains National Recreation Area

INDICATOR

Riparian Habitat Condition

Riparian habitats represent some of Southern California's most critical and vulnerable habitats and support a diverse array of native species.

The term "riparian" refers to vegetation adjacent to, and affected by surface and subsurface hydrologic features such as streams.[62] Riparian habitats are significant because they provide an area of high biological productivity for nesting, nurseries, and foraging for various species of fish, birds, and other animals.[62] Riparian habitats also provide important ecosystem services such as carbon sequestration, flood control in slowing water and reducing erosion, and in replenishing and purifying ground water.[62] These habitats, however, are vulnerable to degradation due to sewage infiltration, clearing of vegetation, introduction of invasive species, and urban development.[63]

Riparian habitats are significant because they provide an area of high biological productivity for nesting, nurseries, and foraging for various species of fish, birds, and other animals.

DATA AND METHODS

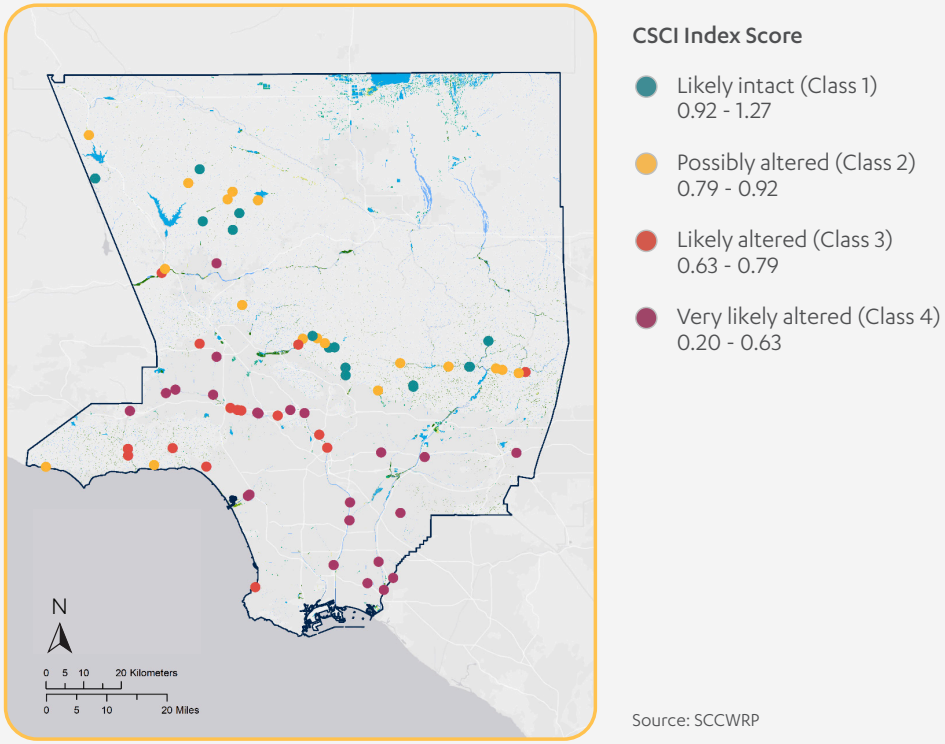
To evaluate county riparian habitat conditions, we looked at the health of wadable, perennial streams. Stream health was assessed using bioassessment and functional assessment scores from 2015-2018 that were calculated by the Stormwater Monitoring Coalition (SMC) and obtained through the Southern California Coastal Water Research Project (SCCWRP). Scores were assessed by watershed (Los Angeles, San Gabriel, Santa Clara, and Santa Monica Bay), and by land use type (agricultural, undeveloped open space, and urban). The following SMC assessments were evaluated in our analyses:

Bioassessments (conducted by SMC using benthic macroinvertebrate (BMI) samples). Scores were expressed in terms of the California Stream Condition Index (CSCI), which uses information regarding macroinvertebrate assemblage, such as ratio of observed and expected taxa and ecological attributes of taxa.[63]

Functional assessments (evaluated by SMC using the California Rapid Assessment Method (CRAM) to determine riparian habitat conditions). CRAM is a standardized methodology that measures riparian wetland condition by evaluating buffer and landscape, hydrologic connectivity, physical structure and biotic structure. Together, these four ecological condition parameters reveal evidence of a stream's capacity to support aquatic life.[63]

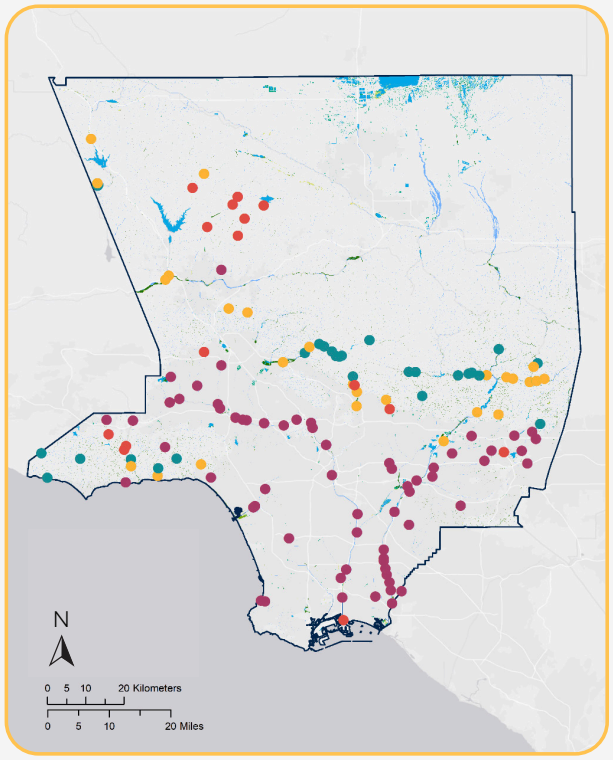
To compare data across parameters our maps and tables show biological conditions distributed among four classes that were based on percentiles compared to a reference condition, allowing for consistency across all parameters. These biological conditions can be interpreted as likely intact (Class 1), possibly altered (Class 2), likely altered (Class 3), or very likely altered (Class 4).[63]

Los Angeles County California Stream Condition Index (CSCI) Scores (2015-2018)



Source: SCCWRP

Los Angeles County California Rapid Assessment Method (CRAM) Scores (2015-2018)



CRAM Index Score

- Likely intact (Class 1) 79 - 86
- Possibly altered (Class 2) 72 - 78
- Likely altered (Class 3) 63 - 71
- Very likely altered (Class 4) 25 - 62

Source: SCCWRP

FINDINGS

- From 2015-2018, the CSCI scores indicated that 57% of stream sites were likely or very likely altered (Class 3 or 4), and only 24% of stream sites were likely intact (Class 1).
- From 2015-2018, the CSCI indicated that the watersheds with the greatest percent of streams likely intact (Class 1) were Santa Clara (39%) and San Gabriel (38%). Only 22% of sites in the Santa Clara watershed were likely or very likely altered (Class 3 or 4) compared to 78% in Santa Monica Bay. None of the assessed Santa Monica Bay streams were likely intact (Class 1).
- Since the 2009-2013 CSCI sampling period, the percentage of stream-miles very likely altered (Class 3 or 4) increased by 12% in the San Gabriel Watershed, remained stable in the Los Angeles Watershed and decreased by 11% in the Santa Monica Watershed and 21% in the Santa Clara Watershed.
- From 2015-2018, the CSCI indicated that 47% of open streams were likely intact (Class 1). In contrast, none of the assessed agricultural or urban streams were likely intact.
- From 2015-2018, the CRAM scores indicated that 54% of stream-miles were likely or very likely altered (Class 3 or 4), and only 24% of stream-miles were likely intact (Class 1).
- From 2015-2018, the CRAM indicated that the watershed with the greatest percentage of streams likely intact (Class 1) was Santa Monica (28%). However, only 8% of sites in the Santa Clara watershed were very likely altered (Class 4) compared to 44% in Santa Monica Bay.
- Since the 2009-2013 CRAM sampling period, the percentage of stream-miles very likely altered (Class 4) increased by 10% in the San Gabriel Watershed, 8% in the Santa Monica Watershed and 5% in the Los Angeles Watershed. However, the Santa Clara Watershed decreased the percentage of stream-miles very likely altered (Class 4) by 3%.
- From 2015-2018, the CRAM indicated that 47% of open streams were likely intact (Class 1). In contrast, only 2% of urban streams were likely intact (Class 1), while no agricultural streams were considered likely intact (Class 1).

RECOMMENDATIONS

Data: Sites should be sampled so that change over time can be easily and accurately assessed. That is, the same sites should be sampled each year, while also selecting sites that are evenly distributed across the county and represent a diversity of ecosystems.

Action: Riparian habitats should be restored across the county to ensure their ecological services are maximized.

Policy: No development within 100 feet of a channelized river/ stream and 300 feet of a soft bed river/ stream.

DATA LIMITATIONS

Assessing the condition of physical habitats comes with challenges: measuring the right variables, calculating meaningful metrics from these variables, comparing these metrics to appropriate references, and ensuring that the metrics are comprehensive enough to characterize habitat degradation.[63]

> Referenced metrics tend to vary widely among reference sites, depending on environmental factors like climate and watershed size.
>
> Sites also may be rejected due to: inaccessibility, non-perenniality, refusal or lack of response from landowners, and non-wadability.

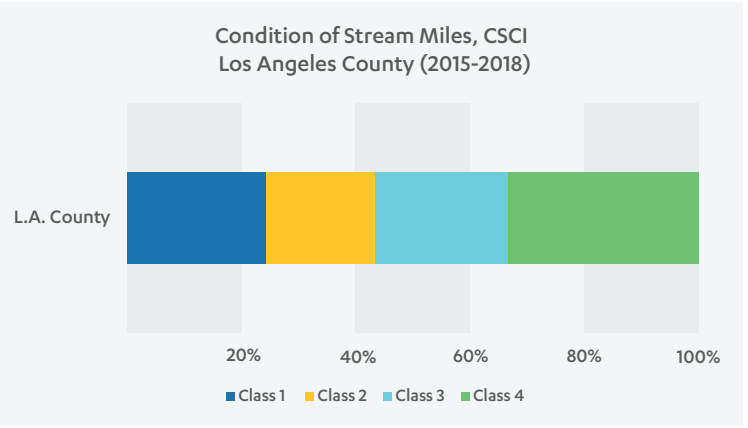
Data obtained from SCCWRP examines perennial wadable streams in Southern California; however, a more comprehensive assessment of coastal watersheds in L.A. County may benefit from including data on non-perennial streams.

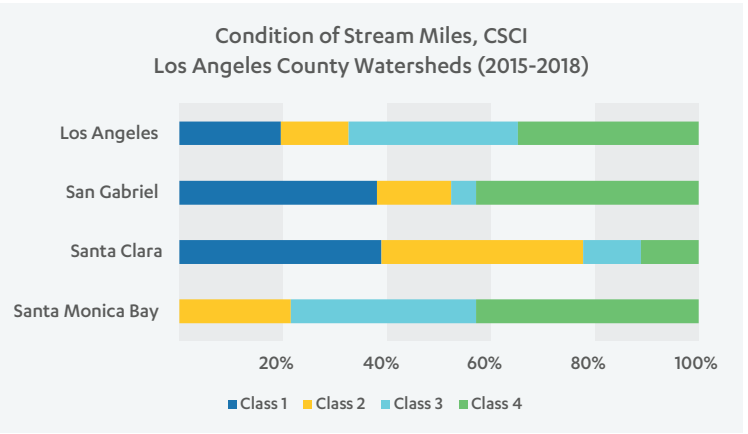
> SCCWRP is currently working on a research program that will include data on non-perennial streams, which make up more than half of Southern California's stream-miles.

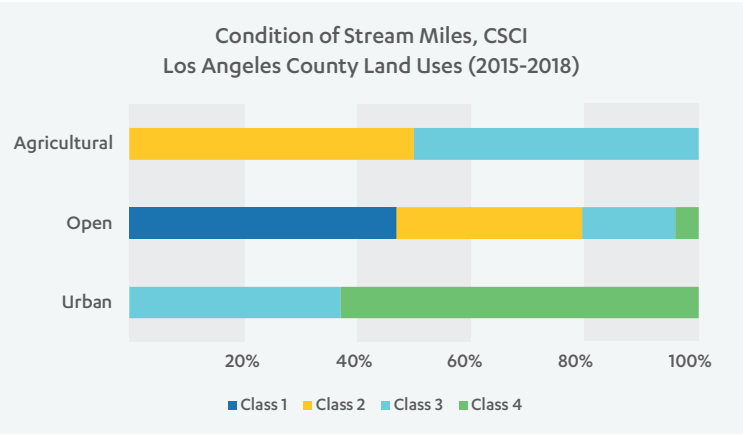
Each class threshold has an associated error rate. For example, 10% of reference sites are in Class 3 or 4, despite the fact that they are, by definition, intact.[63]

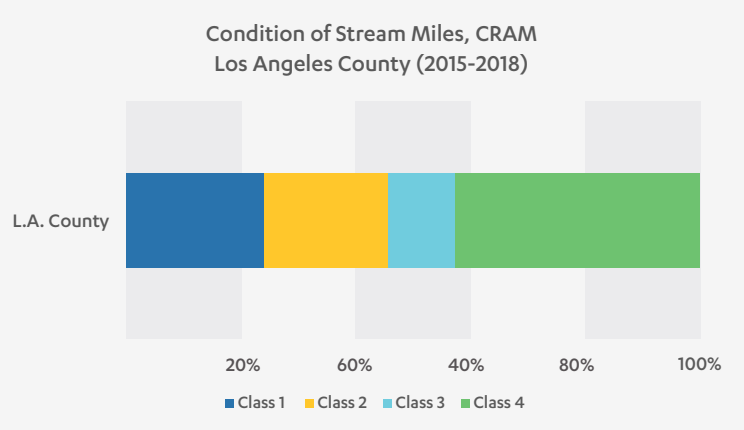
To assess changes over time, we compared CSCI and CRAM scores from 2009-2013 (five years of data) to scores from 2015-2018 (four years of data). This was based on recommendations from SCCWRP and their site monitoring selection that aims to make 5-year segments comparable (2014 was a non-comparable year). 2019 data was not yet available, so there was less data from 2015-2018 available for comparison.

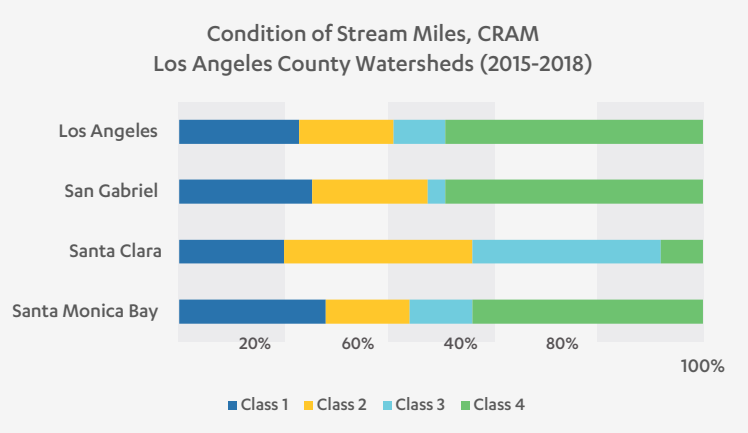
> In particular, the sample size for agricultural streams in L.A. County was smaller in 2015-2018 than in 2009-2013.

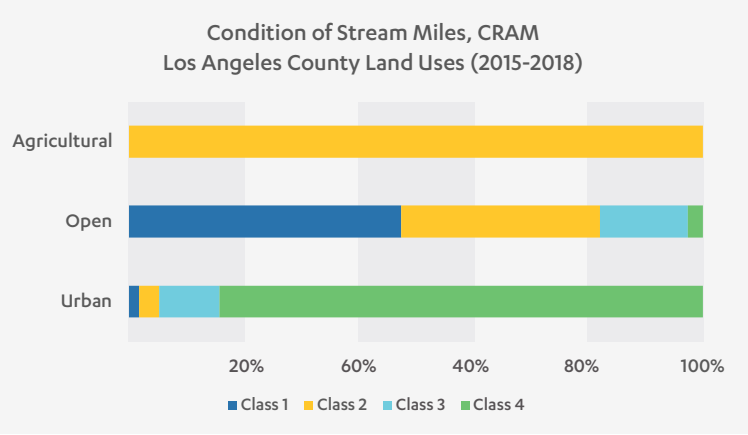












Sycamore Canyon Falls
Photo: U.S. National Park Service, Santa Monica Mountains National Recreation Area

BREAKOUT: HISTORICAL WETLAND HABITAT

Sepulveda Basin
Photo: Nurit Katz

Historically, Southern California was home to a vast network of wetlands, but today only a few remain and a majority of these habitats are severely degraded.

L.A. County experienced a loss of 5,953 acres, or 73%, of coastal wetland area from 8,182 acres in 1850 to 2,229 acres in 2005.[64,65] This degradation from pollution and urban development impairs these critical habitats from providing the ecosystem services that many species, including humans, rely on. According to the Southern California Wetland Recovery Project, there are eight ecosystem services that Wetlands provide, including conservation of native wildlife, carbon storage, improved water quality, flood and shoreline protection, as well as groundwater recharge.[66] These services are instrumental to the health and well-being of our natural lands and our surrounding communities.

To preserve and enhance these ecosystem services, restoration has become a focus for many of these habitats. Los Angeles County has seen some success associated with these efforts, such as the Machado Lake restoration project, which was completed in 2017. Machado Lake's restoration resulted in the removal of 239,000 cubic yards of toxic sediments, including toxins such as DDT and PCBs, from the lake bottom that caused the lake to be an environmental hazard for years.[67,68] The improved water quality has now allowed the park to be fishing friendly, with four newly installed fishing piers and two shoreline-fishing platforms for public use. Biodiversity at Machado Lake is improving and is now home to over 300 species of migratory birds.[69] There are also newly paved pathways, planted trees and native vegetation and pedestrian bridges and benches open to the public. This restoration project is a living example of the benefits to wildlife and the public, and has increased accessibility to natural areas for the surrounding community.

Restoration, however, is not always easy and is often an ongoing commitment. In 1988, Sepulveda Basin's North Reserve was established as a wildlife reserve, and it has required continuous efforts to manage and maintain the wetland. There are annual clean-ups at various locations in Sepulveda Basin that rely on volunteers. In April 2019, Haskell Creek in the Basin's wildlife reserve required a heavy cleaning due to trash pollution, including shopping carts and plastic.[70] Additionally, there are constant efforts by volunteers to remove non-native vegetation and plant native species.[71] Ultimately, restoration is an ongoing process and the cost to benefit ratio is highly variable for each project. Having a model reference restoration site can reduce planning costs, but ongoing monitoring, enforcement and general upkeep can make these projects very resource intensive.[72]

L.A. COUNTY RESTORATION PROJECTS SUMMARY (PAST AND CURRENT PROJECTS)

MACHADO LAKE[73]

Problem: Impaired water body.
Purpose for Restoration: To improve water quality, restore habitat and enhance water conservation.
Cost: $110-million dollars funded by Proposition O.
Mechanism of Restoration: Hydraulic dredging of contaminated sediment, applying bio-layer cap, adding oxygenation and phosphorous removal systems, invasive plant removal and replanting native species.
Status: Construction occurred from March 2014 to June 2017, and project is now complete.

LOS CERRITOS[74,75]

Problem: Impaired water body from oil contamination.
Purpose for Restoration: To reduce the pollution impacts from existing oil production and make more land accessible to the public.
Cost: Estimated at ~$140 million dollars. Will be funded by the state, local government and private agencies.
Mechanism of Restoration: Removal of old oil wells, revegetating the land, creating public access, constructing a visitor's center and restoring wetlands via a mitigation bank.
Status: Ongoing.

MALIBU CREEK[76]

Problem: Man-made barriers that prevent watershed connectivity.
Purpose for Restoration: Create a natural sediment transport regime from creek to shoreline and restore aquatic and riparian habitat connectivity.
Cost: Estimated to cost ~$3.9 million. Funding has yet to be secured.
Mechanism of Restoration: Remove Rindge Dam and other in-stream barriers, such as sediment trapped behind the dam, and re-vegetate area with native riparian species.
Status: Restoration planning completed.

SEPULVEDA BASIN[77]

Problem: Impaired water body with invasive vegetation and pollution from urban development.
Purpose for Restoration: To restore native wildlife habitat, increase biodiversity and improve water quality.
Cost: No documentation. Various restoration and management efforts have occurred since the 1980's. Funding varies, but includes the U.S. Army Corp of Engineers.
Mechanism of Restoration: Sepulveda Basin has been established as a wildlife reserve since 1988. Vegetation management, flood control, and water quality continue to be monitored and managed.
Status: Currently hosting a bird refuge island, extensive native plant re-vegetation and community events like creek clean ups and bird walks.

BALLONA WETLANDS[78]

Problem: Degradation from urban development.
Purpose for Restoration: Create salt marshes and a meandering creek to attract native wildlife and protect coastal communities from floods and rising sea levels.
Cost: Estimated at $182 million for Alternative One. Funded by California Department of Fish and Wildlife, State Coastal Conservancy, and The Bay Foundation.
Mechanism of Restoration: Removal of levees that control water flow to create a sinuous channel, as well as allowing habitat connectivity and adding more trails for people.
Status: The Final Environmental Impact Report was completed in Fall 2019 and the California Department of Fish and Wildlife is preparing the 408 application submittal to the Army Corps of Engineers, including 60% design plans and detailed engineering technical analyses, which should take roughly 6-10 months. The federal Environmental Impact Statement has not yet been issued.

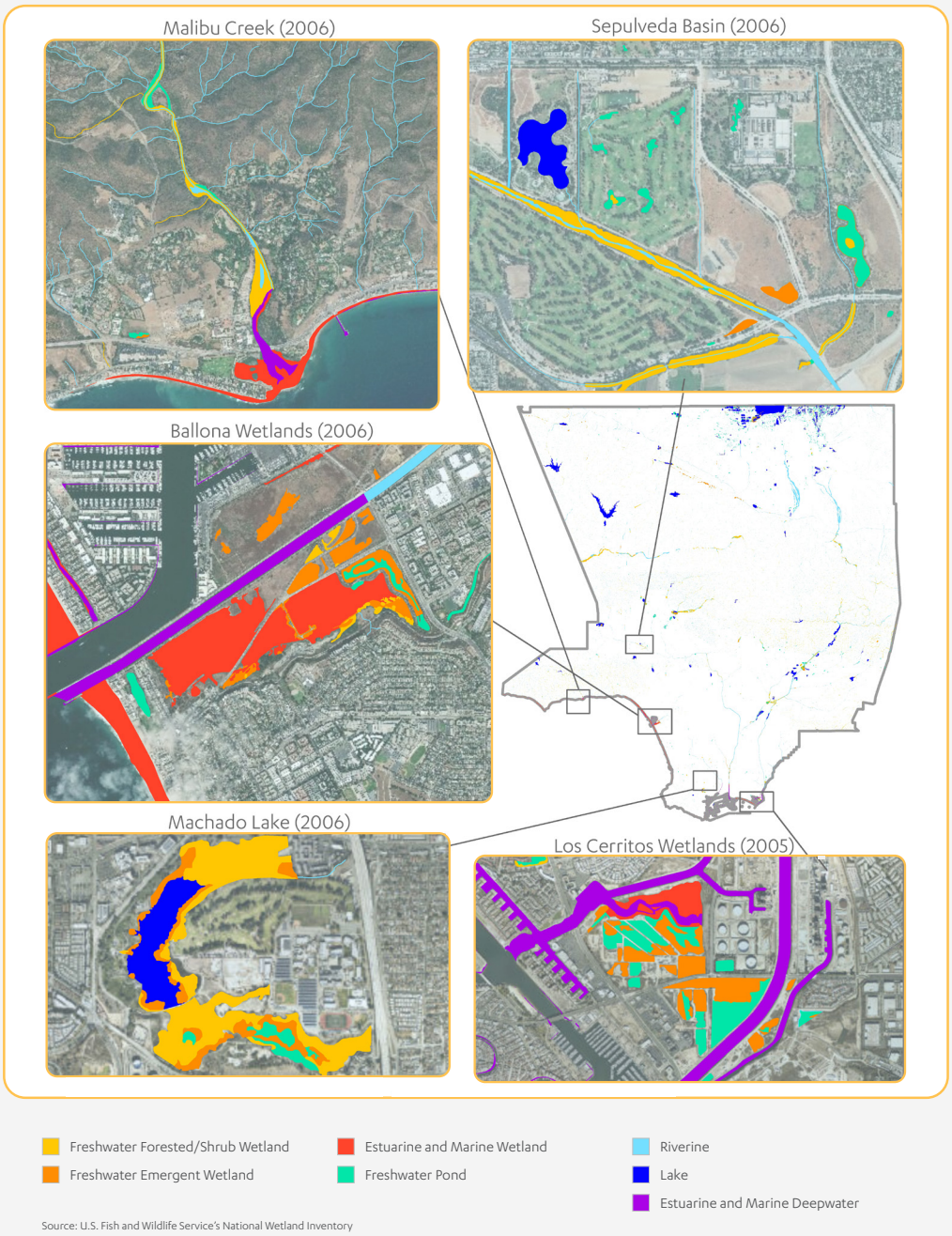
Sepulveda Basin
Photo: Nurit Katz

BREAKOUT: HISTORICAL WETLAND HABITAT

Historical Change in Los Angeles County Wetland Area (1850 and 2005)					
	Total Estuarine Area (acres)		Absolute Change (acres)	% of Total Wetlands in County*	
	1850	2005		1850	2005
Estuarine Unvegetated Wetland	3,118	54	-3,064	38	2
Estuarine Vegetated Wetland	4,087	158	-3,929	50	7
Subtidal Water	976	2,016	1,040	12	90
Total	8,182	2,229	-5,953 (-73%)		

Source: SCCWRP
*Percentages may not add up to 100 due to rounding

Historical Change in Los Angeles County Coastal Wetland Area (2005, 2006)



Source: U.S. Fish and Wildlife Service's National Wetland Inventory

Left: Giant Kelp (*Macrocystis pyrifera*)
Photo: Jesse Rorabaugh, iNaturalist observation 3881415
Right: Diver in Kelp Forest, Channel Islands National Park
Photo: U.S. National Park Service

INDICATOR

Kelp Canopy Coverage

Giant kelp forests are the foundation to some of the most diverse and productive ecosystems on earth.

Along the Central and Southern California coast, giant kelp (*Macrocystis pyrifera*) represent the largest species within rocky subtidal habitats. Their massive floating canopy provides habitat for a variety of invertebrates, fish, marine mammals and birds. Kelp beds typically form on suitable rocky substrate at depths of 20-30 m, although they can form deeper under favorable conditions. They grow at rates of half a meter/ day and can reach lengths of up to 58 m. [79,80]

Kelp canopy coverage displays variable seasonal and interannual dynamics. The canopy is influenced by changes in environmental conditions such as temperature, seasonal wave disturbances, coastal upwelling, sea urchin grazing dynamics, nutrient availability and light penetration.[81] Fluctuations in giant kelp are also related to large-scale changes in ocean climate (El Niño/ La Niña). Despite these natural fluctuations, kelp canopy has been negatively impacted by anthropogenic causes, including sewage discharges, sedimentation, and increases in coastal city populations.[82] Concern over the effects of these impacts on the diversity and productivity of these important ecosystems led to the creation of several kelp research programs.

The canopy is influenced by changes in environmental conditions such as temperature, seasonal wave disturbances, coastal upwelling, sea urchin grazing dynamics, nutrient availability and light penetration.

Los Angeles County Kelp Canopy Coverage (2013-2018) and Comparison to 1911 Historic High*		
Year	**Total Canopy Coverage Area (sq-km)**	**Percent of Total Historic High Coverage**
1911 - Historic High	18.1	-
2013	5.2	29%
2014	3.9	22%
2015	5.2	29%
2016	4.7	26%
2017	4.8	27%
2018	7.7	43%

*The methods used to estimate kelp coverage in the original 1911 survey were different from those used today.

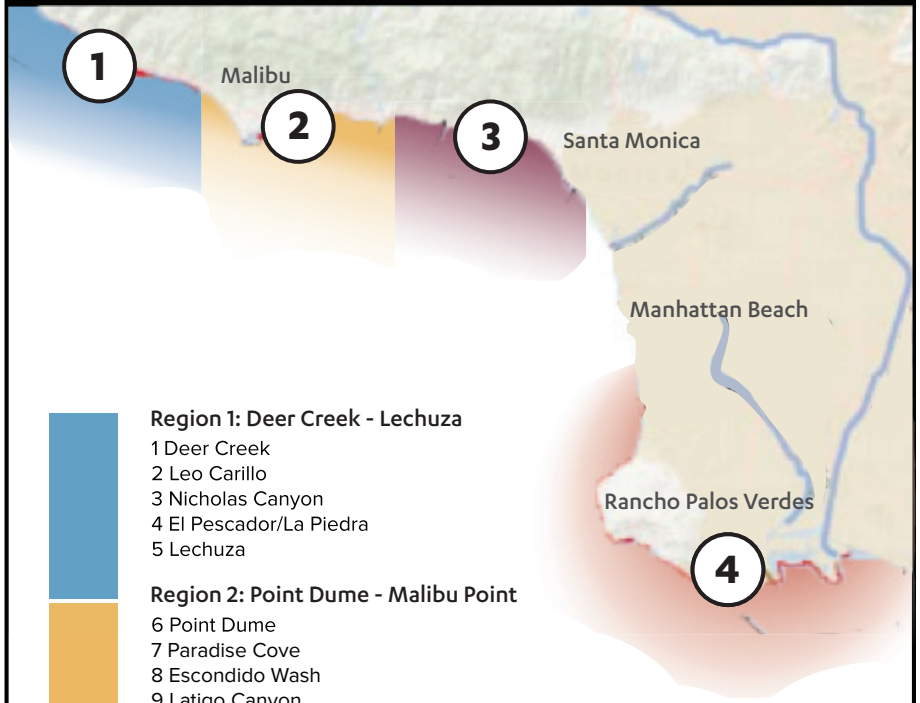
Source: MBC Aquatic Sciences – Status of the Kelp Beds

DATA AND METHODS

We used data from the Central Region Kelp Survey Consortium (CRKSC).[83] The CRKSC was formed in 2003 as a result of regulations from the L.A. Regional Water Quality Control Board. The CRKSC program area extends along the coast from Ventura County south to Orange County. The program was based on the Region Nine Kelp Survey Consortium (RNKSC), which was established in 1983 and extends from Orange County to the U.S./ Mexico Border. Together, the CRKSC and the RNKSC monitor about 220 miles of coastline (divided into Regions) using aerial imaging surveys. Four quarterly imaging surveys are conducted annually for each kelp bed in both regions. The yearly maximum for each kelp bed is used to calculate the total kelp canopy coverage for the year.

To report on change over time, we compared 2018 kelp canopy data to the 2013 data reported in our 2015 Report Card.[1]

Kelp Survey Regions, Los Angeles County (2018)

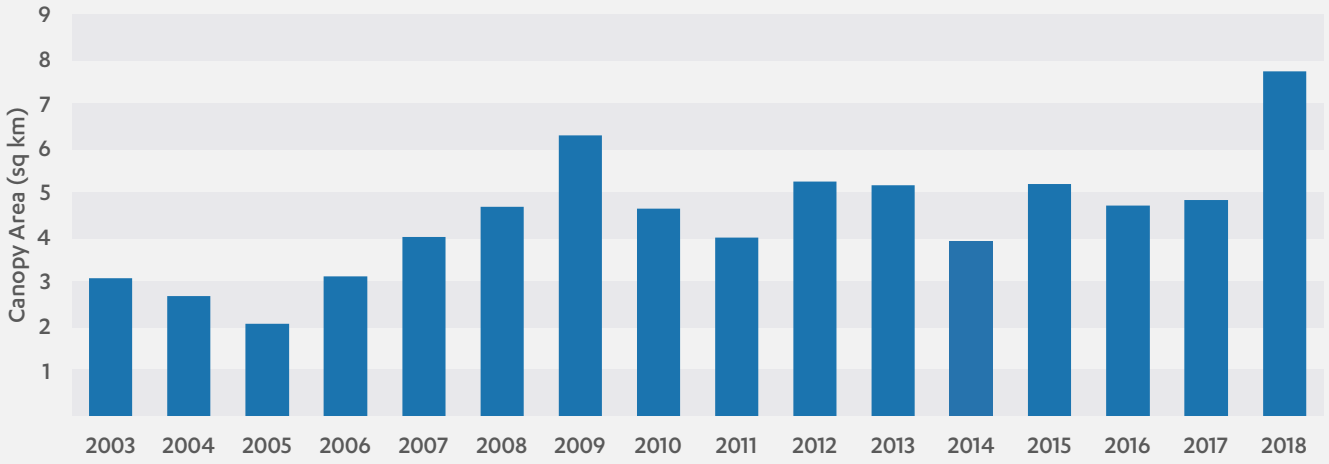


Region 1: Deer Creek - Lechuza
1 Deer Creek
2 Leo Carillo
3 Nicholas Canyon
4 El Pescador/La Piedra
5 Lechuza

Region 2: Point Dume - Malibu Point
6 Point Dume
7 Paradise Cove
8 Escondido Wash
9 Latigo Canyon
10 Puerco/Amarillo
11 Malibu Point

Region 3: La Costa - Sunset
12 La Costa
13 Las Flores
14 Big Rock
15 Las Tunas
16 Topanga
17 Sunset

Region 4: Malaga Cove - POLA/POLB Harbor
18 Malaga Cove-PV Pt. (IV)
19 PV Pt-PT. Vic (III)
20 Pt Vic to Pt Insp (II)
21 Pt Insp to Cabr (I)
22 Cabrillo
23 POLA/POLB Harbor



*No data available for POLA/POLB Harbor until 2005

Sources: MBC Aquatic Sciences –Status of the Kelp Beds

FINDINGS

- In 2018, total kelp canopy coverage in L.A. County was 49% higher than in 2013, increasing from 5.2 sq-km to 7.7 sq-km; the highest increase recorded since annual monitoring began in 2003.
- Region 4 accounted for more than half of the total canopy area in 2018, at 5.3 sq-km. The canopy in this region increased by 82% from 2013 to 2018.
- Regions 2 and 3 experienced a net decrease in canopy coverage from 2013 to 2018. Region 2 declined from 0.90 sq-km to 0.78 sq-km over the five-year period, a 13% decrease. Region 3 had the lowest canopy coverage, declining from 0.12 sq-km in 2013 to 0.046 sq-km in 2018, a 63% decrease.
- Since 2015, three beds in Region 3 disappeared: La Costa, Las Flores, and Topanga. However, these beds returned in 2018.
- Kelp canopy surveys conducted from 2003 to 2018 show that kelp reached its lowest level in 2005 with 2.1 sq-km of canopy coverage. This drop in canopy most likely occurred due to warm waters with poor nutrients, as well as phytoplankton blooms.[84]
- Favorable conditions such as cooler waters with increased nutrients, as well as restoration projects, resulted in a steady canopy increase from 2005-2009. Cooler temperatures, along with stronger upwelling in the first half of 2018 may have accounted for increased canopy in 2018.[85]

RECOMMENDATIONS

Data: Vessel surveys should be conducted to report on kelp health rather than just canopy.

Action: Kelp bed restoration should occur when a bed is lost.

DATA LIMITATIONS

The methods used in the original 1911 survey were different from those used today to estimate kelp coverage. Therefore, historic highs from that time period may not represent an accurate baseline for comparison, and so we report on data from 2003 to today because the methodology has been standardized.

Kelp conditions are commonly linked to regional climate variations (El Niño, La Niña). Loss of kelp during El Niño conditions occurs when warmer-than-average temperatures accompany a reduction in available nutrients. Conversely, surface waters during La Niña conditions enhance kelp growth due to the influx of nutrient-rich bottom waters. However, not all Central Pacific El Niño-Southern Oscillations alter local conditions along the County's coastline. Overall, there are a multitude of factors affecting kelp canopy.

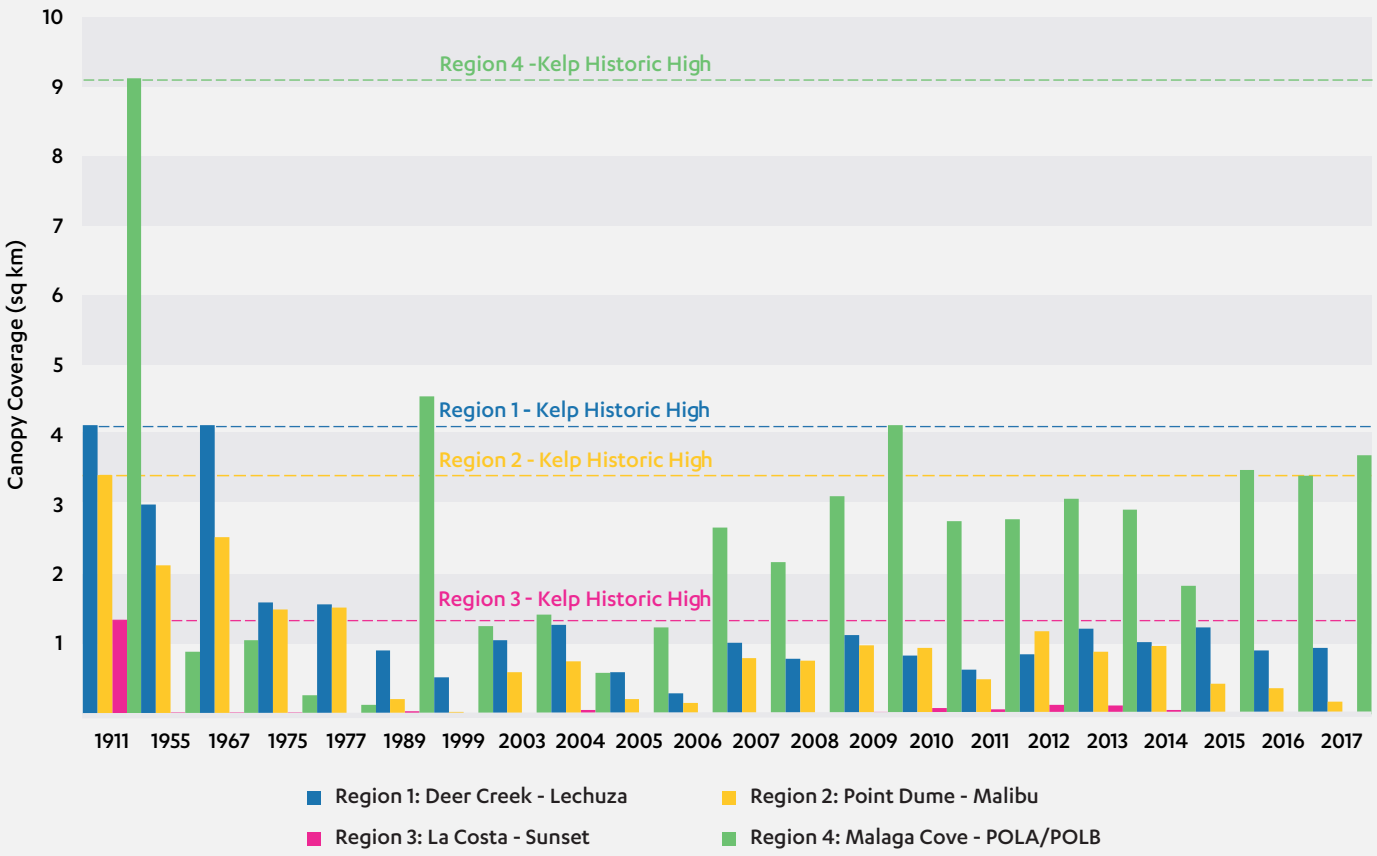
The CRKSC uses the yearly maximum for each kelp bed to calculate the total canopy coverage for a given year. The yearly maximum varies temporally and spatially for each kelp bed, making it difficult to draw a relationship between specific environmental variables and canopy coverage in the CRKSC region at a certain time.

Vessel surveys are only conducted for the RNKSC kelp beds. Therefore, visual observations of surface canopy such as tissue color, sedimentation on blades, and evidence of disease are unavailable for the CRKSC kelp beds along the coast of L.A. County.

There were no data available for kelp beds surrounding the breakwaters of the Ports of L.A. and Long Beach (POLA/ POLB Harbor) until 2005.

Fish in Kelp Forest,
Channel Islands National Park
Photo: U.S. National Park Service

Historic Kelp Canopy Coverage in Los Angeles County by Region (1911-2018*)



No data available for POLA/POLB Harbor from 1911-2014

Note: Historic years are reported when data were available. Measuring methods were standardized in 2003, so historical data comparisons may not be accurate.

Source: MBC Aquatic Sciences –Status of the Kelp Beds

Santa Monica Beach
Photo: U.S. National Park Service, Santa Monica Mountains National Recreation Area

In December 2015 the Urban Coast journal published the Santa Monica Bay National Estuary Program's special State of the Bay report.[86]

This report assesses the progress of and existing challenges to restoration efforts of Santa Monica Bay, and examines numerous sectors including habitat and biodiversity. The authors note several positive trends in the bay relevant to ecosystem health, including successful wetland restoration in Malibu Lagoon, effective implementation of marine protected areas dissuading fishing pressure, and ongoing efforts to protect endangered species (e.g. red-legged frog). However, there are notable areas of concern, such as the ongoing presence of sea star wasting disease, the impacts of invasive species, and habitat areas (e.g. streams) that remain degraded.[87,88] Overall, the progress noted in the report illustrates the positive effects of concerted restoration and management efforts on ecosystem health in Santa Monica Bay. A similarly active approach to ecosystem health in the L.A. area generally may replicate these beneficial outcomes.

BREAKOUT: RESTORATION RECOMMENDATIONS

There are a number of critical habitat sites throughout the region that are highly degraded and in need of restoration.

We consulted with ecological and restoration experts to identify some of those sites and have described them in this section. This list is not exhaustive, nor is it in order of priority, but it does describe some background on these critical habitat sites that we believe have a high potential to provide enhanced ecosystem services for both humans and wildlife.

SANTA CLARA RIVER

The Santa Clara River is the main waterway of the Santa Clara River Watershed in the northern part of L.A. County. It begins above Acton in the San Gabriel Mountains and stretches 84 miles through L.A. and into Ventura County, where it empties water from a watershed area of approximately 1,634 square miles into the Pacific Ocean, making it the largest natural river system remaining in Southern California.[89,90] Historically, it has been home to critical wetland and riparian forest habitats, as well as sixteen federally protected species.[90,91] Local species include willow and Fremont cottonwood trees, and birds like the least Bell's vireo.[92] The river itself provides a critical habitat for the Southern California steelhead trout population, which joined the federal endangered species list in 1997.[93]

This river system faces a multitude of threats, including invasive species like the *Arundo donax*, which can crowd out native plants and the animals that depend on them.[94] There were also two major oil spills to the Santa Clara River in the 1990's, after which the U.S. Fish and Wildlife Service and the California Department of Fish and Wildlife created the Santa Clara River Trustee Council (SCRTC) to conduct restoration projects along the river.[91] Development and water supply issues are also major threats to this river system, including the Freeman Dam, which is a barrier for the endangered southern California steelhead population.[95] In addition, the planned Newhall Ranch residential and commercial development along the river in northern L.A. County is opposed by some environmental and indigenous peoples organizations because of perceived threats to habitat, biodiversity and critical cultural resources currently designated by the county as a Significant Ecological Area (SEA).[96,97]

Santa Clara River
Photo: The Santa Clara River Conservancy, U.S. Fish and Wildlife Service Pacific Southwest Region

Rivers in particular present a management challenge because actions taken upstream impact the waterbody downstream. In addition, The Santa Clara River runs through multiple privately-owned parcels, many of which include agricultural land.[91] Collaborative management across jurisdictions is key to equitable use of this essential resource.

BREAKOUT: RESTORATION RECOMMENDATIONS

California Gnatcatcher
(*Polioptila californica*)
Photo: iNaturalist observation 963482

LAX DUNES

The LAX Airport/ El Segundo Dunes is a 302-acre site owned by Los Angeles World Airports (LAWA) and tucked between the Los Angeles International Airport (LAX) and popular beaches. The airport acquired what was once the Surfridge Estates residential community in this area, which then sat largely abandoned for years. Now, the site is the largest remaining fragment of remnant contiguous coastal dune habitat in southern California, and is considered an Environmentally Sensitive Habitat Area (ESHA).[98,99]

The LAX Dunes are home to 900 different species, including the federally endangered El Segundo Blue Butterfly, which requires a habitat of native seacliff buckwheat plant (*Eriogonum parvifolium*).[100] More recently, burrowing owls were discovered to be wintering there, alongside other native species such as the native beach evening primrose, California gnatcatcher, Blainville's horned lizard and legless lizards.[100]

After substantial restoration efforts by various groups over the preceding decades, LAWA initiated a recent restoration effort in 2012 that involved removing non-native invasive plants and abandoned infrastructure elements, and was supported by volunteer resources from The Bay Foundation (TBF).[98] In 2018, TBF issued an Ecological Monitoring Report, which found that the six-acre dune area is successfully supporting primarily native plants and animals, and thus recommends continuing such efforts in other areas, particularly in the northern section of the dunes site.[98] With demonstrated success in a small portion of the dune area, there is a substantial opportunity to continue restoration efforts throughout the rest of the site.

BALLONA WETLANDS ECOLOGICAL RESERVE

The Ballona Wetlands is part of the last remaining 5% of wetlands in L.A. County, sandwiched between the docks of Marina del Rey and LAX. Historically, there were over 2,000 acres of freshwater, brackish, and salt marshes, as well as mud flats, salt pans, and sand dunes covering the area from Playa Del Rey to Venice Beach and inland to Baldwin Hills.[101] Today, the approximately 577 acres that remain make up the Ballona Wetlands Ecological Reserve (BWER), which is owned by the State of California and managed by the California Department of Fish and Wildlife (CDFW).[101]

Healthy wetlands provide rare and critical habitat with high species diversity; they also help naturally regulate water quality.[102] Species recorded at the site include plants such as sea cliff buckwheat and pickleweed, and animals such as the California legless lizard and the endangered Belding's savannah sparrow.[103] However, monitoring results identify that non-native and invasive plants have taken root in the BWER due to habitat disturbances such as tidal restriction, channelization, sediment dumping, unnatural elevation, farming, and oil drilling.[103] These plants include giant reed, iceplant, mustard, euphorbia, crown daisy and castor bean.[103]

Over the last century, significant changes to the BWER have included creating a channel through the wetlands to convey Ballona Creek to the ocean, which effectively eliminated the estuarine water source for much of the wetland area; and filling in a substantial piece of wetlands in the process of constructing Marina Del Rey, Ballona Creek and surrounding developments.[104] In the 1980's and 1990's, there was a significant push to restore the wetlands, and by 2005, the entire current site was designated as a State Ecological Reserve.[105] After years of working with the State Coastal Conservancy (SCC) and The Bay Foundation (TBF), CDFW released

Left and Right: L.A. River
Photo: Sustainable LA Grand Challenge

the Draft Environmental Impact Report (DEIR) for the Ballona Wetlands Restoration Project in 2017, and the final EIR in December 2019.[106,107] The U.S. Army Corps of Engineers issued a federal Draft Environmental Impact Statement (EIS), although it was not finalized at the same time as the state EIR because of disagreement with the flood control calculations presented by the State.

Next steps for the BWER include the CDFW selecting one of the four proposed alternatives by "certifying" the EIR (one alternative is "no project"); working with the U.S. Army Corps of Engineers to finalize the EIS; receiving input from the Los Angeles County Flood Control District to determine any impact on flood control safety; and gaining approval from other relevant agencies, such as the California Coastal Commission and the Regional Water Quality Control Board.[108,109]

While ecologists are in agreement about the importance of this critical habitat, there is no agreement on the best course of action. While some see the proposed plan as a way to create healthy habitat in an important coastal zone, others oppose the plan because it does not attempt to restore the historical ecology of the site, but rather create a different kind of habitat that would support a different type of ecological community. This illustrates the complex nature of restoration projects in highly disturbed areas, providing yet another example of the importance of preservation of all remaining intact habitat rather than mitigation for all future land use decisions.

OTHER SITES

The three sites described above are far from the only priority restoration sites in L.A. County. Listed below is a selection of other recommended sites identified by UCLA biodiversity experts:

- Baldwin Hills
- Big Tujunga Wash
- San Gabriel Wash (e.g. vic. Santa Fe Dam to vic. Whittier Dam)
- Los Cerritos Wetlands
- Palos Verdes Peninsula
- L.A. River

GRADE: B

Los Angeles County lies within one of only 36 globally recognized "biodiversity hotspots" and is the second most biologically diverse county in the nation.

Our spanning habitats from the islands to the mountains give rise to this biodiversity and allows us to support megafauna such as the mountain lion as well as endemic species like the El Segundo blue and Palos Verdes blue butterflies. However, this biodiversity is under threat from fragmented and degraded habitats, climate change and invasive species. To date, L.A. County is home to 50 endangered or threatened species and has already extirpated 16 species from the region. Protection for the remaining 50 endangered or threatened species as well as all the other native flora and fauna that make our region so unique is critical if we want to preserve these critical natural resources for future generations.

KEY FINDINGS

- **Community science has recorded over 4,200 native species in L.A. County**
- **L.A. County is home to 38 endangered and 12 threatened species**
- **Of the 50 endangered/threatened species, 18 species populations are increasing, 18 are stable and 12 are decreasing (no data for remaining species)**

RECOMMENDATIONS

Data:

- Regional species distribution and population monitoring is needed for all native species. Community science data such as iNaturalist and eBird should be part of the data collection process as well as emerging technologies including environmental DNA and conservation genomics.
- User surveys are needed for iNaturalist and eBird to identify the impact of participation on participant attitudes and determine where outreach efforts need to occur to increase engagement.

Action:

- The species currently listed as threatened or endangered must be monitored to determine whether they become de-listed (positive change) or extirpated (negative change) over time.
- Protect habitats within the county that are home to California's most threatened species, and which are known to be threatened by anthropogenic change. Restore native habitat in natural areas and plant more native vegetation in urban landscapes.
- There should be a set of standards for anthropogenic activity (included recreational and developmental) for all critical habitats (terrestrial, coastal and marine) across the county.
- Enable integration of community science tools such as iNaturalist into K-12 school curricula; increase accessibility of community science tools such as iNaturalist via measures such as language translation and mobile device loan programs.

Policy:

- No further development in critical habitat designated for federally endangered species. All habitat that is deemed essential for the remaining threatened and endangered species should be a priority for restoration efforts. Those species that experienced a population decline in the last 20 years should be made a priority to protect their remaining habitat and restore degraded habitat.
- Prioritize specific and targeted conservation of habitats known to support California Special-status Species, including wetlands, coastal sage scrub, sandy beaches, and others. For migratory species breeding in L.A. County, collaborate with partners to better understand and conserve their migratory pathways and wintering grounds, as preserving L.A. County habitat will do little to protect these species if their full life cycle habitat is not considered.
- The Port of Los Angeles should be regulated to reduce impact on the rocky intertidal systems as well as marine fish and invertebrates.

GRADING

Available data demonstrates promise in achieving near-term biodiversity targets, resulting in the B grade. However, longer-term historical data indicates that 16 species have already been extirpated from the region, which is not reflected in our grade's analysis. To avoid further loss of biodiversity, it is critical for the county to prioritize protection for native wildlife and their habitat.

OURCOUNTY GOALS AND STRATEGIES

Goal 5: Thriving ecosystems, habitats, and biodiversity

Strategy 5A: Increase ecosystem function, habitat quality, and connectivity, and prevent the loss of native biodiversity in the region

Goal 11: Inclusive, transparent, and accountable governance that facilitates participation in sustainability efforts, especially by disempowered communities

Strategy 11B: Promote environmental stewardship and accessible education across different age, income, ethnicity, and language groups

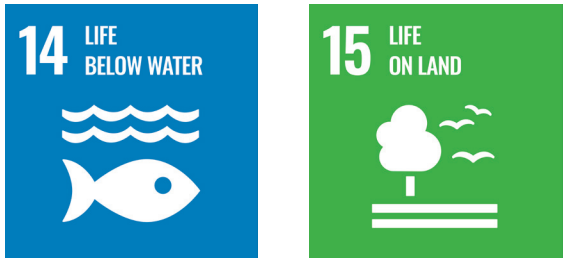
INDICATORS

Native Plant and Animal Diversity, Bird Population Trends, Rocky Intertidal Species Population Trends, Marine Fish and Invertebrate Population Trends, Community Science

BREAKOUTS

California Conservation Genomics Project, Santa Monica Mountains Species Monitoring, UCLA Biophilia Treehouse, CALeDNA

UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS



Coyote
Photo: Citizens for Los Angeles Wildlife (CLAW)

Left: Toyon (*Heteromeles arbutifolia*)
Photo: Debbie Ballentine, iNaturalist, Photo 2900086
Right: Juvenille Cooper's Hawk (*Accipiter cooperii)*
Photo: Santa Monica Mountains National Recreation Area

OurCounty Target:

Ongoing: No loss of native biodiversity

INDICATOR

Native Plant and Animal Diversity

L.A. County is part of the California Floristic Province, which includes approximately 8,000 plant species, and over 3,400 taxa endemic to the region.

Unfortunately, the County has also lost over 70% of its primary vegetation.[110] Some species in the County, like the Palos Verdes blue butterfly, are not found anywhere else in the world. This diversity of species provides many benefits, including air and water purification, pollination, cultural value and general wellbeing. To protect these critical resources we must monitor the health of the species populations over time and protect the habitat that they rely on to survive. However, the vastness of L.A. County's natural habitats and the quantity of species makes it extremely difficult to assess. Thus, researchers have often relied on key indicator species to monitor overall ecosystem health and prioritize areas of conservation.[111]

DATA AND METHODS

The UCLA Biodiversity Expert Council, founded in 2017 and coordinated by SLA GC, was created to provide expert advice to the City of L.A.'s Biodiversity Index assessment.[112] As part of this effort, the expert council identified a total of 100 indicator species and assessed the current conditions of these species. Indicator species were selected and assessed to monitor species population trends and ecosystem health within L.A. County. Although 100 species are nowhere close to the total plant and animal species in the County, these selected species serve as a good representation across key taxa groups. We established our own methodology to categorize these indicator species (see "Indicator Species Methodology" table on the right).

Among all selected species, those labeled with Common Natural Areas and are monitorable, emblematic and indicators of high habitat quality were considered the most ideal indicator species. The list also includes other important species that are less commonly seen, but are critical in determining the quality of a habitat. In addition, some highly common species were included to make the monitoring process more approachable to community science participants.

To assess recorded native biodiversity in L.A. County, we used iNaturalist records from 2018 and organized all species into nine taxonomic groups to get total number of species recorded.[113] Endangered and threatened species were identified that currently occur in L.A. County and were listed as endangered or threatened under the federal Endangered Species Act.[114] The list for all threatened and endangered species came from searching the United States Fish and Wildlife Service (USFWS) 5-year plans by L.A. County as well as cross-listing it with State listed species. Current population statuses for each species were confirmed using online databases of species records, including eBird and iNaturalist for vertebrates, the Consortium of California Herbaria for plants, and UCLA species experts.[113,115,116]

Indicator Species Methodology

Indicator Type	Monitorable	Emblematic	Indicates high quality habitat
Rare, Threatened or Endangered		x	x
Common Natural Areas Species	x	x	x
Common Urban Areas Species	x	x	

Native Species Count for Los Angeles County (2018)

Taxa Group	Total Number of Native Species	Endangered			Threatened		Candidate for Listing	Extirpated
		State Only	Federal Only	Both State & Federal	State Only	Federal Only		
Birds	462	1	1	3	0	2	0	5
Mammals	72	0	8	0	0	1	1	2
Amphibians	16	0	2	0	0	1	0	0
Reptiles	68	0	1	0	0	2	0	2
Insects	1372	0	2	0	0	0	0	1
Arachnids	127	0	0	0	0	0	0	0
Mollusks	355	0	2	0	0	0	0	0
Fish	123	0	3	1	0	0	0	0
Plants	1661	2	2	10	0	6	0	6
TOTAL	4256	3	21	14	0	12	1	16

Data Sources: iNaturalist, U.S. Fish and Wildlife, Consortium of California Herbatia

FINDINGS

- As of 2018, iNaturalist recorded 4,256 native species in L.A. County, with plants and insects being the most diverse taxa groups recorded.
- In 2019, the UCLA Biodiversity Expert Council identified 38 endangered species, 12 threatened species and one candidate species within L.A. County.
- The UCLA Biodiversity Expert Council identified 16 historically native species that have been extirpated, or no longer exist in L.A. County since 1900.
- As of 2018, of the 51 endangered species, the populations of 18 species increased, 18 species remained roughly the same and 12 species decreased since 2000. Three plant species did not have data on population change.

RECOMMENDATIONS

Data: iNaturalist data will continue to show an increase in the number of species reported due to the lack of coverage in some areas and the cryptic nature of some species. Thus, the total number of species should continue to increase, but a more detailed analysis of which species are being recorded over time and where these species are found is an important next step in understanding countywide biodiversity.

Action: The species currently listed as threatened or endangered must be monitored on a reoccurring basis to determine whether they become de-listed (positive change) or extirpated (negative change) over time. In addition, a regional indicator species list should be solidified that prioritizes species that indicate quality habitat and have available data.

Policy: All critical habitat for the remaining threatened and endangered species should be protected against development and should be a priority for restoration efforts. Protection of habitat and restoration of degraded habitat should be a priority for species that experienced a population decline in the last 20 years.

Top: Coast Horned Lizard (*Phrynosoma blainvillii*)
Photo: Santa Monica Mountains National Recreation Area (SMMNRA)
Bottom Left: Striped Skunk (*Mephitis mephitis*)
Photo: SMMNRA
Bottom Right: Hummingbird Sage (*Salvia spathacea*)
Photo: Steve Berardi, iNaturalist, Photo 21890

Threatened and Endangered Species Population Trends (2000-2018)		
Classification	Common Name	Trend since 2000
Designated Plants	Braunton's milk-vetch	Increased
Designated Plants	Nevin's barberry	No change
Designated Plants	Thread-leaved brodiaea	No change
Designated Plants	San Fernando Valley spineflower	Decreased
Designated Plants	Slender-horned spineflower	Decreased
Designated Plants	Agoura Hills dudleya	No Data
Designated Plants	Marcescent dudleya	No Data
Designated Plants	Santa Monica dudleya	No Data
Designated Plants	California Orcutt grass	No change
Designated Plants	Lyon's pentachaeta	Increased
Designated Plants	Spreading navarretia	No change
Designated Plants	San Clemente Island Indian paintbrush	Increased
Designated Plants	Catalina Island mountain-mahogany	No change
Designated Plants	San Clemente Island larkspur	Increased
Designated Plants	Island rush-rose	Increased
Designated Plants	San Clemente Island woodland star	Increased
Designated Plants	San Clemente Island lotus	Increased
Designated Plants	San Clemente Island bush mallow	Increased
Designated Plants	Santa Cruz Island rock cress	No change
Gastropods	Black abalone	Increased
Gastropods	White abalone	Decreased
Crustaceans	Vernal pool fairy shrimp	No change
Insects	El Segundo blue butterfly	No change
Insects	Palos Verdes blue butterfly	No change
Fishes	Santa Ana sucker	No change
Fishes	Tidewater goby	Decreased
Fishes	Santa Ana sucker	No change
Fishes	Tidewater goby	Decreased
Fishes	Unarmored threespine stickleback	No change
Fishes	Southern steelhead	Decreased
Amphibians	Arroyo toad	No change
Amphibians	Southern mountain yellow-legged frog	No change
Amphibians	California red-legged frog	Decreased
Reptiles	Pacific leatherback sea turtle	Decreased
Reptiles	Green sea turtle	No change
Reptiles	Desert tortoise	Decreased
Birds	California condor	Increased
Birds	Bald eagle	Increased
Birds	California least tern	Increased
Bird	Western snowy plover	Decreased
Birds	California spotted owl	Decreased
Birds	San Clemente loggerhead shrike	Increased
Birds	Least Bell's vireo	Increased
Bird	Coastal California gnatcatcher	No change
Mammals	Desert bighorn sheep	Decreased
Mammals	Santa Catalina Island fox	Increased
Mammals	Mojave ground squirrel	No change
Mammals	Sei whale	Increased
Mammals	Blue whale	No change
Mammals	Fin whale	Increased
Mammals	Humpback whale	No change
Mammals	Killer whale	Decreased
Mammals	Sperm whale	Increased
Data Sources: eBird, iNaturalist, Consortium of California Herbaria and UCLA species experts		

DATA LIMITATIONS

Data from iNaturalist relies on reporting from volunteers (community scientists). This fact unavoidably skewed our results because they are solely based on what people chose to report and were able to observe. Thus, this total number of native species represents the baseline for all species, but we expect there are far more species and individuals than what these data represents.

BREAKOUT: CALIFORNIA CONSERVATION GENOMICS PROJECT

To address the current biodiversity crisis, the California Conservation Genomics Project (CCGP) is engaging leading experts in genomics and conservation science to rapidly sample and study the genetics of species that span the breadth of California's native species and ecosystems.

The $12 million, state-funded project is creating an unparalleled body of knowledge that will enable policy makers and natural resource managers to make sound decisions that help species survive as climate changes continue. The data and resulting geospatial analyses will inform the optimal siting of alternative energy facilities to least impact ecosystem health, identify landscapes that harbor the genetic diversity needed for climate resilience in endangered species, and produce genetic roadmaps for individual species and broader ecosystem protection and recovery. Researchers and experts from all ten University of California campuses are involved in this research partnership, which is managed by UCLA.

All funded CCGP projects are listed on the CCGP website.[117] Some notable studied species include commercially and recreationally-exploited marine species (e.g. Dungeness crab, California grunion), California's only native freshwater turtle (the western pond turtle), and our state bird, the California quail.

Over the next several months, researchers will create reference genomes for focal species. These gold-standard genomes will serve as the genetic foundations to then assemble and analyze the ~20,000 resequenced genomes that will result from the CCGP. The CCGP will make these reference genomes publicly available as a free resource for conservation and resource managers, as well as the broader scientific community.

California Quail (*Callipepla californica*)
Photo: dblanco, iNaturalist observation 54702099

BREAKOUT: SANTA MONICA MOUNTAINS SPECIES RESTORATION PROGRAM

At 154,095 acres, the Santa Monica Mountains National Recreation Area is the world's largest urban national park.

Since its establishment in 1978, the park has grown to include many individual parks and protected areas in the greater L.A. area through partnerships with state and local agencies, universities, and other groups.[118]

Combined, these protected spaces preserve unique mountain, canyon, beach, and rocky shoreline habitats for approximately 500 mammal, bird, reptile, and amphibian species. It is also one of the best examples of a Mediterranean ecosystem in the world.

Combined, these protected spaces preserve unique mountain, canyon, beach, and rocky shoreline habitats for approximately 500 mammal, bird, reptile, and amphibian species.

California Red-Legged Frog
Photo: National Park Service

California Red-Legged Frog (*Rana draytonii*)

The California Red-Legged Frog population was once considered the most common native species in the Western United States.[119]

By 2014, however, populations of the Red-Legged Frog had been extirpated from 70% of their home range due to urbanization and are now considered a federally endangered species.[119,120] In response, the National Park Service and the U.S Fish and Wildlife Service created a plan in 2014 to reintroduce the California Red-Legged Frogs to the Santa Monica Mountains using an adjacent source population from the Simi Hills. By 2017, researchers found evidence of successful breeding of the newly introduced populations.[119] Nonetheless, the road to restoration has not been easy due to the Woolsey Fire in November 2018, which impacted three out of four breeding streams by fire debris flows, prompting the disappearance of all the prior existing breeding pools.[121] Hope for the Santa Monica Mountains population is still strong, however, because Simi Hills frog populations are recovered and can continue to contribute to restoration efforts. Relocations have been ongoing and monitoring of populations occur throughout the year.

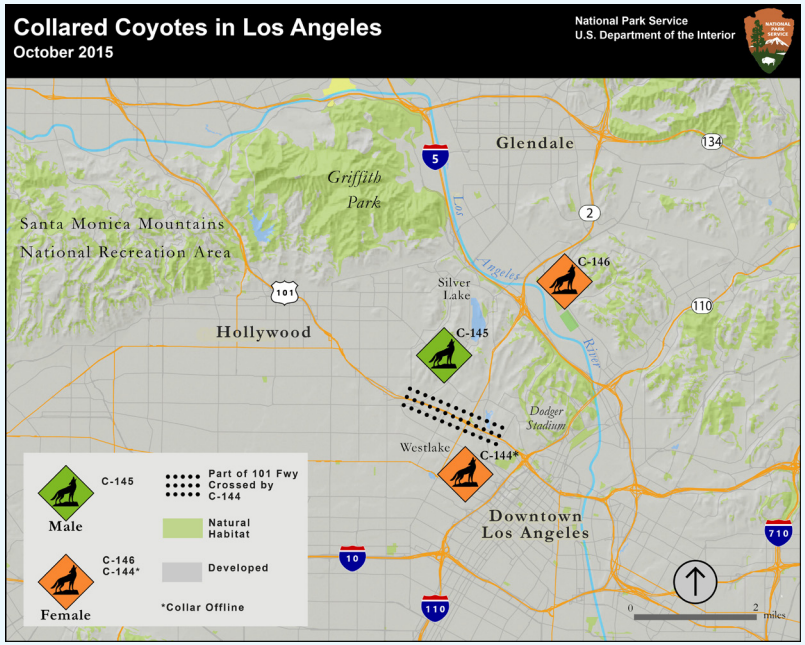
BREAKOUT: SANTA MONICA MOUNTAINS SPECIES RESTORATION PROGRAM

Mountain Lion (*Puma concolor*)

Los Angeles is one of two megacities in the world that is home to a large cat population.[122]

Large cats rarely inhabit megacities because they are large-ranging species and are susceptible to urbanization and fragmentation. The National Park Service began studying the mountain lions of the Santa Monica Mountains in 2002, leading to 75 tagged pumas as of August 2019. Currently, mountain lion populations in the Santa Monica Mountains are stable, with healthy rates of survival and reproduction.[122] However, there are concerns for the long-term survival of puma populations as studies have revealed that habitat fragmentation has led to a variety of issues including low genetic diversity, death by vehicle collisions, and intraspecific strife.[122,123] Lethal poisoning by rodenticides is also a major concern. Efforts to regulate the sale and use of rodenticides, combined with the construction of the wildlife crossing over the 101 freeway give researchers hope that the local mountain lion population will be able to recover.

Above: Mountain Lion Road Mortalities
Source: National Park Service
Below: P-23 Crossing Road
Photo: National Park Service



Above: C-144 Pups with L.A. Backdrop
Photo: National Park Service
Below: Collared Coyotes in L.A.
Source: National Park Service

Coyote (*Canis latrans*)

Coyotes are one of the few large mammal species that have adapted to increased urbanization.

National Park Service researchers have found evidence of their distribution across the county including in downtown L.A. – not as transients but as residents of the urban area. GPS data have also revealed that at least some individuals are able to successfully cross the 101 Freeway.[124] However, now that we know coyotes are living among high human densities, it is imperative that human-wildlife conflict is minimized. Coyotes are wild animals that are typically fearful of humans, but can pose a threat to domestic pets. A National Park Service study found that coyote scat samples showed that more coyotes in urban areas (20%) are eating domestic cats than those in more natural areas (4%).[125] Apart from a threat to domestic pets, habituated coyotes can lose wariness of humans that will prompt increased visits to urban areas and yards, often leading to lethal measures to remedy the problem. Therefore, when coexisting with coyotes, there are various ways that people can reduce the human-wildlife conflict and keep coyotes wild.

TIPS ON HOW TO REDUCE COYOTE HABITUATION TO HUMANS:[126]

- Remove food attractants from yards. This includes properly securing trash cans, picking up fruit from trees, enclosing any vegetable gardens, and keeping pet food indoors or storing it away at night.
- Keep pets safe by bringing them in at nighttime.
- Yell, chase, use loud noises to scare away coyotes from neighborhoods to maintain their fear of humans.
- Remove any cover and hiding places where a coyote could den. This includes thick vegetation and debris piles.

BREAKOUT: SANTA MONICA MOUNTAINS SPECIES RESTORATION PROGRAM

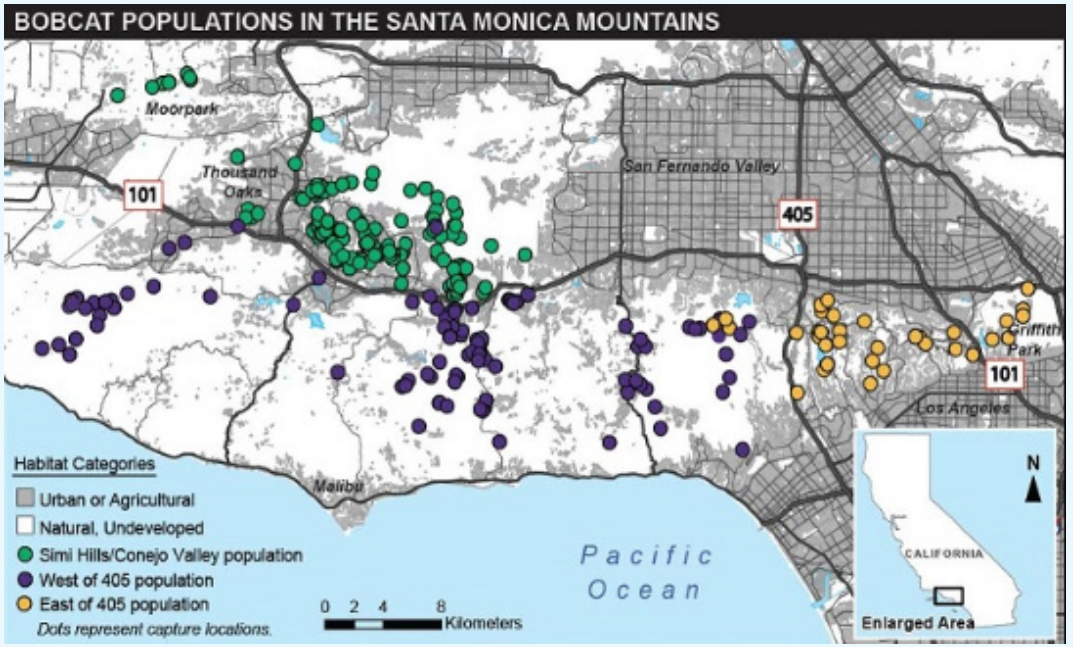
Bobcats (*Lynx rufus*)

The National Park Service (NPS) has been continuously studying and radio-tracking bobcats in targeted areas since 1996, making it one of the longest bobcat studies ever.

Prior to 2002, bobcats had relatively high survival rates in the study area, but that has changed over the last 16 years.[127] In the spring of 2002, the NPS began to witness a disease epidemic in urban bobcats, and their numbers decreased dramatically in the following months and years. Animals were dying with severe infections of notoedtric mange. In addition to having mange disease, all of these individuals tested positive for exposure to one or more of the anticoagulant chemicals commonly found in some types of rodenticides, with most having relatively high levels of the compounds. Bobcats generally do not die directly from these poisons, but rather tend to ingest sub-lethal levels of the chemicals, which over time causes immune system dysfunction and makes them more susceptible to other diseases, such as mange.[127]

Bobcats are also impacted by urbanization and loss of habitat. Based on the NPS's long-term study of local bobcats, males require about three square miles of space and females 1.5 square miles. Of the more than 350 bobcats sampled from 1996-2012, the eastern population comprising the hillside communities east of the 405, including the Hollywood Hills and Griffith Park, had the lowest genetic diversity in the Santa Monica Mountains.

The largest contiguous population of bobcats is found west of the 405 Freeways, from Topanga to Point Mugu. Another distinct population inhabits the relatively small, highly urbanized stretch of the mountains east of the 405 that includes the Hollywood Hills and Griffith Park. The open space patches north of the 101 Freeway that comprise the Simi Hills and the Conejo Valley are home to the third genetically distinct population of bobcats in the region.[127]



Above: Santa Monica Mountains Bobcat Populations
Source: National Park Service
Below: National Park Service Tagged Bobcat
Photo: National Park Service, Niki Yoblonski

Left: Black-Crowned Night-Heron (*Nycticorax nycticorax*)
Photo: W. Tryan, iNaturalist Photo 12941937
Right: Red-winged Blackbird (*Agelaius phoeniceus*)
Photo: Don Loarie, iNaturalist Photo 28025

OurCounty Target:

Ongoing: No loss of native biodiversity

INDICATOR

Bird Population Trends

Bird population data not only suggest information about the health of a particular taxa group, but they also can indicate changes in the overall health of local ecosystems.

Birds can be effective surrogates for measuring habitat quality because their populations are measurable and are ubiquitously distributed across a habitat.[128] In addition, because birdwatching has long been a cultural pastime, and because birds have long been a topic of interest to scientists and enthusiasts, there are ample academic and community datasets available to help inform estimates of avian biodiversity and abundance.

Birds can be effective surrogates for measuring habitat quality because their populations are measurable and are ubiquitously distributed across a habitat.

DATA AND METHODS

We analyzed 35 species of birds that comprise a range of ecological guilds and local abundance levels, which we refer to as "focal species." These species were identified as part of the UCLA Sustainable LA Grand Challenge's biodiversity index methodology (see "Indicator Species Methodology" table) by one or more categories: "Rare, Threatened or Endangered," "Common-Natural Area," and "Common-Urban." Our final list represents a mix of birds found in a variety of natural and modified habitats across the L.A. Basin (coastal-slope lowlands of L.A. County), including native scrub, native and non-native woodland, coastal saltmarsh, sandy beach, freshwater wetlands, and urban/ developed habitats. It excludes species found primarily in the desert and mountain areas that rarely range into the urbanized coastal lowlands. Please refer to the Appendix for additional detail on focal species selection.

Indicator Species Methodology

Indicator Type	Monitorable	Emblematic	Indicates high quality habitat
Rare, Threatened or Endangered		x	x
Common Natural Areas Species	x	x	x
Common Urban Areas Species	x	x	

Three data sources were used to estimate the population trends of bird species common within urban L.A. County: eBird, the Breeding Bird Survey, and the Christmas Bird Count.

eBird is an online community-science driven database launched in 2002 that allows amateur and expert bird watchers alike to record and share their observations of individual bird sightings.[129] It is managed by the Cornell Lab of Ornithology, but is available worldwide. Over 100 million bird sightings are recorded in the database each year. We requested and downloaded the compiled basic eBird data set for L.A. County. We extracted data on bird observations starting in the year 2007 and ending in 2019 (the last year for which the data was verified).

The great increase in the popularity of eBird during our study period (2007-2019) proved to be a confounding factor in our analysis (i.e. are there more birds, or simply more observers?), so we adjusted for this increase of observations by first calculating an "annual ratio of counts" for each focal species (number of focal species observed per year: total number of all species per year), rather than using the raw number of observations. We then averaged this ratio across the first four years of recorded data (2007-2010) for each of the 35 focal species to calculate a "predicted" ratio of counts, which represented background level of abundance/ detection. We then compared the predicted number of individuals to the observed population for each species by averaging these predicted/observed ratios for the last three years of data collection (2017-2019) to avoid any year-specific aberrations in particular species. These last three years comprised our "observed" data. We then plotted the difference between observed and predicted ratios for each focal species (see "Percent Difference Between Observed and Predicted Population Counts of Select Bird Species in L.A. County" figure), which identifies species that are currently reported either above or below their predicted levels, based on their abundance during the previous period 2007-2010.

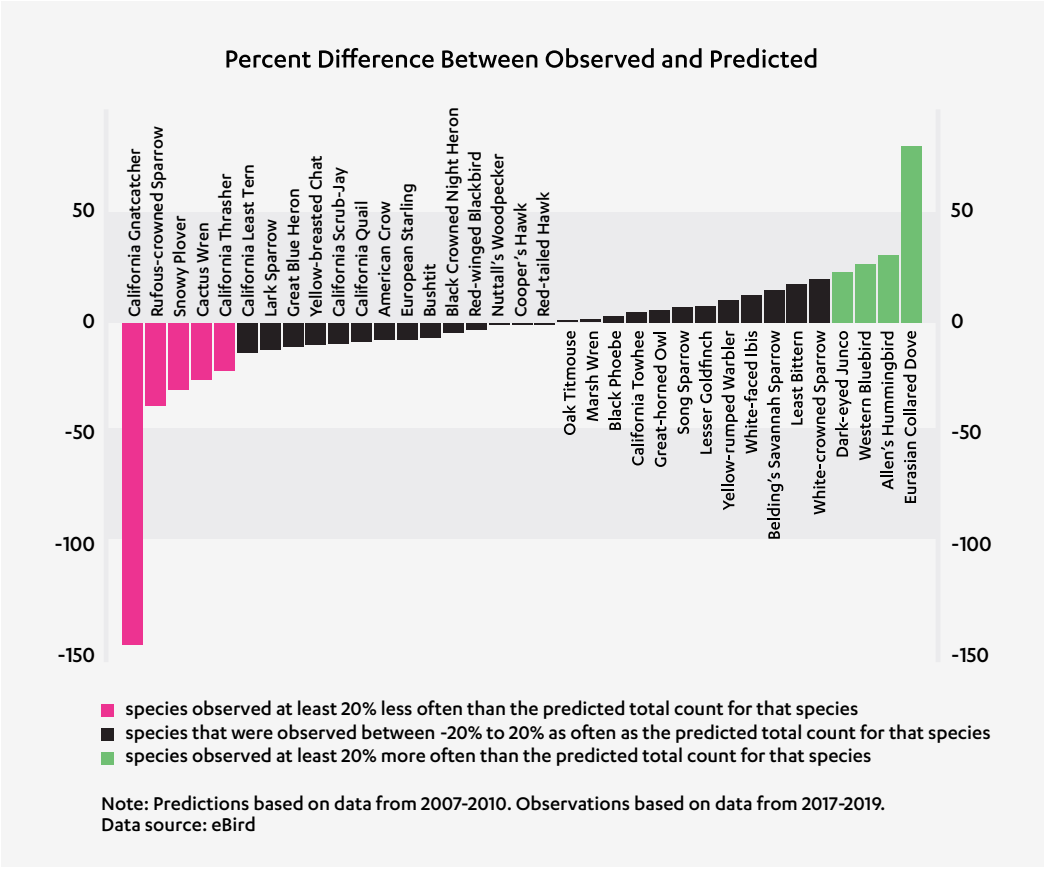
We categorized the discrepancy between observed and predicted sightings of each species into three broad classes: those that were observed **much less often** than predicted, those that were observed **about as often** as would be predicted, or those species that were observed **much more frequently** than predicted.

To further validate these findings, we compared these trends with those reported from two independent datasets that consisted of records collected as part of the national Breeding Bird Survey (BBS)[130,131] and the Christmas Bird Count (CBC)[132] in L.A. The advantages of these data are that they are standardized across routes, effort is more consistent across areas and years, and long-term regression trends can be quantitatively compared to historical estimates. A disadvantage of these data are that in some cases not enough sightings have been made for certain species along certain BBS route or in certain CBC circles to extract meaningful trends. In addition, these programs make observations only in particular parts of the county (e.g. there is only one BBS routes in the southern parts of L.A. County) and during specific times of the year (e.g. there are no CBC counts performed during the summer). Nevertheless, we report, where available, both of these trends (BBS and CBC) along with our estimated trends from eBird data, for each of our 35 focal species for which sufficient data were available.

Finally, as a spatial visualization of bird species distributions throughout L.A. County, two additional maps created for the L.A. Biodiversity Atlas are presented. The first map used data from L.A. Audubon's 2016 Los Angeles County Breeding Bird Survey to map bird species richness (or the number of different bird species present) across L.A. County. The second map represented species richness specifically for bird species of conservation concern including endangered, threatened and sensitive bird species.

FINDINGS

- Of the 35 species examined, five species counts were observed at a much lower rate than would be predicted (at least 20% less than the predicted count), four species were observed much higher than predicted (at least 20% more than the predicted count), and 26 species were observed about as often as predicted.
- The largest declines in observed birds included those species that rely on native, unaltered chaparral and scrubland habitats, such as Cactus Wren, California Gnatcatcher, Rufous-crowned Sparrow, and California Thrasher, suggesting that resident scrubland birds may be declining in the study area. Two of these are considered Special-status Species in the state: the California Gnatcatcher, and the coastal population of Cactus Wren. Our analysis did not differentiate between coastal and desert populations of Cactus Wren, but both may be imperiled, the former by low population size and drought, and the latter by recurrent wildfire and ongoing development impacting Joshua Tree woodland.
- The Snowy Plover was also observed at a rate below that predicted, and it too favors a rare habitat type: sandy, undisturbed beaches.
- Increases in observation of species above predictions were highest in species that are able to utilize human-altered landscapes and urban areas. These include the Dark-eyed Junco, the Western Bluebird, Allen's Hummingbird, and the invasive Eurasian Collared-Dove.
- Several species were observed to be relatively stable in their population trends over the past 12 years, including familiar species like Red-tailed Hawk and Black Phoebe.
- Overall, bird species richness was highest in known natural areas, including the Angeles Forest and the Santa Monica Mountains However, bird species of conservation concern were found in smaller pockets in the southeastern section of the Angeles Forest and near the northern edge of the county.



Note: Predictions based on data from 2007-2010. Observations based on data from 2017-2019.
Data source: eBird

RECOMMENDATIONS

Data: Continue collection of seasonal distribution and abundance data on focal (and other) species, in addition to routine and scientific observations across the major ecoregions within L.A. County. Establish new BBS routes in urban and peri-urban areas to cover major regions within the county that are not covered by current routes. Continue monitoring and analyzing eBird and other community-science data, which will allow for the baseline estimates presented in this report to be tracked and compared with future yearly or seasonal estimates. Monitor California's threatened ("Special-status") species within the county in habitats known to be at risk from anthropogenic change.

Action: Promote eBird initiatives and other community-science programs to continue observation of bird populations, baselines, and future trends. Specific support should be provided for BBS/ Audubon initiatives in L.A. County. Protect habitats within the county that are home to California's most threatened species, and which are known to be threatened by anthropogenic change. Plant more native vegetation in urban landscapes to support critical habitat.

Policy: Prioritize specific and targeted conservation of habitats known to support California Special-status Species, including wetlands, coastal sage scrub, sandy beaches, and others. For migratory species breeding in L.A. County, collaborate with partners to better understand and conserve their migratory pathways and wintering grounds, as preserving L.A. County habitat will do little to protect these species if their full life cycle habitat is not considered.

DATA LIMITATIONS

One fallibility of community science data is the observing public's proclivity for recording certain species over others, despite what may be present. Simply put, it is easier to observe an American Crow compared to a California Thrasher. Yet, this can work the other way too; the American Crow is an example of a species that is generally common in urban areas and easily recognizable, which could also mean it does not generate enough interest from birders to be entered into eBird upon each sighting. This indicates a larger drawback to a generalized database like eBird: while it is extremely useful for centralizing data collection, it lacks the benefit of standardized efforts such as BBS data collection or BioBlitzes, when observers are specifically looking for and recording included species. However, because we compare species trends only within each species, as long as the proclivity to observe a particular species has not changed, our estimates should be representative of general trends.

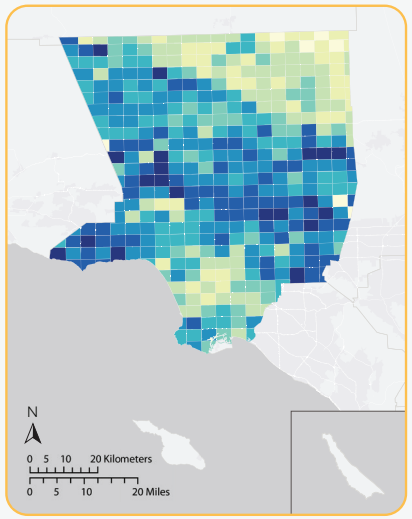
California Quail (*Callipepla californica*)
Photo: Anne Parsons, iNaturalist Photo 11856236

Several species were not recorded in sufficient numbers to properly analyze, so would need to be surveyed through other methods to ascertain trends (if possible). These were noted as "NA" in the Avian Species Trends table.

eBird sightings are not validated, so we cannot assume that all records are correct; however, we made an effort to only include as focal species those that are relatively easy to identify (when detected), and to not include confusing species, particularly when they co-occur with a more common one (e.g., we include Anna's Hummingbird, which is common, and not the similar Costa's Hummingbird, which is relatively scarce).

eBird data is dependent on observer density; that is, the number of observations recorded in a given area depends on how many observers are there. As is true of all analyses, the more data recorded for a given species, the more confidence we have in the count's accuracy.

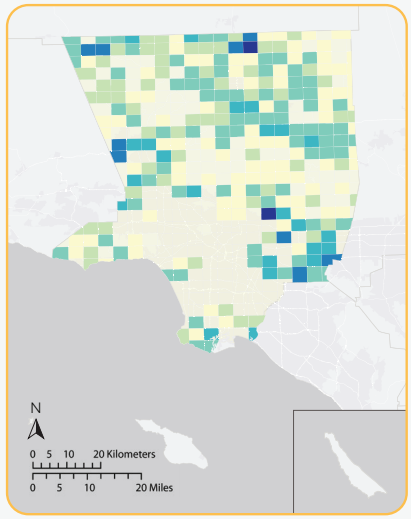
Breeding Bird Species Richness in Los Angeles County (2016)



Map courtesy of the Biodiversity Atlas of Los Angeles. Accessed October 3, 2020. [biodiversityla.org].

Data Source: Los Angeles County Breeding Bird Survey © LA Audubon 2016.

Breeding Bird Species of Conservation Concern in Los Angeles County (2016)



Map courtesy of the Biodiversity Atlas of Los Angeles. Accessed October 3, 2020. [biodiversityla.org].

Data Source: Los Angeles County Breeding Bird Survey © LA Audubon 2016.

Avian Species Trends in L.A. County based on Breeding Bird Survey (BBS), Christmas Bird Count (CBC), and eBird Data (2007-2019)

Common Name	eBird Observations vs. Predicted Years 2007-2019 (% of total observed)	BBS Trend (* indicates significantly different from zero)	CBC Trend (* indicates significantly different from zero)
Allen's Hummingbird	30.4	NA	2.8
American Crow	-7.7	-0.8	-12.6*
Belding's Savannah Sparrow	14.4	NA	1.27
Black Crowned Night Heron	-4.5	NA	-1.1*
Black Phoebe	2.8	-0.5	-4.5*
Bushtit	-6.9	-0.5	-19.5*
Cactus Wren	-26	NA	0.1
Calif. Scrub-Jay	-9.7	-1.5*	-2.0
California Gnatcatcher	-145.7	NA	-0.1
California Least Tern	-13.4	NA	NA
California Quail	-8.5	-0.8	-6.9*
California Thrasher	-21.8	-0.4	-1.3
California Towhee	4.9	-0.9	-4.7*
Cooper's Hawk	-0.4	-0.2	-0.2
Dark-eyed Junco	23.0	1.1*	-1.9
Eurasian Collared-Dove	79.8	0.5	4.2*
European Starling	-7.5	-0.5	-41*
Great Blue Heron	-10.8	NA	-1.3*
Great Horned Owl	5.2	0	-0.4*
Lark Sparrow	-12.1	0.1	-1.1
Least Bittern	17.4	NA	-0.1
Lesser Goldfinch	7.3	0.7*	-7.2*
Marsh Wren	1.4	NA	0.1
Nuttall's Woodpecker	-0.5	0	0.6
Oak Titmouse	0.7	-0.8	-2.2*
Red-tailed Hawk	0	0.1	-2.3*
Red-winged Blackbird	-3.2	NA	-32.8*
Rufous-crowned Sparrow	-37.3	-2	0.4
Song Sparrow	7.0	0.1	-1.9*
Western Bluebird	26.5	0.5*	-0.5
Western Snowy Plover	-30.4	NA	0.1
White-crowned Sparrow	19.4	NA	-2.7
White-faced Ibis	12.2	NA	-0.3
Yellow-breasted Chat	-9.7	NA	NA
Yellow-rumped Warbler	10.1	NA	-51.2*

"NA" indicates not enough data available or species not breeding in the County.
Highlighted rows indicate species for which trends, either positive or negative, agree between eBird analysis and at least one of the other (BBS or CBC) significant estimates.

BREAKOUT: UCLA'S COUNTERFORCE LAB BIOPHILIA TREEHOUSE

Biophilia Treehouse
Photo: Rebeca Méndez, Counterforce Lab

"Changing behavior is the driving force behind art and design. It's our superpower," Méndez said. "It's really about giving the ability to take something that is highly complex and being able to have that connection to people in a human way."

UCLA's Counterforce Lab is a research and fieldwork studio founded by Rebeca Méndez, a professor in the department of Design Media Arts at UCLA.

The studio works to facilitate collaborations and develop research methods to create projects around the ecological impacts of the climate crisis.

Throughout 2019 and 2020, UCLA's Counterforce Lab was a participant in the non-profit Pando Populus's PANDO Days challenge. Participants in the PANDO DAYS Challenge are tasked with developing a creative project inspired by one of the 12 goals of the L.A. County Sustainability Plan. The Counterforce Lab team was asked to creatively respond to goal number five of the Sustainability plan: Thriving ecosystems, habitats and diversity.[133]

Méndez and her team focused their project on L.A. County's birds, which play a major indicator species role for ecosystem health. With 527 bird species in the region, L.A. County is on record as having the most species of birds in any county in the United States.[113]

For their submission, Méndez and her team developed a prototype for a lightweight sculpture they call a "biophilia treehouse."[134] These structures intend to serve a dual purpose as both a habitat for birds and a space to appreciate and interact with native biodiversity.

Through the creation and eventual installation of the "biophilia treehouses," Méndez and her team hope to fundamentally reshape the way Angelenos engage with the natural world and reshape their relationships with non-human elements of the ecosystem.

"Changing behavior is the driving force behind art and design. It's our superpower," Méndez said. "It's really about giving the ability to take something that is highly complex and being able to have that connection to people in a human way."

Additionally, the team has said that their sculptures will contribute to the innovation of new methods of green building, increase biodiversity in urban habitats, and shift the way people understand their place in the greater ecosystem.

Beyond the PANDO DAYS Challenge, the Counterforce Lab team intends to make their prototype a reality and hopes to build at least five biophilia treehouses across L.A. County over the next five years. The Counterforce Lab team hopes to make the design available to community members who may be inspired to build and grow similar biophilia treehouses throughout the region.

Left: California mussels (*Mytilus californianus*)
Photo: Zack Gold
Right: Ochre Sea Star (*Pisaster ochraceus*)
Photo: Dan Horowitz, iNaturalist, Photo 100795723

OurCounty Target:

Ongoing: No loss of native biodiversity

INDICATOR

Rocky Intertidal Species Population Trends

Between the high and low tide lies the rocky intertidal shore, an area that incorporates both terrestrial and marine environments.

The physical complexity created by rock topography, waves, and the flux in temperature and salinity generates high biological diversity representing an array of niches. The unique properties of the rocky intertidal shore also contribute to its vulnerability, in which the intertidal habitat and its species are increasingly threatened by climate change, pollution, and other human activities such as coastal development and erosion.[135-137]

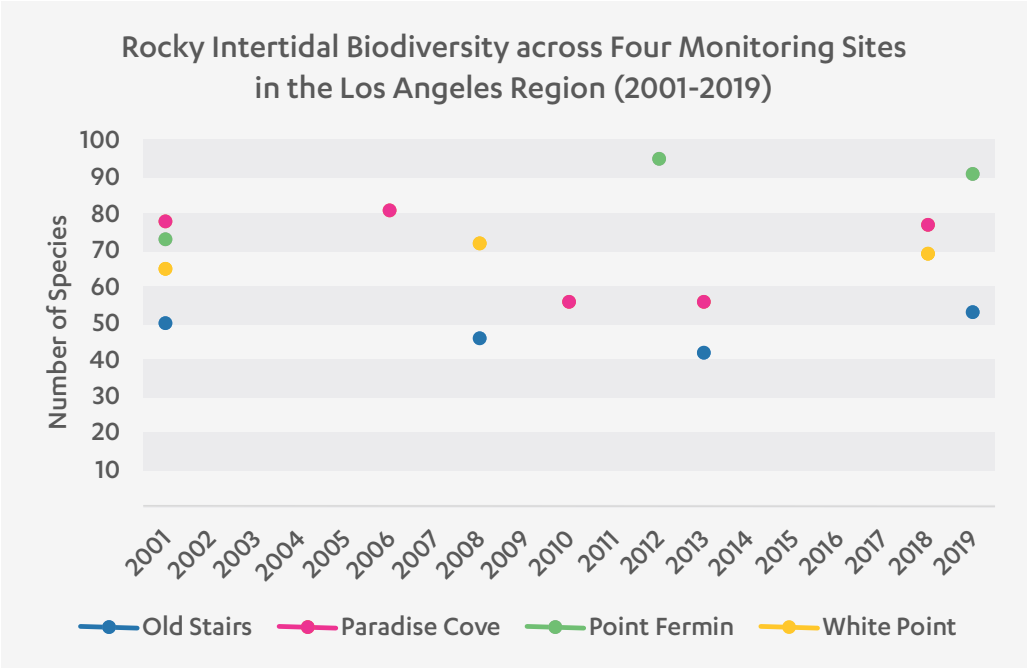
To assess the impacts of these threats we report on the population dynamics of four indicator species monitored along the southern California pacific coast over the last 17 years.

DATA AND METHODS

Intertidal communities have been monitored through a long-term research program at over 200 rocky intertidal sites along the Pacific Coast by the Multi-Agency Rocky Intertidal Network (MARINe).[138] Here, we report overall biodiversity, as well as percent cover and population size for a select group of indicator species from the MARINe database to track historical changes in their abundance and distribution in the L.A. County coastal region.

We selected the following indicator species (with years of data in parentheses): ochre sea stars (*Pisaster ochraceus*) (1994-2017), acorn barnacles (*Chthamalus dalli/ fissus* and *Balanus glandula*) (2002-2018), California mussels (*Mytilus californianus*) (2002-2018), and surfgrass (*Phyllospadix* spp.) (2003-2018) based on data availability and their indication of ecosystem health. The four sites that were sampled include: Paradise Cove, White Point, Point Fermin, and Old Stairs. Biodiversity data was collected for these four sites sporadically between 2001 and 2019. Thus, the data presented shows snapshots in time rather than overall historical trends. All sites are located within L.A. County, with the exception of Old Stairs, which is in Ventura County near the L.A. County line. Old Stairs was included to give a representation of L.A. County's westernmost coastline. We present summaries of population counts for sea stars, and percent cover averages for barnacles, mussels, and surfgrass. All species have data from all four sites, except surfgrass that was only measured at Paradise Cove and Point Fermin.

Note that these sites were sampled twice per year, in the spring and fall until 2015 when sampling frequency for most species was reduced to one time per year. For more information on sampling methodology, please refer to the MARINe site.[138]



FINDINGS

Three of the four sites showed a relatively stable number of overall species recorded in 2019 compared to 2001, with Point Fermin reporting an increase of 18 species. Overall biodiversity seems to be stable across all four sites.

The ochre sea star population crashed at most sites in late 2013 and early 2014, and since then stabilized at a relatively constant, but low count of 20 or less individuals across all four sites.

OCHRE SEA STARS

- The ochre sea star population crashed at most sites in late 2013 and early 2014, and since then stabilized at a relatively constant, but low count of 20 or less individuals across all four sites. The most likely cause of population decline was sea star wasting syndrome (SSWS), which caused catastrophic loss of sea stars along the entire North American Pacific Coast in 2013 and 2014.[139]
- SSWS struck Paradise Cove in Spring of 2014, reducing the population to zero from a historical high of 300 in 2002. Point Fermin began with a historical high population of 90 in 2003, which may have been a result of a large recruitment pulse that occurred in previous years. Since then, recruitment has been low, but population numbers remained above zero. However, SSWS was found at Point Fermin in the fall of 2013, and no stars have been recorded in the plots for the past five years. The White Point population has decreased from a historical high of 200 in 2007, to near zero after SSWS was found in the Fall of 2013. Old Stairs was the last site to be impacted by SSWS, where population counts were over 100 in the fall of 2013, but dropped to only seven the following year. [140]

ACORN BARNACLES

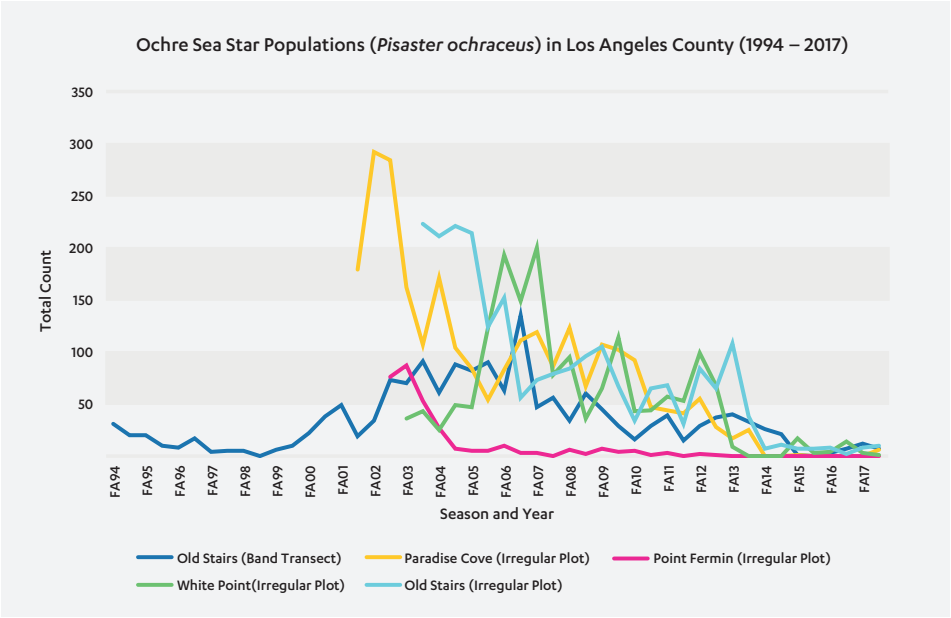
- The percent cover for acorn barnacles decreased over time at Paradise Cove and Old Stairs up until spring of 2015, but increased at both sites in more recent years.
- Percent cover of barnacles at Point Fermin has been steady at around 40%, except between 2003-2006 when cover jumped to nearly 80%.
- Cover at White Point declined until 2010 to around 20% and then stabilized. Plots at White Point have been colonized by the non-native alga, *Caulacanthus*, which might decrease available habitat for barnacles, although plenty of bare rock is still present.[140]

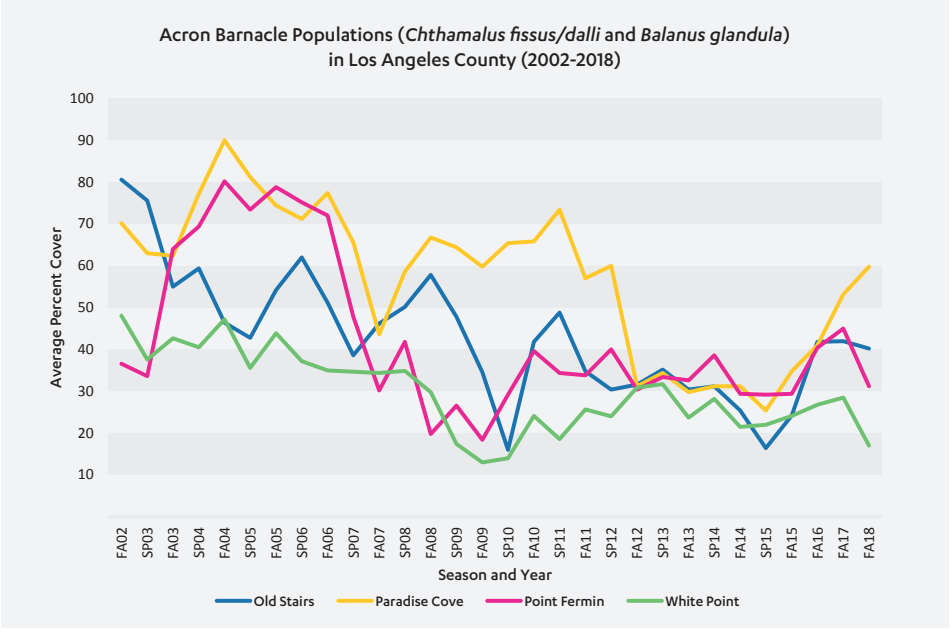
CALIFORNIA MUSSELS

- The long-term population trend for California Mussels varied over time at two sites (Old Stairs and Paradise Cove) and declined at the other two sites (White Point and Point Fermin).
- Decline at White Point was not as severe, and percent cover of mussels increased slightly in 2017 and 2018.
- At Point Fermin the decline in mussel cover was severe and shows no signs of recovery; the population may be slow to recover because as mussel patches thin, they become increasingly susceptible to wave damage. Notably, Point Fermin is the closest site to the Port of L.A., although the potential for negative impacts on the intertidal community from this large port have not been investigated as part of this study.[140]

SURFGRASS

- There was an ongoing fluctuation in percent cover for surfgrass at both Paradise Cove and Point Fermin. Note that there are intermittent periods of surfgrass sand burial, which makes it difficult to confirm if there are true surfgrass declines.[140]
- There was a seasonal variation where percent cover was higher in the fall and lower in the spring across both sites.
- Recent surveys were only done in the fall, which removes the seasonal signal and shows Surfgrass cover as quite stable over the past three years at both sites.





RECOMMENDATIONS

Data: With only four monitoring sites in or near the L.A. County coastline, it is hard to understand the true health of the rocky intertidal ecosystems that span our coastline. There should be more data collected, more frequently at different sites to ensure we can report on the overall ecosystem health for the county.

Action: There should be a set of standards for anthropogenic activity (including recreational and developmental activity) for all rocky intertidal habitats across the County. In addition, there should be local enforcement of take limits at the most visited tidepool sites.

Policy: The Port of L.A. should be regulated to reduce impact on rocky intertidal systems.

DATA LIMITATIONS

Biodiversity data was collected at the four sites sporadically between 2001 and 2019. Thus, the data presented shows snapshots in time rather than overall historical trends. Ensuring that biodiversity surveys are conducted on a regular time interval across all sites would allow for a better understanding of how the rocky intertidal community composition changes over time.

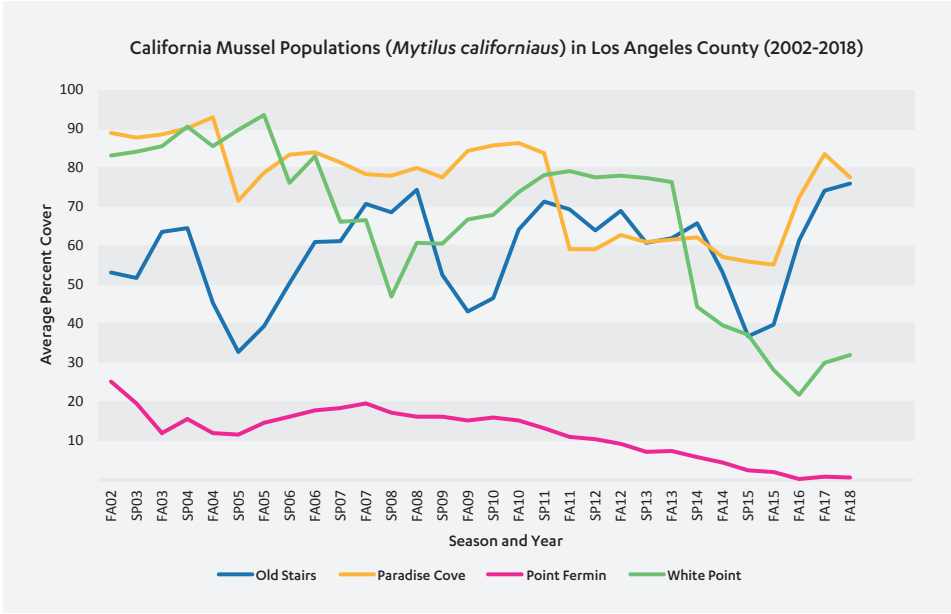
The selected four key species may not provide a comprehensive representation for rocky intertidal community health. Though they may be a valid indication of the current state of the intertidal zone, the evaluation of more species would provide a more holistic representation.

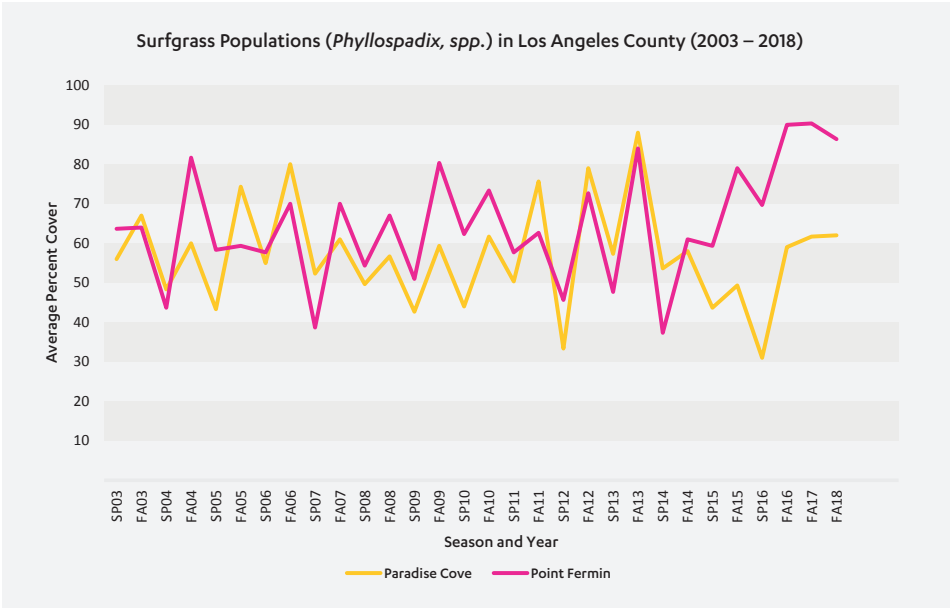
We selected four sites to evaluate intertidal species along the L.A. County coastline. However, these four sites may not provide a collective assessment of coastal habitat. Trends at additional sites throughout California and the entire west coast can be viewed on the MARINe website (www.rockyintertidal.org). These data do not evaluate external factors that may also influence the health of the rocky intertidal, such as species recruitment, and ecosystem recovery and resilience. Additionally, because data points were taken either twice a year or once a year, short-term dynamics in disease emergence and prevalence for populations was not well captured.

Occasional plot loss occurs due to external factors, such as rock break-out, which means that new plots may have been established and incorporated into data summaries.

Populations monitored may have experienced changes in size and depth that were not evident in the dataset. For example, mussel populations at Paradise Cove changed from a tight multilayered bed of mussels, to a loose monolayer, which is not translated into percent cover.

Chthamalus dalli and *Chthamalus fissus* were not distinguished as two species until 2001. *Balanus glandula is* another barnacle species that was surveyed in addition to *Chthamalus dalli/ fissus*. The data surveys for MARINe's four sites lump both of these species together.





Left: California spiny lobster (*Panulirus interruptus*)
Right: Purple Sea Urchin (*Strongylocentrotus purpuratus*)
Photos: Zach Gold

OurCounty Target:

Ongoing: No loss of native biodiversity

INDICATOR

Marine Fish and Invertebrate Population Trends

The L.A. County human population utilizes coastal resources for recreational activities and commercial industries, posing challenges for coastal marine life in terms of habitat loss, the introduction of pollutants, and the harvesting of seafood and other marine resources.[142]

In 1999, California enacted the Marine Life Protection Act (MLPA) to redesign the state's marine protected areas (MPAs) to better protect and conserve marine life.[143] Major revisions and additions to MPAs were made in 2012 that partially or fully restrict the harvesting of marine organisms (see MPA types and descriptions in accompanying table). Here we look at the MLPA's South Coast Study Region (SCSR), which spans from Santa Barbara County in the north to San Diego County in the south to assess the impacts of coastal activities on the region's valuable marine resources. The SCSR is composed of diverse habitats, such as sandy beaches and rocky coasts, and contains a high level of biodiversity: 481 fish species, four sea turtle species, and more than 5,000 invertebrate species.[143]

Southern California Marine Protected Areas (MPAs)	
Reserve Type	**Description**
State Marine Reserve (SMR)	An MPA designation that prohibits damage or take of all marine resources (living, geologic, or cultural) including recreational and commercial take
State Marine Conservation Area (SMCA)	An MPA designation that may allow some recreational and/or commercial take of marine resources (restrictions vary)
State Marine Conservation Area (No-Take)	An MPA designation that generally prohibits the take of living, geological, and cultural marine resources, but allows potentially affected and ongoing permitted activities such as dredging and maintenance to continue
Special Closure	An area designated by the Fish and Game Commission that prohibits access or restricts boating activities in waters adjacent to sea bird rookeries or marine mammal haul-out sites (restrictions vary)
Source: California Department of Fish and Wildlife	

Selected Reef Check Monitoring Sites			
Site	**Region**	**Associated Marine Protected Area (MPA)**	**Reserve Type**
Leo Carillo	Malibu	Point Dume SMCA (adjacent)	Non-MPA
Paradise Point/ Little Dume	Malibu	Point Dume SMCA	SMR
White Point	Palos Verdes	Abalone Cove SMCA (adjacent)	Non-MPA
Abalone Cove	Palos Verdes	Abalone Cove SMCA	SMCA
Isthmus Reef	Catalina Island	Blue Cavern Onshore SMCA (adjacent)	Non-MPA
WIES Intake Pipes	Catalina Island	Blue Cavern Onshore SMCA	SMCA (No-Take)
Source: Reef Check			

Selected Native Fish and Invertebrate Indicator Species in the South Coast Study Region		
Taxa Group	**Species**	**Background**
Fish	California Sheephead (*Semicossyphys pulcher*)	California Sheephead are recreationally and commercially fished in the LA area.
Invertebrate	California Spiny Lobster (*Panulirus interruptus*)	California Spiny Lobster are one of the most commercially fished invertebrates in the LA area.
Invertebrate	Purple Urchins (*Strongylocentrotus purpuratus*)	Purple Urchins are a good indicator species because their exponential growth can represent an unhealthy ecosystem that eventually leads to dramatic declines in the kelp canopy.
Invertebrate	Red Urchins (*Strongylocentrotus fanciscanus*)	Red Urchins are one of the most valuable commercial invertebrates in the L.A. area, as well as throughout California. In 2011, 2 million pounds of red urchins arrived at L.A. ports alone.
Source: Freiwald, J., and C. Wisniewski. "Reef check California: Citizen scientist monitoring of rocky reefs and kelp forests: Creating a baseline for California's South Coast, Final Report South Coast MPA Baseline Monitoring 2011-2014." Reef Check Foundation, Pacific Palisades (2015).		

DATA AND METHODS

We examined the average population density over time for one native marine fish and three invertebrate indicator species in the SCSR using data from Reef Check California (RCCA): California Sheephead (*Semicossyphys pulcher*), California spiny lobster (*Panulirus interruptus*), purple urchin (*Strongylocentrotus purpuratus*), and red urchin (*Strongylocentrotus fanciscanus*). RCCA is a branch of the Reef Check Foundation that provides data on California's nearshore rocky reefs and kelp forests to improve science-based management and decision making regarding California's marine resources and policies.[144] Part of this program involves monitoring key species of fishes (33 species) and invertebrates (33 species) across the SCSR. Species are selected by RCCA for monitoring based on their ecological or economic importance, or because they are of specific management concern.

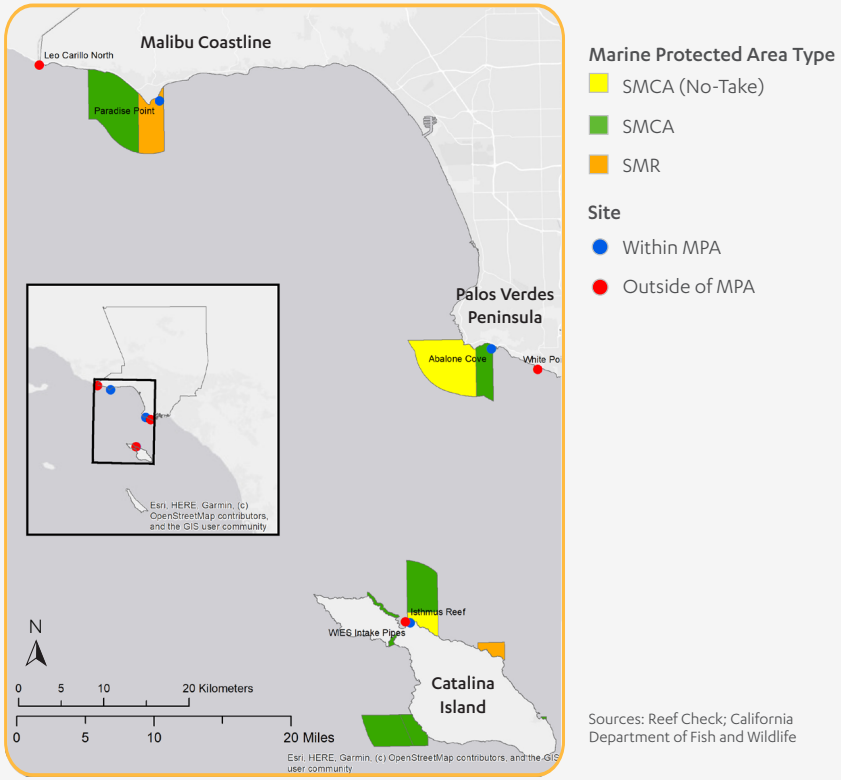
Monitoring sites were selected inside and outside of MPAs to evaluate the efficacy of the California MPA network over time. We used data from pairs of sites within L.A. County that represented similar habitat in each of the three geographical groupings where monitoring sites were concentrated: the Malibu coastline, the Palos Verdes peninsula, and Santa Catalina Island. One MPA site and one non-MPA site were selected in each area. If multiple sites met these area criteria equally, we selected sites that have been assigned to a higher priority tier, and sites for which monitoring data were available for the greatest number of years from 2006-2019. These sites are listed in the Selected Sites table, along with their protection status and the MPA that they are in or to which they are adjacent. Sites were surveyed by the RCCA during the same time of year to reduce inter-annual variability in the data. We focused on one fish species and three invertebrate species that were chosen by RCCA as good candidates for long-term MPA monitoring due to their abundance in RCCA surveys, their presence across the SCSR, and their ecological importance.

Species are selected by Reef Check California for monitoring based on their ecological or economic importance, or because they are of specific management concern.

FINDINGS

- California Sheephead have maintained fairly stable mean population densities from 2006-2019. In most years, mean population density was highest at the protected Catalina Island site (WIES Intake Pipes), and second highest at the unprotected Catalina Island site (Isthmus Reef). Average population density declined slightly at all six sites between 2017 and 2019.
- California spiny lobster mean population density was low across all selected sites (protected and unprotected), and was zero at some sites for multiple years. Although consistently low until 2019 at the Palos Verdes sites, mean population density was generally higher at the protected Malibu and Catalina sites: in Malibu, it remained above zero all but one year at the protected Paradise Point site, and remained at zero all but one year at the unprotected Leo Carillo North site.
- There was a significant decline in purple urchin mean population density across all sites following the 2012 MPA change (with the exception of the already-zero protected Catalina Island site, WIES Intake Pipes). The mean population density is consistently low at both Catalina Island Sites, and generally higher at the unprotected Palos Verdes and Malibu sites (White Point and Leo Carillo North, respectively) than at the corresponding protected sites (Abalone Cove and Paradise Point, respectively). The decline at Catalina Island sites is due to an influx of crowned urchins.[145] Since 2016, average population density fell under 100 urchins per 60 m^2 at all sites except for the unprotected Leo Carillo North site in Malibu, which rebounded to near its highest pre-2012 level. Note that a healthy reef would not have a high density of urchins.
- Red urchin mean population density remained low at both Catalina Island sites, with a slight increase at the unprotected Isthmus Reef in 2011, just before the new 2012 MPA implementation. The decline at Catalina Island sites is due to an influx of crowned urchins. At the unprotected White Point site at Palos Verdes, mean density gradually decreased overall since 2008, while the mean population density oscillated at the Palos Verdes protected Abalone Cove site. At Paradise Point, the protected Malibu site, mean population density spiked unusually in 2012, before falling back to a level slightly lower than that at the Malibu unprotected Leo Carillo North site. Note that a healthy reef would not have a high density of urchins.

Selected Sampling Sites and Marine Protected Areas in Los Angeles County (2020)



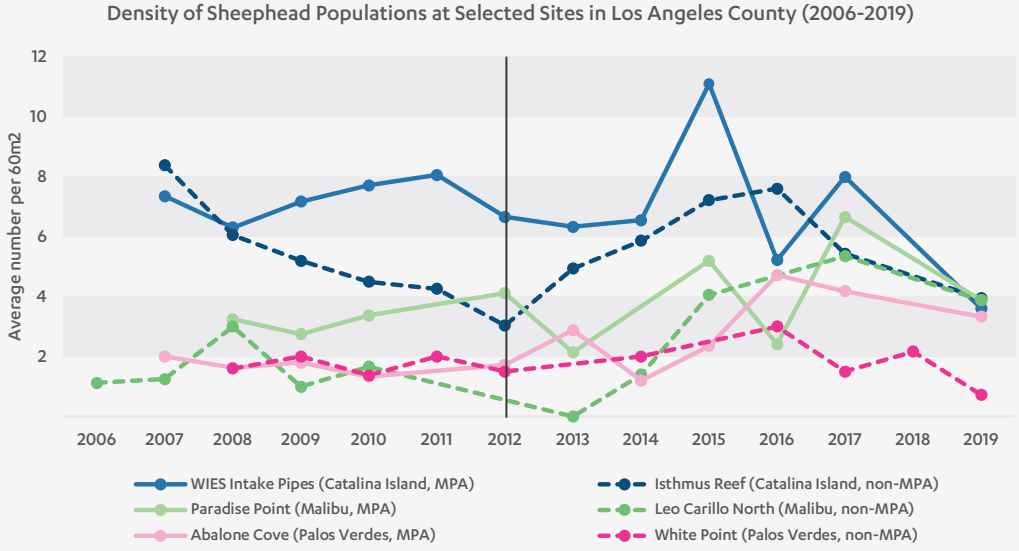
Sources: Reef Check; California Department of Fish and Wildlife

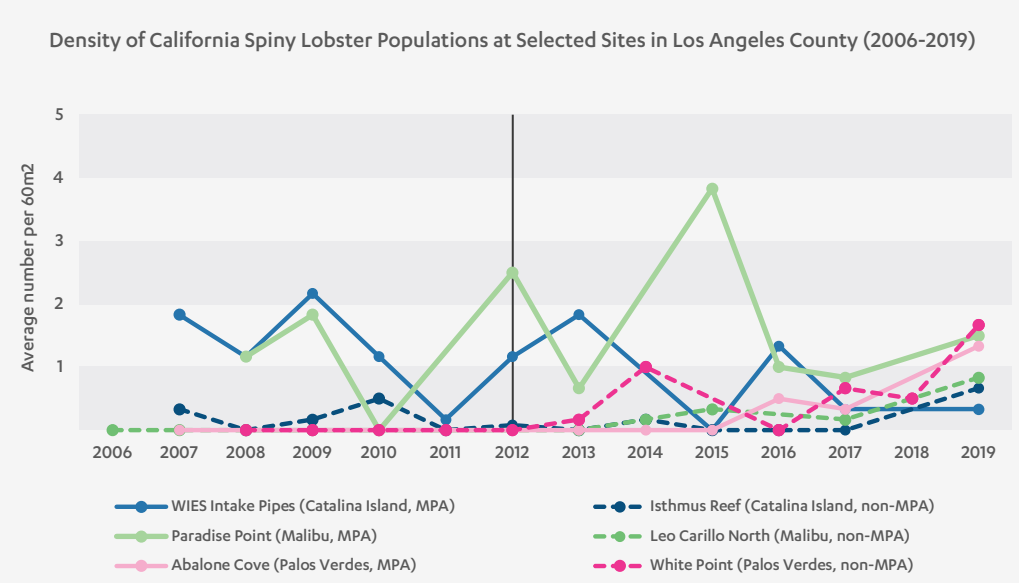
RECOMMENDATIONS

Data: Continuous annual sampling across all sites would allow for a more accurate reporting on species population trends over time. For example, additional years of monitoring data at Point Vicente West and Christmas Tree Cove would permit comparison for the Point Vicente SMCA.

Action: Increase funding for marine habitat monitoring efforts, specifically the kelp forests that provide habitat for many marine fish and invertebrate species.

Policy: Expand the no-take areas for sites that continue to show population declines across species. Improve coastal regulations; for example, increase regulations on fishing practices that have high bycatch.





DATA LIMITATIONS

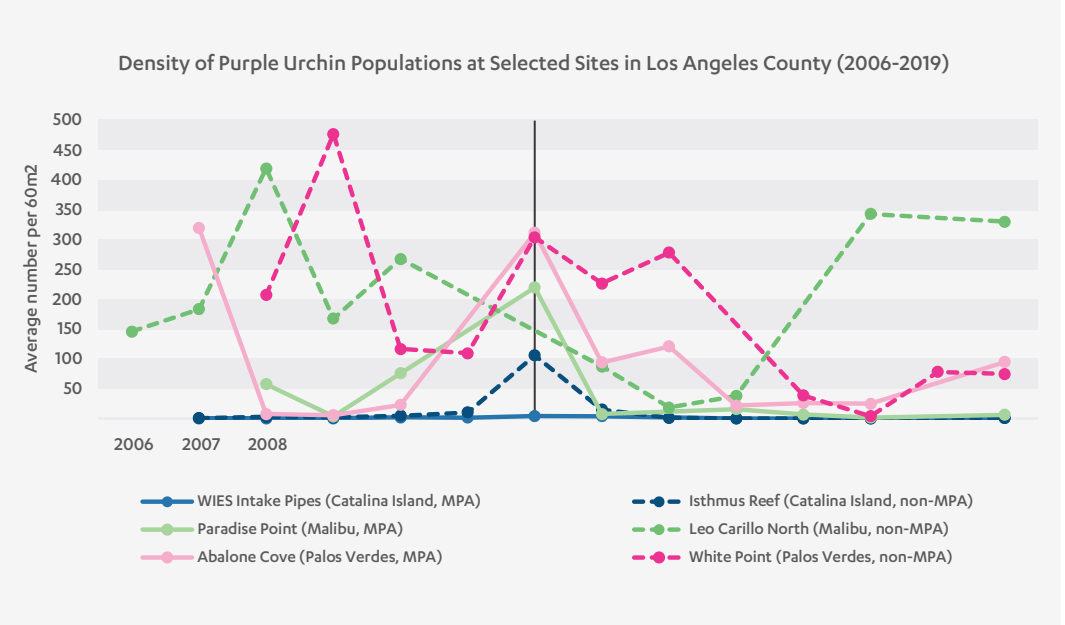
Although RCCA monitors a total of 29 sites off the coast of L.A. County and Catalina Island, continuous annual sampling from 2006-2019 is not available for most sites.

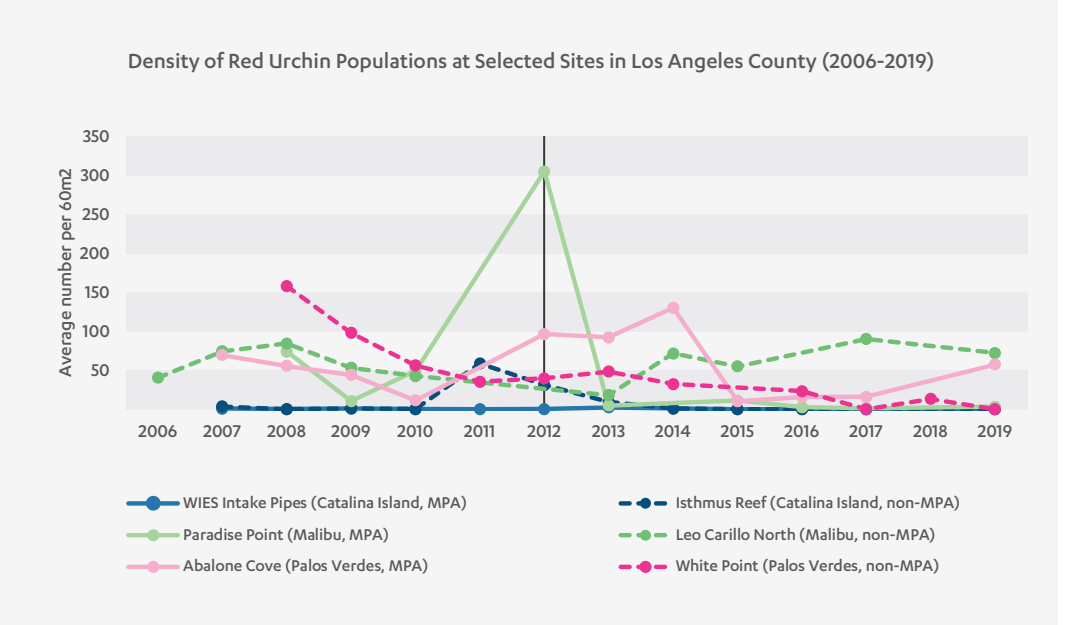
Different types of MPAs have different restrictions on activities and take, as described in the Southern California MPAs table. Therefore, species within different types of MPAs have different levels of protection.

In addition to the mean density of invertebrate populations, the biomass of fish and invertebrate species within and outside of MPAs is a stronger metric of population health for future consideration.

Differences observed between protected and unprotected sites after the implementation of MPAs in 2012 could be due to other unrelated factors.

These data provide a preliminary picture of average population densities over time before and after the 2012 implementation of the Point Dume SMR at Malibu, the Abalone Cove SMCA at Palos Verdes, and the Blue Cavern Onshore SMCA (No-Take) at Catalina Island. However, more long-term data is needed to assess the ecological effectiveness of MPAs.





OurCounty Targets:

Baseline: L.A. County placed 2nd for the number of people participating in the City Nature Challenge in 2019, with 1,555 participants.

2025: L.A. County continues to place within the top three participating jurisdictions in the City Nature Challenge.

Left: BioBlitz 2016: The Natural History Museum of Los Angeles County held a marine-themed BioBlitz in Malibu. Students from the L.A. area helped find and sort organisms to be included in the species count for the week.
Right: BioBlitz 2016: Ranger Mary talks to students about tidepooling and intertidal marine life.
Photos: Santa Monica Mountains National Restoration Area

INDICATOR

Community Science

Community science refers to a data-gathering collaboration between the public and the scientific community in which individuals record their observations of the natural world to create a repository of data.[146]

While the practice has gone by many different names over the years, the Natural History Museum of Los Angeles County (NHMLAC), which has spearheaded many local, national, and global projects, uses the inclusive term 'community science' to more accurately reflect the entirety of the diverse L.A. community.[147]

iNaturalist is one example of a specialized web application tool used in an ongoing community science effort that makes use of a web interface to both expand the observer's educational experience and enable global participation. Developed in 2008,[148] iNaturalist serves as an online network where the community can record observations of organisms by location. Groups can also use the platform to upload observations for a specific location, taxonomic project, or event such as a bioblitz.[149] Individual and organized efforts have led to the generation of millions of species occurrence records on the iNaturalist platform. Unusual, serendipitous observations can even reveal new data about a species' range, which has the potential to reveal significant data about the impacts of invasive species or climate change.[150]

Several scaled projects are led by the NHMLAC, including the City Nature Challenge (a friendly annual 3 to 5-day species observation competition between metropolitan areas around the world) and various BioBlitzes (time-bound events to record as many species in a specific area as possible).[151] Short-term and/ or species-specific projects like the City Nature Challenge and the NHMLAC's BioBlitzes are important tools for generating public interest and building community engagement, which increases support for enacting measures to protect biodiversity.[152]

DATA AND METHODS

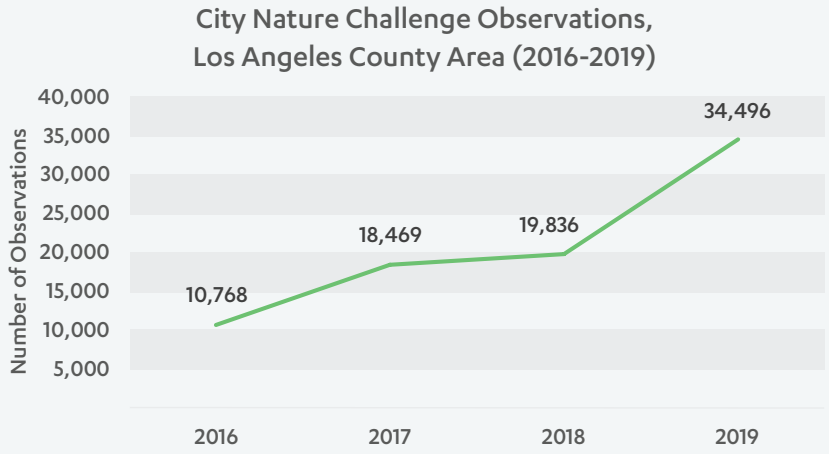
Data on L.A. County's participation in and contributions to the iNaturalist community science database are available on the iNaturalist website. We looked at the number of observers (participants), the number of observations recorded, and the number of species observed and reported on iNaturalist in L.A. County from 2012 – 2018. In addition, we looked at the same statistics for a specific selection of the NHMLAC's taxon-focused community science programs, including SLIME (Snails and Slugs Living in Metropolitan Environments), RASCals (Reptiles and Amphibians of Southern California), and the Southern California Squirrel Survey. Finally, we looked at the same statistics from the City Nature Challenge for 2016 – 2019, as posted on the City Nature Challenge organization website.[153]

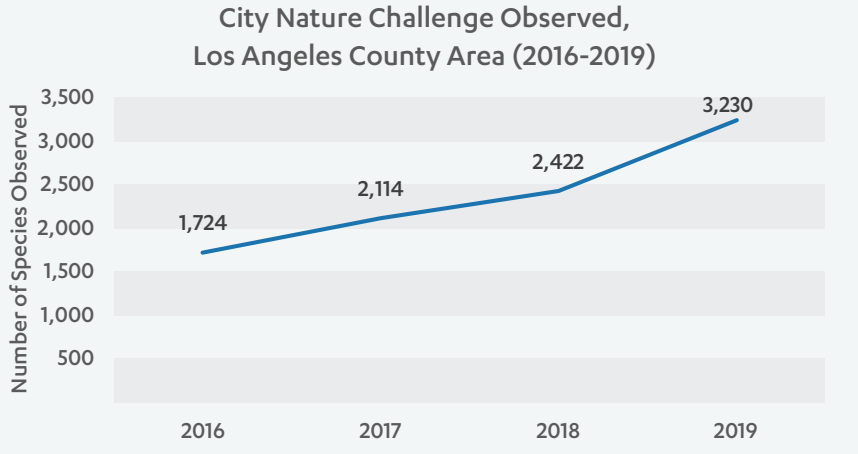
Note that number of observations, species, or observers is not cumulative; rather, it is annually independent. For example, there were 5,693 species observed in L.A. County in 2018 and recorded on iNaturalist; there were 4,732 species observed and recorded in 2017. The 2018 species list may or may not include all of the same species that were listed in 2017.

Participation and Results for Select Ongoing Community Science Projects from the Natural History Museum of Los Angeles County (2013-2018)

Project Name		SLIME	RASCals	Southern California Squirrel Survey	Total
2013	Observations	NA	375	117	508
	Species	NA	47	4	57
	Observers	NA	113	27	150
2014	Observations	NA	1,131	114	1,283
	Species	NA	50	5	67
	Observers	NA	164	39	231
2015	Observations	458	1,897	378	2,733
	Species	31	50	4	85
	Observers	138	341	138	617
2016	Observations	2,000	3,403	632	6,035
	Species	46	64	7	117
	Observers	261	641	228	1,130
2017	Observations	2,069	4,495	1,016	7,580
	Species	46	62	8	116
	Observers	250	779	216	1,245
2018	Observations	1,963	4,176	1,081	7,220
	Species	39	88	14	141
	Observers	324	824	164	1,312

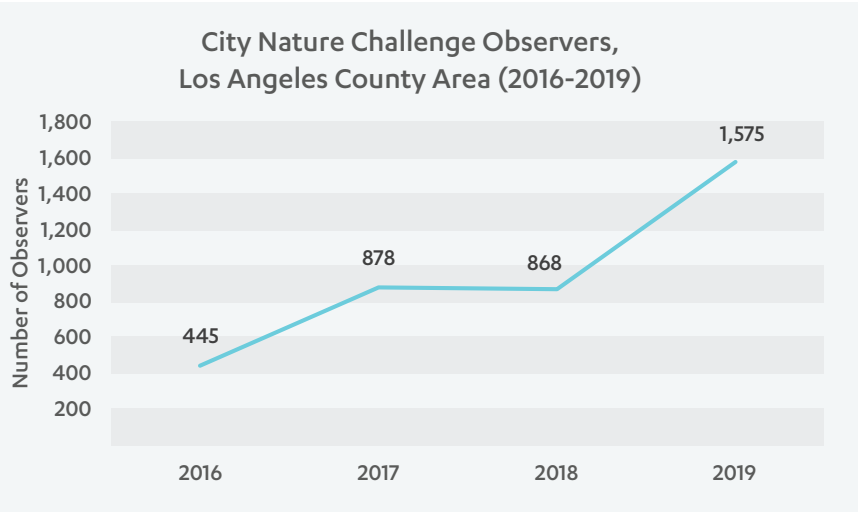
Note: SLIME began in 2015. RASCals and the Southern California Squirrel Survey began in 2013. We chose to include only data from each project's first year and onward, excluding any data for years prior to a project's creation that was later entered into iNaturalist.

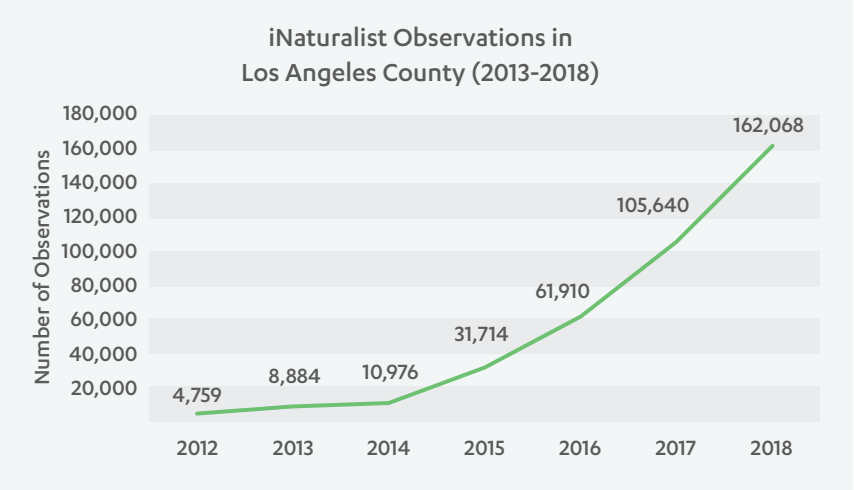


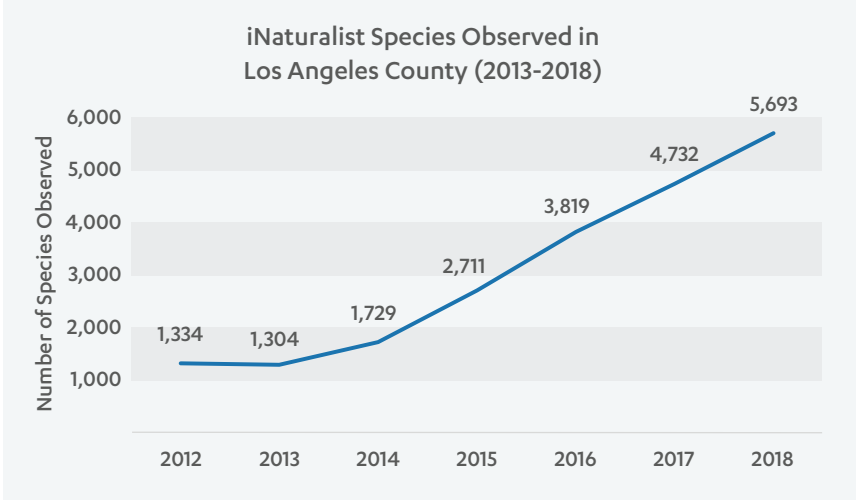


FINDINGS

- In 2018, 8,002 observers in L.A. County recorded 162,068 observations of 5,693 species on iNaturalist. The numbers of observers, observations, and species observed have all increased continuously since 2012, exponentially growing in 2014, when NHMLAC began expanding its community science programming and staff.
- During the 2019 City Nature Challenge, 1,555 observers made 34,125 observations of 3,249 species in L.A. County. Overall, L.A.'s participation in and contribution to the City Nature Challenge has grown over the past few years.
- While there was a sharp increase in participation in the NHMLAC's SLIME, RASCals, and the Southern California Squirrel Survey between 2014 and 2016, the rate of growth leveled off, and participation has since remained around its peak level in 2016, with some fluctuations. For SLIME and RASCals, the number of observations declined between 2017 and 2018 even though the number of participants increased. The decline in observations is likely due to 2018 being a drier year, allowing for greater observer participation, but with less snail, slug, amphibian, and reptile activity.



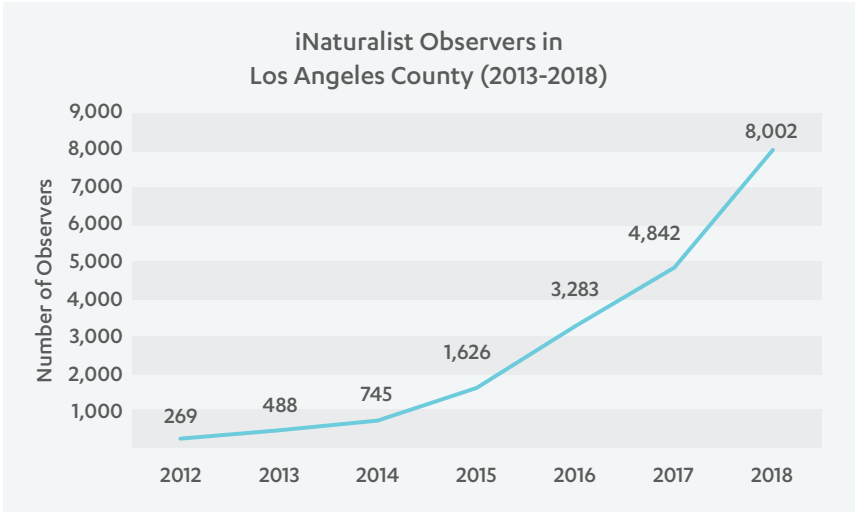




RECOMMENDATIONS

Data: Conduct user surveys to identify the impact of iNaturalist participation on participant attitudes.

Management: Enable integration of community science tools such as iNaturalist into K-12 school curricula; increase accessibility of community science tools such as iNaturalist via measures such as language translation and mobile device loan programs.



DATA LIMITATIONS

Community science is a unique method of community engagement and education because it also results in aggregated data that is usable for scientific endeavors. However, data quality can present a challenge to researchers. Community science practitioners and researchers must create projects and programs that employ data quality control and assurance methods and provide adequate training for participants. In addition, an uneven spatial distribution of volunteers may result in data gaps, requiring practitioners to address those gaps. However, community science enables data collection on a larger scale that would often otherwise be infeasible and in urban areas is a good method for documenting species occurrence records from private property that are otherwise largely inaccessible to researchers.[154]

In extracting iNaturalist use data, we applied the L.A. County location filter, which applies to observation location. However, observation location is not necessarily the same as the observer's home location, meaning that the number of users may not be exclusive to L.A. County-based users. We chose to include the number of observers regardless because we assume visitor entries have a negligible impact on overall trends.

We do not examine the distribution of users within L.A. County. This information could support targeted outreach to communities within the county.

BREAKOUT: CALeDNA

As animals and plants pass through an environment they leave behind traces of their presence in the form of feces, shed skin or fur, leaves, pollen, mucus, etc.

All of these contain DNA, termed environmental DNA (eDNA), which is found in environmental samples, such as soil and sediment. Once collected, environmental samples can be analyzed using DNA sequencing technology to identify the community of organisms present in that location. CALeDNA is a project that set out to pair volunteer community scientists with University of California researchers to collect soil samples across California to assess biodiversity. Once community volunteers sign up online, they are trained to collect soil samples and subsequently attend "bioblitzes" to collect samples, which are later sequenced and analyzed in University of California labs. CALeDNA already has over 700 users, over 1,100 samples, and about 27,000 organisms identified. The project is also developing a course for undergraduate students at UCLA that will teach students about California's biodiversity and have them participate in sample collection. The field data and eDNA results gathered by all of these efforts are publicly available to encourage a wide understanding of eDNA's potential for conservation. Expansive projects like CALeDNA are increasingly important in scientific efforts to not only engage the community in conservation but to better understand what protecting California's biodiversity will entail moving forward.[155]

L.A. River
Photo: Sustainable LA Grand Challenge Staff

GRADE: C

The 2019 UN biodiversity report lists these top five threats to biodiversity in order of magnitude: (1) changes in land and sea use; (2) direct exploitation of organisms; (3) climate change; (4) pollution and (5) invasive species.

Our region's urban sprawl has caused a myriad of problems ranging from loss of habitat, increased impervious surfaces and increased nighttime light pollution. Our region has also already experienced some impacts from climate change that have caused periods of prolonged droughts that have degraded habitat quality in our remaining natural areas. In addition, our economy is heavily reliant on the movement of goods and services, which makes us increasingly vulnerable to the entry of non-native species through our ports. One additional regional threat is our increased risk from wildfire, especially as the climate changes and more invasive plants take over our native habitats. All these factors will contribute to the continued decline of ecosystem and community health in the region if we do not effectively mitigate their associated risks as well as plan for a more resilient future.

KEY FINDINGS

- **Approximately 21% of L.A. County's total area is categorized as Very High Fire Hazard, with a total of 1,959,415 residents living in this area.**
- **From 1992 to 2012 there was a significant decrease in stable nighttime light within the Santa Monica Mountain National Recreational Area and San Gabriel Mountains.**
- **81% of land cover is pervious in L.A. County (2014).**
- **The region experienced a significant decrease in greenness from 2000 to 2018.**

RECOMMENDATIONS

Data:

- The county should track populations in high fire hazard severity zones, nightlight pollution and greenness at the parcel scale over time.
- The county should disseminate recent versions of the Los Angeles Region Imagery Acquisition Consortium (LARIAC) to all academic institutions on a recurring basis.
- There needs to be a county-wide effort to report on data of the current most impactful invasive species in the region.

Action:

- Place a greater emphasis on fire prevention techniques, such as putting power lines underground, conducting controlled burns and removing invasive species.
- Continue managing nighttime light pollution to ensure all protected areas (CPAD and SEAs) have a mean radiance of < 0.5 (nanowatts/cm^2/sr x 1E9).
- Create a county plan to increase pervious surfaces in neighborhoods that currently have the highest percentage of impervious surfaces.
- Reports that include a time series of greenness by land cover type are needed to assess native vegetation, tree canopy, and crown change.
- Implement institutional management of invasive plant species within the county, like there is for pest species.

Policy:

- General plans should be modified to maintain high fire risk areas as undevelopable open space and new development should be restricted in high fire hazard zones to minimize the population at risk. There should also be insurance disincentives for redevelopment and mandatory requirements that include risk mitigation strategies.
- Standards should be created that regulate nighttime light at the wildland interface and the urban core, especially around urban parks that provide habitat for native biodiversity.
- Impose percentage limits of impervious surfaces for different land use types (residential, open space, recreational, commercial, industrial, etc.).
- An Integrated Pest Management Plan should be standardized for all invasive species and nuisance species in the County.

GRADING

The increasing frequency and severity of wildfires and the increased number and spread of invasive species are both major, albeit different, threats to the region's biodiversity that require effective implementation of mitigation and management strategies. With regard to imperviousness, there is potential to reduce this threat through innovative green infrastructure that may also serve to improve the region's biodiversity and water management. For nighttime light pollution, management strategies have contributed to reducing this threat, but for drought stress, we will not see an improvement here until we address the larger threat of climate change, which requires ambitious regional, state, federal and global commitments.

Downtown Los Angeles
Photo: open access

OURCOUNTY GOALS AND STRATEGIES

Goal 2: Buildings and infrastructure that support human health and resilience.

- **Strategy 2A**: Integrate climate adaptation and resilience into planning, building, infrastructure, and community development decisions

Goal 3: Equitable and sustainable land use and development without displacement

- **Strategy 3A**: Increase housing density and limit urban sprawl
- **Strategy 3E:** Limit development in high climate-hazard areas

INDICATORS

Wildfires, Nighttime Light Pollution, Impervious Surfaces, Vegetation Greenness, Invasive Species

BREAKOUTS

Ecological Recovery After Fire, Pairing Environmental DNA With Remote Sensing to Map Biodiversity After Wildfire, National Park Service Invasive Species Monitoring Program, California Rodenticide Restrictions, Los Angeles County Herbicide Restrictions

UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

Left: Paramount Ranch, Woolsey Fire 2018
Right: Woolsey Fire 2018 from the Mulholland overlooking King Gillette Ranch
Photos: National Park Service

More frequent short-interval fires (≤ 10 years) can convert this native habitat into easily ignitable exotic grassland.

INDICATOR

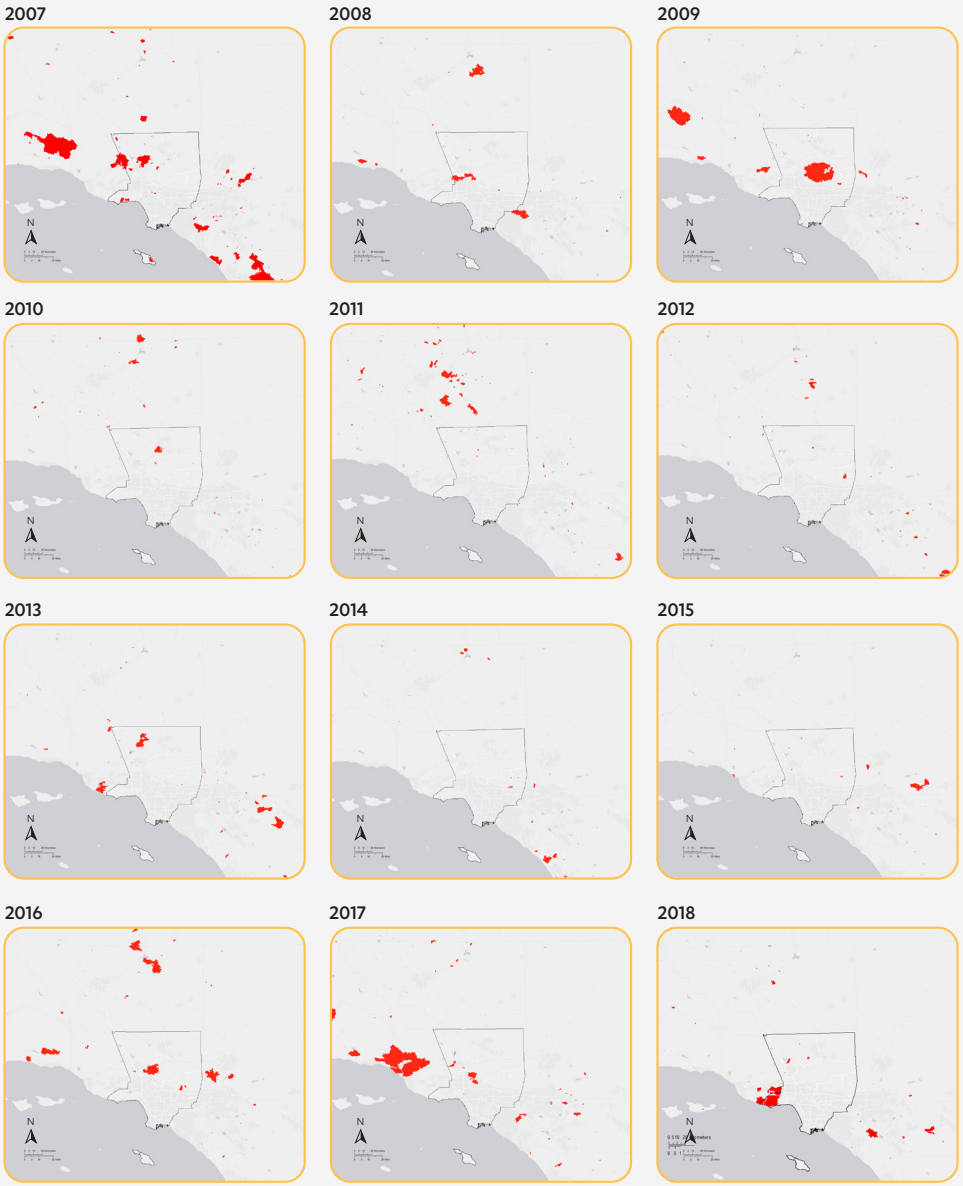
Wildfires

Chaparral habitat and coastal sage scrub cover many of southern California's foothills and low mountains, supporting high levels of native biodiversity.

These Mediterranean-type shrublands are adapted to a natural fire regime characterized by large, infrequent, high-severity fires every 30 to 150 years.[156,157] More frequent short-interval fires (≤ 10 years) can convert this native habitat into easily ignitable exotic grassland.[158] Substantial growth of these non-native annual grasses can lead to a positive feedback cycle in which grass promotes fire and shortens the fire-return interval.[156] Conversely, high elevation, conifer forests in the San Gabriel Mountains historically experienced frequent lightning ignited fires, but today are impacted negatively by reduced fire frequency from highly effective fire suppression policies. These forest ecosystems have accumulated anomalous fuel loads and are at risk of experiencing stand-replacing, high-severity wildfires, which can greatly alter these forests.[159]

Increased fire frequency is a result of many factors, but the dominant cause (more than 95%) is accidental and intentional ignition by humans.[160] Expansion of housing development is associated with the high frequency of anthropogenic ignitions in the wildland-urban interface.[156] In particular, power line ignitions, which are associated with above ground power lines combined with strong Santa Ana winds, contribute to extreme fire behavior and are a major source for area burned in the Santa Monica Mountains.[160]

Wildfire Distribution in Los Angeles County and Surrounding Areas within an 80-Mile Radius (2007-2018)



Data source: CAL FIRE – Fire Perimeters

DATA AND METHODS

We used data from the California Department of Forestry and Fire Protection (CAL FIRE) and other agencies to evaluate the distribution and frequency of wildfires over the period 2000-2018, as well as data from the UCLA Biodiversity Atlas to evaluate the location of fire hazard severity zones in L.A. County.

The Fire and Resource Assessment Program (FRAP) fire perimeter database is a multi-agency, statewide database of fire history for public and private lands.[161] This database was used to plot the distribution of wildfires in L.A. County from 2007-2018 (see data limitations). An 80-mile radius around L.A. County was used to capture nearby fires. Perimeter data was also used to illustrate fire frequency from 2000-2018. For fires reported by CAL FIRE, timber fires 10 acres or greater, brush fires 30 acres or greater, and grass fires 300 acres or greater are included. For fires located within U.S. Forest Service lands, only fires of 10 acres or more have been included in the FRAP database since 1950.

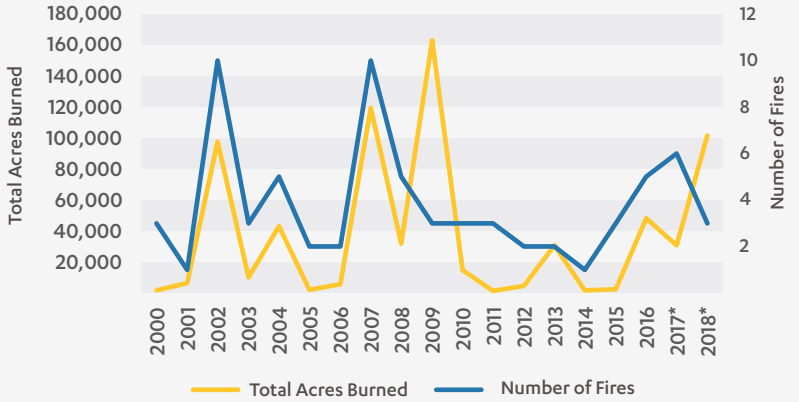
Large fire data for wildfires greater than 300 acres in L.A. County (2000-2016) were collected from CAL FIRE's annual Large Fire Lists.[162] Data for 2017 and 2018 were obtained through incident updates on their website, as full reports for these years had not yet been released at the time of analysis. Note that the entire acreage burned was listed for each fire whether it burned partially or entirely within L.A. County.

Fire hazard severity zones were identified by the Fire Hazard Severity Zones maps, which were established in 2007 and are available through CAL FIRE's website.[163] These data are also publicly available through the UCLA Biodiversity Atlas. Note that the Fire Hazard Severity Zones map only includes fire hazard severity zones in state and local responsibility areas; other fire hazard severity zones exist in the county but fall in federal responsibility areas.[164] Further analyses examining the interaction between fire hazard areas, residents, and natural areas were conducted by Dr. Ryan Harrigan. Specifically, Dr. Harrigan calculated an estimated percentage of L.A. County's population living in a wildfire hazard area by overlaying census tracks with the local and state responsibility area fire hazard severity zone data. This included census tracts within half a mile or less of only very high fire hazard severity zones (excluding high or moderate severity). In addition, he overlaid the natural areas map, discussed in a previous chapter, with the fire hazard data to get an estimated percentage of the amount of natural area that overlaps with a fire hazard zone.

FINDINGS

- 2018 experienced the greatest number of acres burned from wildfires (101,681 acres) since 2009. The Woolsey Fire comprised the majority of that area, at 96,949 acres. While this includes burn area across both L.A. and Ventura counties, a significant portion of the burn occurred within the L.A. County boundary, which can be seen on the map.
- The 2009 Station Fire was the largest wildfire in the history of L.A. County, burning 160,557 acres, all within L.A. County.
- From 2000 to 2018, there were an average of four large fires per year in L.A. County, with an average of 37,800 total acres burned annually. Annual area burned ranged from just under 1,500 acres in 2011 to just over 163,000 acres in 2009.
- The median fire size from 2000 to 2018 was 1,592 acres (~1,200 football fields).
- Several areas throughout the Santa Monica Mountains, Angeles National Forest, and Los Padres National Forest burned more than once from 2000 to 2018, which may increase the risk of native vegetative type-conversion to non-native plants.
- The number of wildfires and total acres burned from 2000 to 2018 exhibit high variability. However, there does appear to be a 5-10 year cycle where the region experiences extensive acreage burned.
- As of 2019, fire hazard severity zones include the Santa Monica Mountains, and associated coastal areas, Rancho Palos Verdes, areas around the San Fernando Valley, and several other locations in both coastal and inland areas.
  - Approximately 21% of L.A. County's total area is categorized as state or local responsibility area Very High Fire Hazard Severity Zone.
  - A total of 600 census tracts (21%) contain state or local responsibility area Very High Fire Hazard Severity Zone areas, representing a total of 1,959,415 (19%) residents. Furthermore, a total of 869 census tracts (31%) in L.A. County are within a half-mile of these Very High Fire Hazard Severity Zone areas, representing a total of 2,939,954 (29%) residents.
  - Approximately 29% of L.A. County's total natural area is categorized as state or local responsibility Very High Fire Hazard Severity Zone (493,716 acres). However, nearly 78% of all natural areas in the County include at least some state or local responsibility Very High Fire Hazard Severity Zone areas (1,313,859 acres). This is a conservative estimate, as it includes large natural areas susceptible to wildfires that spread.

Wildfires 300 Acres and Greater in Los Angeles County (2000-2018*†)



*2017 and 2018 fire data are approximations from several sources (see Data and Methods). CAL FIRE had not yet released full reports for these years at the time of this analysis.
†2018 includes all acres burned in the Woolsey fire, which spread through both L.A. and Ventura counties.

Data Source: CAL FIRE – Fire Incidents

- The Angeles National Forest covers approximately 650,000 acres of dense chaparral, as well as conifer forests at higher elevations.
  - Approximately 53% of the landscape is experiencing more frequent fires compared to pre-settlement fire regimes. An estimated 9% of historic shrubland was converted to annual grassland between the 1930s and 2011.[165]
  - Conifer forests, however, are burning less frequently than they have in the past, resulting in high-severity fires when they do burn. Since 2003, 10-30% of conifers have burned at high severity.[164]

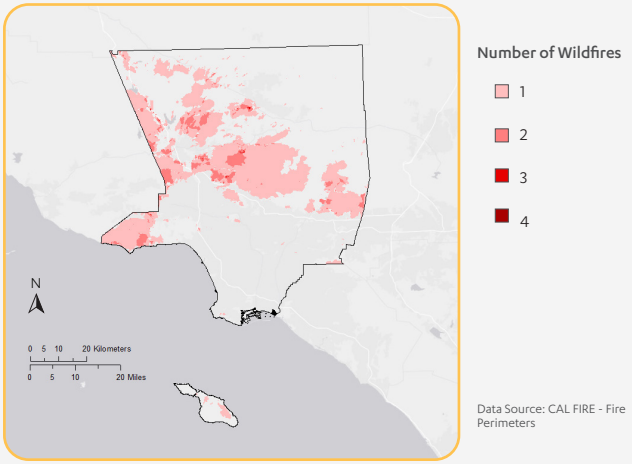
RECOMMENDATIONS

Data: The population in high fire hazard severity zones should be examined historically (e.g. past 10 years) and tracked over time to inform permitted building in such zones. Data should be collected on development permits in high fire hazard areas. Data such as fire hazard area and Angeles National Forest fire impacts should be updated regularly. Data should also be collected on the dominance of non-native species, mixed native and non-native species, or native species in natural areas that have burned repeatedly.

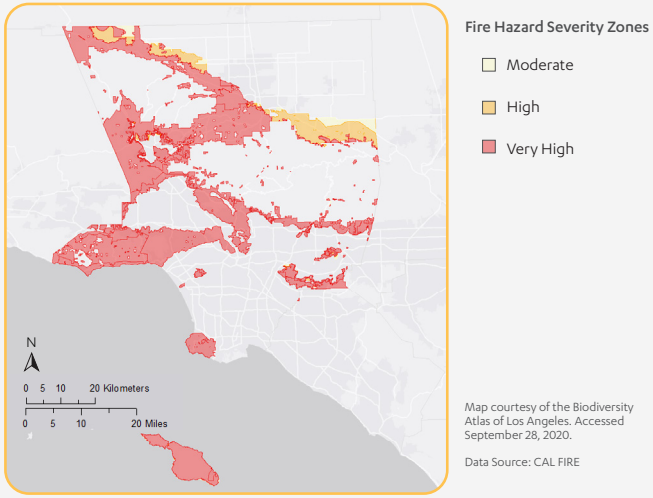
Action: Wildfire policy and management focus too heavily on fire suppression and fuel management; however, experts recommend placing a greater emphasis on fire prevention techniques, such as putting power lines underground, restricting activities that could start a fire during extreme weather conditions, and greater patrol for arson.[164] Conducting controlled burns and removing invasive species can also contribute to fire prevention. Additionally, natural areas with mixed dominance of native and non-native plants should be prioritized for fire suppression and management to ensure that non-native species do not out-compete and overtake native species.

Policy: All future power line repairs and installation in high fire hazard zones should be installed underground and a program for retrofitting the existing lines should be put into place that prioritizes underground installation in high fire hazard areas. Rapid shutoff technology should be investigated as an intermediary change where necessary. General plans should be modified to maintain high fire risk areas as undevelopable open space. New development should be restricted in high fire hazard zones to minimize the population at risk. There should also be insurance disincentives for redevelopment and mandatory requirements that include risk mitigation strategies such as fire-resistant structures, only native plants, and regular brush clearance if rebuilding is permitted.

Wildfire Frequency in Los Angeles County (2000-2018)



Fire Hazard Severity Zones in State and Local Responsibility Areas in Los Angeles County (2007)



*This does not include fire hazard severity zones in Federal Responsibility Areas, primarily in the San Gabriel Mountains and northwestern county area.

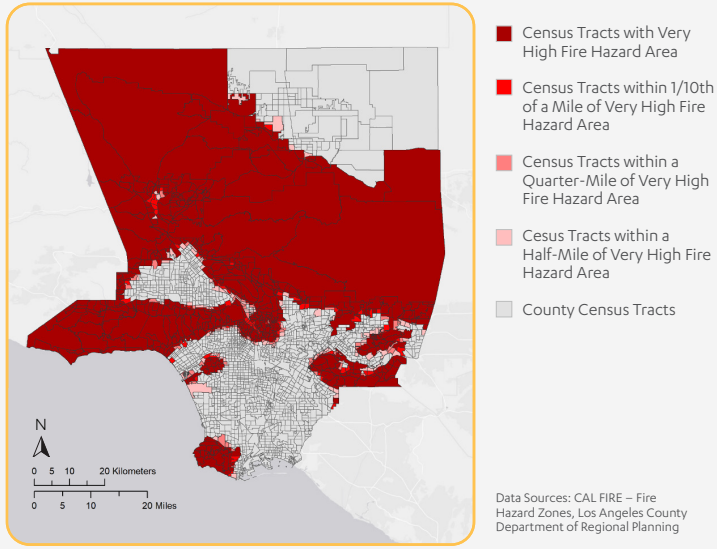
Wildfires 300 Acres and Greater in Los Angeles County (2000-2018)

Year	# Fires	Total Acres Burned
2018*†	3	101,681
2017*	6	30,844
2016	5	48,347
2015	3	2,438
2014	1	1,952
2013	2	30,986
2012	2	4,717
2011	3	1,489
2010	3	15,040
2009	3	163,049
2008	5	31,863
2007	10	119,635
2006	2	5,958
2005	2	2,294
2004	5	43,076
2003	3	10,250
2002	10	7,823
2001	1	6,544
2000	3	1,651
Average	4	37,800
Median	3	1,592

*These are approximations from several sources (see Data and Methods). CAL FIRE had not yet released full reports for these years at the time of this analysis.
†2018 includes all acres burned in the Woolsey fire, which spread through both L.A. and Ventura counties.

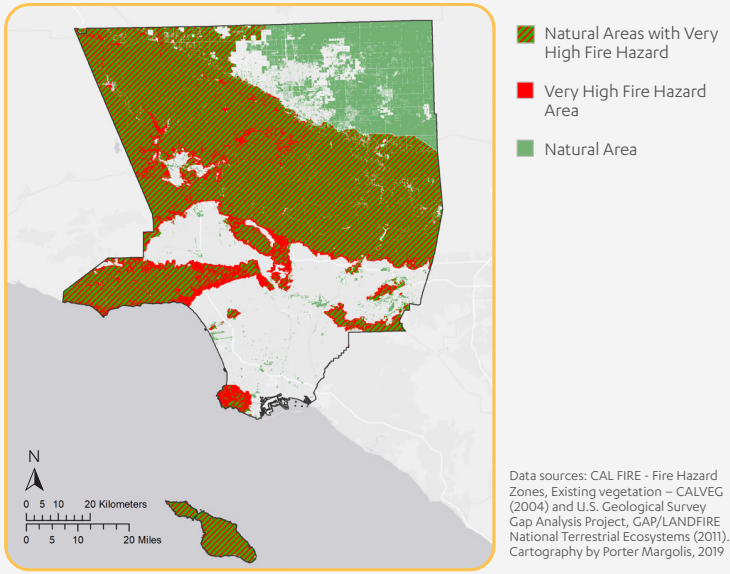
Data Source: CAL FIRE – Fire Incidents

Census Tracts (2018) and Very High Fire Hazard Zones (2007) in Los Angeles County



Data Sources: CAL FIRE – Fire Hazard Zones, Los Angeles County Department of Regional Planning

Natural Areas and Very High Fire Hazard Zones in Los Angeles County (2018)



Data sources: CAL FIRE - Fire Hazard Zones, Existing vegetation – CALVEG (2004) and U.S. Geological Survey Gap Analysis Project, GAP/LANDFIRE National Terrestrial Ecosystems (2011). Cartography by Porter Margolis, 2019

DATA LIMITATIONS

The fire perimeter database represents the most complete digital record of fire perimeters in California. However, fires may be missing or have missing attribute data either due to the minimum size cutoff or inadequate documentation. Errors may include overgeneralization (unburned "islands" within the perimeter are depicted as burned). In some instances, different agencies record differing fire perimeters for the same fire.

Although relevant, the annual number of acres burned in L.A. County does not provide further insight on vulnerable areas that experience high fire frequencies and short fire return intervals.

The baseline Fire Hazard Severity Zones visualized in this indicator were established by CAL FIRE in 2007. We acknowledge that these areas may have expanded over the past 13 years, but we are confident that these data include the minimum area that falls into a hazard zone.

The map of census tracts containing or near high fire hazard severity zones categorizes the entire census tract as high fire hazard. Because census tracts vary widely in size, this does not visually convey the population at risk.

All future power line repairs and installation in high fire hazard zones should be installed underground and a program for retrofitting the existing lines should be put into place that prioritizes underground installation in high fire hazard areas.

BREAKOUT: ECOLOGICAL RECOVERY AFTER FIRE

Many factors shape how an ecosystem returns after a fire.

For example, in Southern California's chaparral, invasive grasses do not burn as intensely as native shrubs, so recovery is slower for native chaparral plants, which can allow invasive grasses, mustards, and weeds to gain ground. A team of researchers led by UCLA, along with over 100 mostly student volunteers, are working on research to determine how vegetation recovers following the massive Woolsey wildfire by measuring the rate of post-fire regrowth of different species with respect to local burn severity.[166] For six months starting in early 2019, the team assessed 52 locations within the burn area of the November 2018 Woolsey fire in the Santa Monica Mountains. Because the severity of the fire varied across the burn area, volunteers first measured the local impact of the burn in a series of 10 discrete square-meter units, or quadrats. They returned to these same quadrats for six monthly sampling trips to track plant regrowth as well as the presence of insects and invertebrates such as spiders, worms, and snails. Uniquely, this project focused on the relationship between recovery and burn severity on a very fine spatial scale over a short time course, as opposed to long-term plant regrowth. This approach highlights the ecological challenges faced by species up the food chain: if plants do not return sufficiently rapidly, insects that rely on them cannot recolonize, and lizard, birds and mammals that depend on them may not survive either. Because there is evidence that climate change is causing increases in fire frequency and severity, understanding the impact of burns on ecological recovery at the local level should help managers predict what to expect after future burns. If severity is impacting recovery, this work could inform best practices for fire management policy.

Researchers gather before collecting data after the Woolsey Fire
Photos: Brad Shaffer

BREAKOUT: PAIRING ENVIRONMENTAL DNA WITH REMOTE SENSING TO MAP BIODIVERSITY AFTER WILDFIRE

UCLA Undergraduate students collect data after the Woolsey Fire
Photo: Rachel Meyer

The team hypothesized that species richness would increase in unburned refugia and the role of refugia to reseed communities would be measurable with eDNA and explained by remote sensing.

Researchers working together in the CALeDNA citizen and community science program, which was initiated by the University of California (UC) Conservation Genomics Consortium,[167] joined forces with NASA Jet Propulsion Laboratory (JPL) megafire expert Natasha Stavros and eco-hydrologist Michelle Newcomer from Lawrence Berkeley National Laboratory to try out a new way to map and model biodiversity after wildfire. Remote sensing data has revolutionized fire prediction and management, revealing functional biodiversity and areas experiencing drought stress, disease, and mortality. CALeDNA's total biodiversity profiles from environmental DNA (eDNA) metabarcoding to inventory species serve as *in situ* observations to complement JPL's remote sensing data and extrapolate taxonomic diversity from functional diversity. DNA in each sample reveals hundreds of bacteria, archaea, fungi, protists, plants, algae, and animals that can be associated with spectral of hyperspectral gradients on the landscape. The team hypothesized that species richness would increase in unburned refugia and the role of refugia to reseed communities would be measurable with eDNA and explained by remote sensing.

Students and postdocs from the labs of Robert Wayne and David Jacobs at UCLA, coordinated sampling with CALeDNA managers Rachel Meyer and Miroslava Munguia Ramos from both inland and lagoon sites in the vicinity of Malibu's devastating Woolsey Fire that occurred in late 2018. They have amassed a research collection of 200+ samples from before the Woolsey fire and at several time intervals thereafter. Students at multiple UC campuses are now sequencing and studying these samples. UC, Santa Cruz graduate student Sabrina Shirazi and undergraduate Haylee Bregoff discovered some DNA samples from burned areas have problematic chemical inhibitors and have developed protocols for handling eDNA from burned areas. CALeDNA also discovered the eDNA in surface soil from only weeks after fire occurred largely still contains the DNA signals of pre-fire biodiversity. Soon they will integrate results with remote sensing data and hydrogeochemical data from the Santa Monica Mountains. The UC is using these findings to plan eDNA surveys now for the six UC Reserves that experienced wildfire in 2020 megafires.

This research was supported by Bob Wayne's Howard Hughes Medical Institute (HHMI) grant and by Lawrence Berkeley National Laboratory funding to Dave Jacobs and Rachel Meyer.

Downtown Los Angeles
Left Photo: National Park Service
Right Photo: Ashley Kruythoff

Over 99% percent of the population in the U.S. lives within a light-polluted area.

INDICATOR

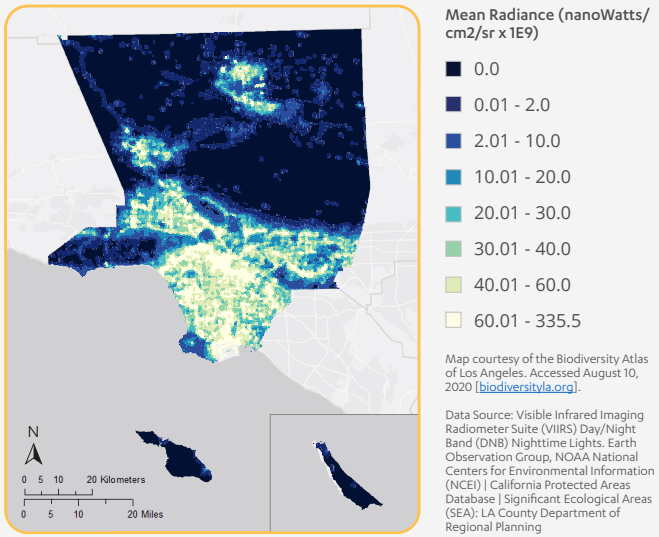
Nighttime Light Pollution

Los Angeles County is a vibrant urban environment where more than 10 million people reside.

Impacts of anthropogenic activities associated with the sprawling population are numerous, including highly elevated nighttime light. Over 99% percent of the population in the U.S. lives within a light-polluted area.[168] Exposure to nighttime light pollution has known health consequences including the disruption of sleep patterns, which in turn may negatively impact the psychological, cardiovascular and/or metabolic functions.[169] In addition, artificial nighttime light imposes negative effects on ecosystems and wildlife.[170] Studies have shown that excessive light at night can cause the disorientation, misorientation, repulsion or attraction to the light source, which subsequently will alter patterns of migration, reproduction, and communication among wildlife. Some of the most detrimental examples include deaths of migratory birds around tall lighted structures, and those of hatchling sea turtles disoriented by lights on their natal beaches.[171]

Since 1992, the National Park Service has collaborated with various agencies to reduce the nighttime light pollution and ecological harm in protected areas.[172] A 2016 study that examined satellite data between 1992 and 2012 indicated a steady decrease of nighttime light pollution in the Santa Monica Mountains Recreational Area.[172] The decrease could be attributed to the local outdoor lighting policies, as a majority of the cities that are within and adjacent to this area have nighttime lighting zoning restrictions as well as an ordinance and coastal program that aims to reduce nighttime light pollution.[172] Such efforts are critical to the conservation of natural resources and wildlife and require ongoing assessment of nighttime light across the county.

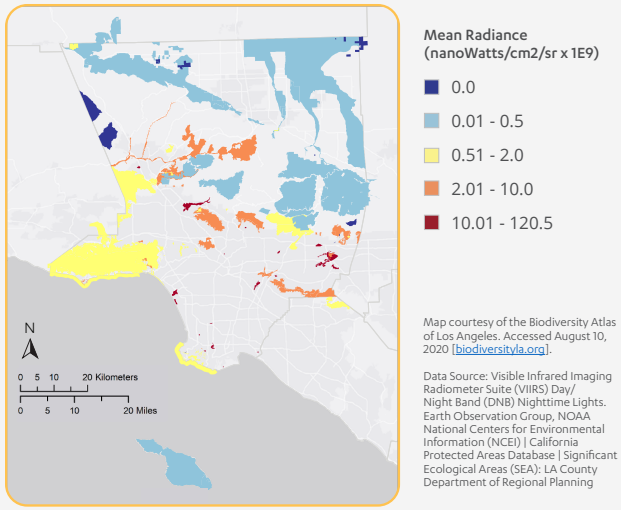
Nighttime Light in Los Angeles County (2016)



Map courtesy of the Biodiversity Atlas of Los Angeles. Accessed August 10, 2020 [biodiversityla.org].

Data Source: Visible Infrared Imaging Radiometer Suite (VIIRS) Day/Night Band (DNB) Nighttime Lights. Earth Observation Group, NOAA National Centers for Environmental Information (NCEI) | California Protected Areas Database | Significant Ecological Areas (SEA): LA County Department of Regional Planning

Light Pollution in Protected Natural Areas in Los Angeles County (2016)



Map courtesy of the Biodiversity Atlas of Los Angeles. Accessed August 10, 2020 [biodiversityla.org].

Data Source: Visible Infrared Imaging Radiometer Suite (VIIRS) Day/Night Band (DNB) Nighttime Lights. Earth Observation Group, NOAA National Centers for Environmental Information (NCEI) | California Protected Areas Database | Significant Ecological Areas (SEA): LA County Department of Regional Planning

DATA AND METHODS

The data used was from DMSP-OLS annual average visible and stable lights and VIIRS accessed from the Earth Observation Group as well as the NOAA National Center for Environmental Information (NCEI).[173]

This DMSP product provides cloud-free and ephemeral lights-free nighttime lights time series. A global radiance calibrated product for selected years was available to address the saturation issue from bright sources (e.g. cities). We calibrated the cloud-free yearly average nighttime light images obtained from different DMSP satellites to a year of reference (1999) with a polynomial regression model to reduce the discrepancies between DMSP satellites and to estimate change over time. The level of nighttime light was quantified and then assigned a digital number (DN) in the radiometric system.[170] There are six categories classified under the radiometric system (DMSP), which include non-lit (< 1), very low (1–2), low (3–5), medium low (6–10), medium (11–20), high (21–62), and very high (> 62).

VIIRS was used for current countywide nighttime light measures as well as to examine the status of light pollution in California Protected Areas (CPAD) and Significant Ecological Areas (SEA) within the county. Mean radiance was reported in (nanowatts/cm^2/sr x 1E9).

All data analyzed and produced for this indicator were done through the work of the UCLA Biodiversity Atlas project led by UCLA professor Dr. Thomas Gillespie.

FINDINGS

- **In 2016, the mean radiance for the county was 13.18 (nanowatts/cm^2/sr x 1E9).[174] Compared to the county, levels of nightlight were significantly lower in both CPAD and SEA, with a mean radiance of 0.45 and 1.19 (nanowatts/cm^2/sr x 1E9), respectively. The level of nighttime light within these two categories of protected areas falls under the non-lit and very low categories, as categorized by the radiometric system.**
- **In 2016, the maximum value of nighttime light across the county was 335 (nanowatts/cm^2/sr x 1E9). The maximum value within the CPAD and SEA were 83.52 and 120.49 (nanowatts/cm^2/sr x 1E9), respectively. These levels of nighttime light are categorized as "very high" by the radiometric system.**
- **Protected areas like the Santa Monica Mountains, East San Gabriel Valley, Santa Clarita River, and Tujunga Valley experienced medium to very high levels of light pollution occur.**
- **From 1992-2012, the National Park Services collaborated with other federal and state agencies to reduce light pollution and ecological harm from other forms of human activity in protected areas. Their protective strategies have led to a significant decrease in nighttime light within the Santa Monica Mountain National Recreational Area and San Gabriel Mountains. Although there are several small areas that did experience a significant increase in nighttime light pollution, the reduction in the large natural areas show the importance of effective regulation.[170]**
- **Despite the decreasing trend in protected areas, nightlight pollution has been increasing in several areas adjacent to new development in the north west and north east sections of the county. These increases should be investigated and mitigated to reduce the impact on the surrounding natural areas.**

RECOMMENDATIONS

Data: Continue tracking nightlight pollution using the 2013 satellite product.

Action: Continue managing nighttime light pollution to ensure all protected areas (CPAD and SEAs) have a mean radiance of <0.5 (nanowatts/cm^2/sr x 1E9). Monitor nighttime light pollution in all protected areas and provide annual reports for natural resource managers.

Policy: Create standards that regulate the mean radiance at the wildland interface as well as the urban core, especially around urban parks that provide habitat for native biodiversity.

DATA LIMITATIONS

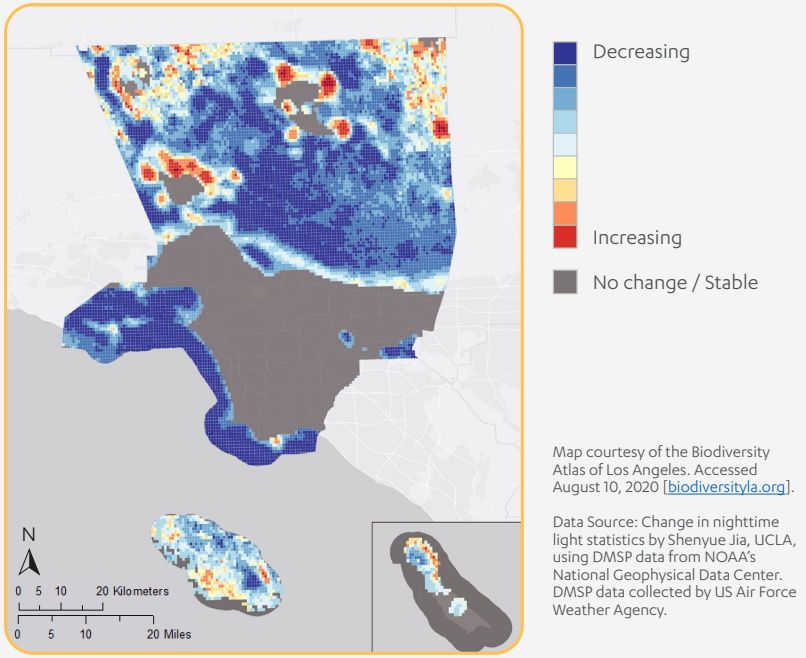
The nighttime light data that is currently available has a resolution of 375 m. Higher resolution data would provide the necessary information needed to report on more nuanced changes in nightlight across the county.

The World Atlas of Artificial Night Sky Brightness assesses nightlight pollution more comprehensively than the data used in this indicator; however, the World Atlas dataset is not updated consistently.

The data used to report historical change over time (DMSP) is different than the data used to report current averages (VIIRS) and therefore cannot be directly compared.

Although there are several small areas that did experience a significant increase in nighttime light pollution, the reduction in the large natural areas show the importance of effective regulation.

Change in Nightime Light, Los Angeles County (1992-2012)



Map courtesy of the Biodiversity Atlas of Los Angeles. Accessed August 10, 2020 [biodiversityla.org].

Data Source: Change in nighttime light statistics by Shenyue Jia, UCLA, using DMSP data from NOAA's National Geophysical Data Center. DMSP data collected by US Air Force Weather Agency.

Impervious surfaces
Left Photo: (open access)
Right Photo: Ashley Kruythoff

OurCounty Targets:

Baseline: Research is currently being conducted to understand how much of L.A. County's land area is covered by heat-trapping surfaces. In 2014 there were seven heat-stress emergency department visits per 100,000 residents.

2025: Convert 10% of heat-trapping surfaces to cool or green surfaces. Reduce by 15% the number of heat-stress emergency department visits per 100,000 residents.

2035: Convert 20% of heat-trapping surfaces to cool or green surfaces. Reduce by 45% the number of heat-stress emergency department visits per 100,000 residents.

2045: Convert 30% of heat-trapping surfaces to cool or green surface. Reduce by 75% the number of heat-stress emergency departments visits per 100,000 residents.

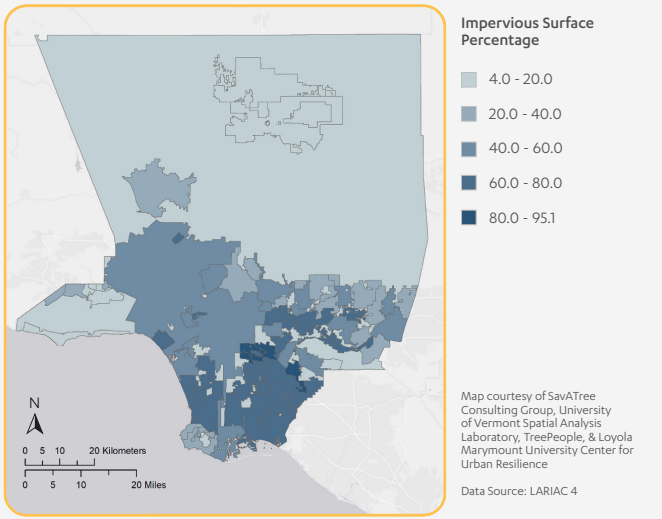
INDICATOR

Impervious Surfaces

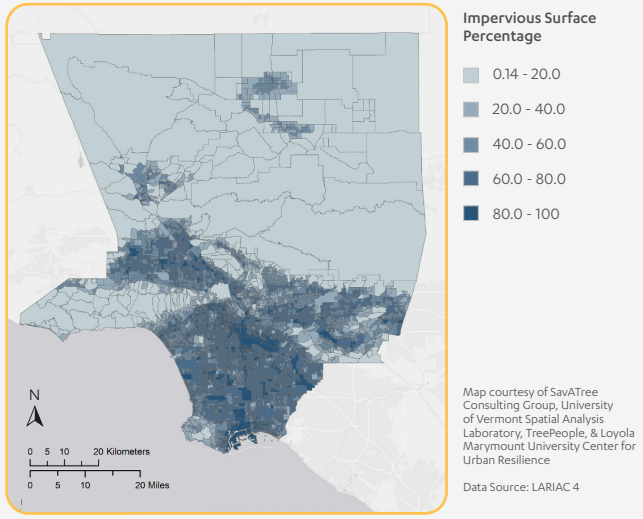
Impervious surfaces are defined as surfaces covered by materials, including asphalt, concrete, brick or stone, which prevent the infiltration of water into underlying soils and groundwater aquifers.

Widespread replacement of permeable surfaces (vegetated areas or bare soil) by impermeable surfaces is due to both the extent of overall development, and the increase in home size.[175] As total area of impervious surfaces in the County increases, there is a significant reduction in drainage capacity. Loss of drainage capacity causes problems with stormwater management, flood prevention, and replenishment of groundwater aquifers.[176,177] The increase in impervious surface area is also associated with reductions in urban tree canopy and other natural areas that serve to increase carbon sequestration, connect and provide habitat area, and support local biodiversity; they also increase property values and provide ecosystem services to residents, including a reduction in air pollution, and mitigation of the urban heat island effect through reduced local temperatures and increased shade.[178-180] Changes to urban hydrology caused by increased impervious cover result in widening and deepening of natural stream channels, and a host of related impacts on water quality and stream biota.[181-183]

Percent Impervious Surface in Los Angeles County Unincorporated Areas and by City (2014)



Percent Impervious Surface by Census Block in Los Angeles County (2014)



DATA AND METHODS

Spatial data for L.A. County was derived from the Los Angeles Regional Imagery Acquisition Consortium (LARIAC) 4 data—the 2014 aerial imagery data set generated by LARIAC, a regional organization with dozens of participating public departments, municipalities, and agencies.[184] County-wide land cover statistics on pervious and impervious area in square feet were provided by TreePeople, SavATree, the Center for Urban Resilience at Loyola Marymount University, and the University of Vermont (UV) Spatial Analysis Lab.[185]

The UV Spatial Analysis lab used the LARIAC land cover model and aerial imagery data to calculate the impervious area (in square feet) and impervious area percentage for a variety of reference geographies. To calculate impervious land cover statistics for L.A. County cities and unincorporated areas, assessor's parcels were intersected with city and unincorporated area boundaries maintained and provided by the L.A. County Department of Public Works. Land cover statistics at the city-specific level were generated and the square feet and percentage values for pervious-impervious land cover for each city and unincorporated area in L.A. County were determined.

In addition, the UV Spatial Analysis Lab calculated percentage values for pervious-impervious at the census tract level to help researchers understand the distribution of these surfaces relative to neighborhood characteristics, such as average household income.

The increase in impervious surface area is also associated with reductions in urban tree canopy and other natural areas that serve to increase carbon sequestration, connect and provide habitat area, and support local biodiversity...

Photo: Ashley Kruythoff

FINDINGS

- In 2014, across the entirety of L.A. County, approximately 81% of land cover was pervious while approximately 19% was impervious. However, these figures are heavily weighted by the unincorporated areas of the County, which largely overlap with the county's natural areas and account for 74% of the County's total pervious land cover.
- When examining only incorporated cities, which better reflect the conditions encountered by a majority of L.A. County residents, the 2014 data shows that only 55.5% of the incorporated land area is pervious, while 44.5% is considered impervious.
- The cities with the highest percent of land area categorized as impervious include the City of Vernon (95.1% impervious), the City of Commerce (87.4% impervious), and the City of Huntington Park (80.9% impervious), though several other cities also had impervious land cover percentages in the high seventies or just over eighty.
- The cities with the lowest percentage of land area categorized as impervious include the City of Malibu (12.5% impervious), followed by Bradbury (13.2% impervious) and Palmdale (14.5% impervious).
- These results show a strong correlation between percent of impervious surfaces and average household income arising from parcel sizes in residential neighborhoods. Census tracts that represent high-income neighborhoods had some of the lowest percentages of impervious surfaces, representing a striking inequity with regards to the distribution of ecosystem services. Further research is required to better understand this relationship.

RECOMMENDATIONS

Data: To date, there have been five versions of LARIAC released (LARIAC - 2006, LARIAC2 – 2008, LARIAC3 – 2011, LARIAC4 - 2014 LARIAC5 – 2017).[186] L.A. County should work to ensure there is ongoing dissemination of this information.

Action: As part of the county's goal to increase equity of ecosystem services in the 2019 OurCounty plan, the county should create a plan to increase pervious surfaces in neighborhoods that currently have the highest percentage of impervious surfaces. This plan should reflect the work that is already being conducted in this space including Southern California Coastal Water Research Project (SCCWRP)'s "Hydromodification Assessment and Management in California" Plan and the county's "Low Impact Development Standards Manual."

Policy: There should be set percentage limits of impervious surfaces for different land use types (residential, open space, recreational, commercial, industrial, etc.).

DATA LIMITATIONS

These findings were based on spatial data collected in 2014 representing a snapshot of impervious surfaces from that year. To better understand the patterns of development across the County we need to measure the change over time, ideally on a regular basis every 3-5 years.

Vegetation, Los Liones Canyon
Photo: Ashley Kruythoff

OurCounty Targets:

Baseline: Research is currently being conducted to understand how much of L.A. County's land area is covered by heat-trapping surfaces. In 2014 there were seven heat-stress emergency department visits per 100,000 residents.

2025: Convert 10% of heat-trapping surfaces to cool or green surfaces. Reduce by 15% the number of heat-stress emergency department visits per 100,000 residents.

2035: Convert 20% of heat-trapping surfaces to cool or green surfaces. Reduce by 45% the number of heat-stress emergency department visits per 100,000 residents.

2045: Convert 30% of heat-trapping surfaces to cool or green surface. Reduce by 75% the number of heat-stress emergency departments visits per 100,000 residents.

INDICATOR

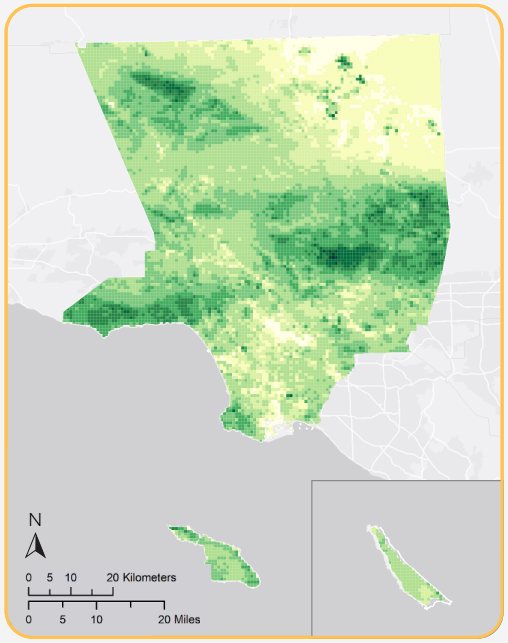
Vegetation Greenness

In Mediterranean regions, vegetation indices such as Normalized Difference Vegetation Index (NDVI) inform us about vegetation density, or how much plant life is in an area, and photosynthetic activity.

Photosynthetic activity is associated with biomass, carbon sequestration, plant water stress, and biodiversity. NDVI from high (2 meters) to moderate (250 meters) spectral resolution spaceborne sensors has been significantly associated with vegetation type, plant species richness, live fuel moisture, and time series of NDVI can monitor post-fire regeneration, plant productivity/stress, and tree planting program success. Natural and urban areas may be monitored using the NDVI vegetation index that is calculated as a function of the visible and near-infrared wavelengths. NDVI, here referred to as vegetation greenness, ranges from -1.0 to 1.0 with positive values (e.g. 0.5) representing high greenness and negative values (e.g. -0.1) representing little or no vegetation. The NDVI or greenness of protected areas, which are less impacted by human activities, can be used to track the effect of climate change on natural ecosystem functioning, while changes in NDVI in urban areas are generally related to the planting or removal of trees and lawns or increases in impervious surfaces.

Vegetation in L.A. County is also sensitive to prolonged drought, characterized by low precipitation and warm temperatures. The drought stress of vegetation can be assessed by satellite imagery using the Normalized Difference Vegetation Index (NDVI). Both properties are directly influenced by water availability and linked to valuable ecosystem services such as the reduction of the urban heat island effect (i.e. excess urban heat retention) and carbon sequestration.[187,188] Increasing drought damage to wildlands and their terrestrial ecosystems is an ecological concern, as these effects cannot be relieved by traditional water reallocation and irrigation efforts.[189] A better understanding of vegetation responses to drought stress will help us predict future climate scenarios that likely include less precipitation in Southern California by the end of the 21st century.[189]

Vegetative Greenness in Los Angeles County (2018)



-0.11 - 0.10
0.11 - 0.15
0.16 - 0.20
0.21 - 0.30
0.31 - 0.40
0.41 - 0.50
0.51 - 0.60
0.61 - 0.70
0.71 - 0.75
0.76 - 0.82

Map courtesy of the Biodiversity Atlas of Los Angeles. Accessed August 10, 2020 [biodiversityla.org].

Data Source: NDVI generated from MOD13Q1 data, which was retrieved from the online MODIS Data Products, courtesy of the NASA EOSDIS Land Processes Distributed Active Archive Center (LP DAAC), USGS/Earth Resources Observation and Science (EROS) Center, Sioux Falls, South Dakota, modis.gsfc.nasa.gov/data/dataprod/mod13.php.

DATA AND METHODS

Moderate resolution imagery from satellite sensors such as NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) provide a high temporal resolution analysis of natural areas and the built environment. The NDVI data presented here is at 1 kilometer resolution and was produced in 16-day intervals from 2000-2018. NDVI ranges from -1.0 to 1.0, with higher values representing sparse (e.g. 0.2-0.3) to dense (e.g. > 0.6) vegetation, and lower values representing little to no vegetation (e.g. < 0.1) or water (values approaching -1). Change in greenness was calculated using dry-season (June, July, and August) NDVI data for the years 2000 and 2018.[190] A seasonal average was calculated for each year before finding the difference between them. All data analyzed and produced for this indicator were done through the work of the UCLA Biodiversity Atlas project led by UCLA professors Thomas Gillespie, Glen MacDonald, and Greg Okin.[174]

FINDINGS

- **The average NDVI score for L.A. County in 2018 was 0.274, with a minimum value of -0.0481 and a maximum value of 0.767. The average NDVI score for L.A. County in 2000 was 0.327, with a minimum value of 0 and a maximum value of 0.807. There was an overall decreasing trend in greenness for the region from 2000 to 2018. This suggests that L.A. County experienced reduced photosynthetic activity, and vegetation experienced pronounced drought stress.**
- **The Angeles National Forest saw the greatest decline in greenness from 2000 to 2018 due to the Station Fire (2003). However, in 2018, the Angeles National Forest had some of the highest recordings of vegetative greenness demonstrating potential recovery from the impact of fire in previous years.**
- **Most of the NDVI decreases in native coastal sage scrub and chaparral vegetation of the Santa Monica Mountains were associated with recent droughts (2012-2016).[189,191]**
- **Low vegetative greenness was expected in highly urbanized zones like downtown L.A., as there is little vegetation in this area. However, cities like Santa Monica, Venice and Westwood have been getting greener while cities such as Rosemead have been getting browner since 2000.**
- **A rise in mean temperatures across the county since 2000 caused a steady decline in mean soil moisture, which further amplified the severity of the 2012-2016 drought.[192]**

RECOMMENDATIONS

Data: Use Landsat imagery at 30 meters from 1986 to present to create NDVI or greenness maps by land cover type for L.A. County.

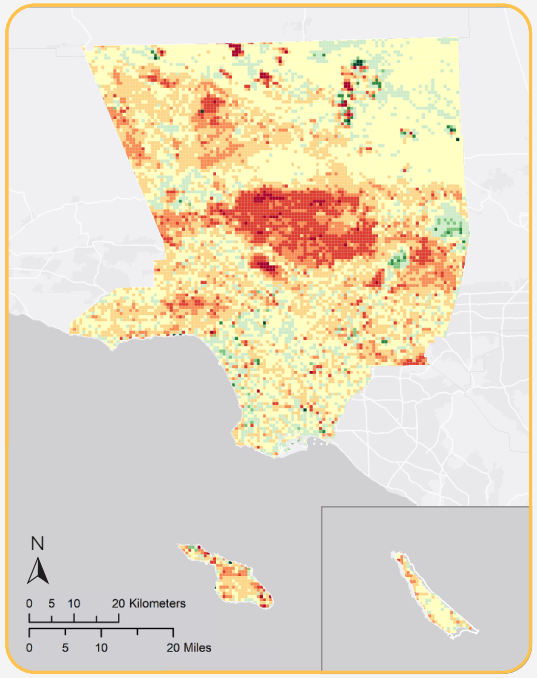
Action: Time series of greenness are needed to assess native vegetation, tree canopy, and crown change. In urban areas, MODIS pixels that have experienced a significant decline should be examined to identify the mechanism (building, imperious surfaces, tree or lawn removal) behind the decline. The same can be done for areas that experience significant increase that are most likely due to the increases in tree canopy cover or irrigated lawns. All protected areas and natural areas in L.A. County should be monitored with NDVI from MODIS/VIIRS to identify if development, drought, or fire are responsible for declines. High resolution (10 cm to 30 m) NDVI at the parcel level can identify parcels, neighborhood, or cities that have significantly declined or increased in greenness.

Policy: The county should require that all new developments or redevelopments include "best" practices to accompany low impact development ordinances that require rainwater from a three-quarter inch rainstorm to be captured, infiltrated and/or used onsite at most developments and redevelopments where more than 500 square feet of hardscape is added. In addition, achieving the net zero emissions target will help offset some of the more severe climate impacts such as prolonged drought that could dramatically alter our native vegetation in natural areas.

DATA LIMITATIONS

Greenness cannot discriminate between native and non-native vegetation, thus GIS data on vegetation type or tree crown cover are needed to assess change over time. A low NDVI value does not necessarily reflect the impacts of drought.

Change in Vegetative Greenness in Los Angeles (2000-2018)



Map courtesy of the Biodiversity Atlas of Los Angeles. Accessed August 10, 2020

Data Source: NDVI generated from MOD13Q1 data, which was retrieved from the online MODIS Data Products, courtesy of the NASA EOSDIS Land Processes Distributed Active Archive Center (LP DAAC),USGS/Earth Resources Observation and Science (EROS) Center, Sioux Falls, South Dakota, modis. NDVI statistics: Chunyu Dong, UCLA.

Left: Invasive black mustard, Santa Monica Mountains Recreational Area
Photo: National Park Service
Right: Fox Squirrel (*Sciurus niger*)
Photo: Ashley Kruythoff

OurCounty Target:

Ongoing: No loss of native biodiversity

INDICATOR

Invasive Species

Invasive species are organisms not native to a given area that spread quickly and negatively impact the environment, economy and/or human health and are threatening biodiversity worldwide.[193]

Cases of species proliferating outside of their native range are numerous and are often aided in some form by human activity, whether intentional or inadvertent.[194] Humans have deliberately introduced many species for reasons including erosion prevention, ornamentation and as biological controls.[195] Accidental introductions have occurred from the release of pets and from organisms moving via global trade. When invasions occur, these species often cause reductions in the populations of native species and inadvertently shift the overall ecosystem structure.[196] These effects can be caused directly (e.g. predation, competition) and indirectly (e.g. trophic cascades, increased wildfire risk, disease vectoring). As a biodiversity hotspot with a major international airport and seaport, L.A. County is particularly vulnerable to the negative consequences of invasive species introduction and establishment.

Invasive Species Terminology	
TERM	**DEFINITION**
Prevalence	**Prevalence indicates the overall presence of the invasive species in L.A. County. Impact ratings in the ecological, economic, and public health sectors indicate severity of impacts in areas where the species is present.**
Ecological Impact	**Ecological impact rating is determined by negative effects on native ecology—the degree to which an invasive species directly or indirectly damages or disrupts native organisms through predation, competition, ecosystem transformation, disease vectoring or carrying, and/or other means.**
Economic Impact	**In most cases, quantitative data on the economic costs associated with reviewed species were not available. As such, the ratings in the scale are largely determined by the number and type of documented ways in which a species may impose economic costs. These ways include agricultural impacts, infrastructure damage, requiring expenditures for pest control, tourism reduction, and secondary costs associated with human health impacts.**
Public Health Impact	**The public health impact rating is determined by a species' potential severity of deleterious health outcomes it may cause. Health-related concerns considered include the species' role as a vector or carrier for diseases, toxicity, and negative effects on water quality.**

DATA AND METHODS

For purposes of assessing the impact of these species on ecosystem health in L.A. County, 23 organisms were identified for evaluation through consultation with several UCLA biodiversity experts and the National Oceanic and Atmospheric Administration (NOAA), who provided their list of oceanic and riparian invasive species in Southern California.[197] Species were identified for evaluation based on level of distribution, ecological and economic impact and level of prioritization within ongoing programs (i.e. California Fisheries Restoration Grant Program and Pacific Coastal Salmon Restoration Fund). The 23 organisms evaluated therefore reflect the variety of invasive species that are currently found in the L.A. area.

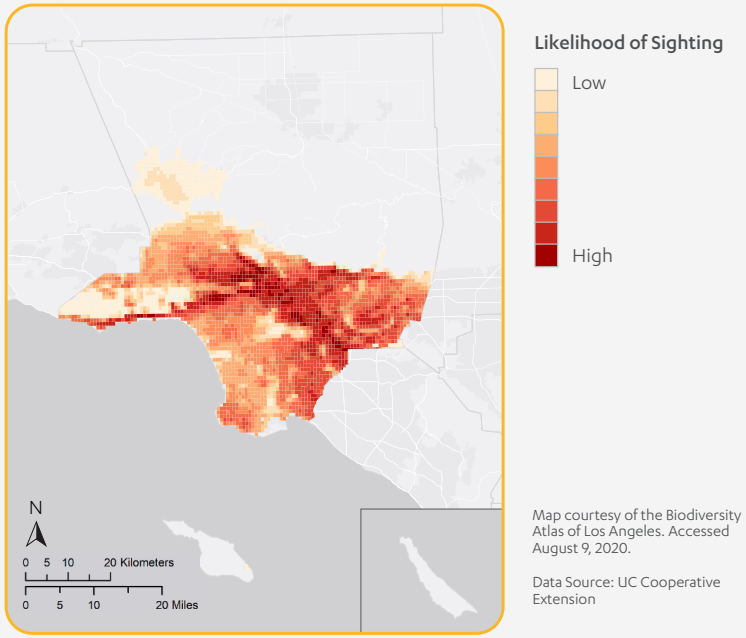
Each of the 23 indicator species was evaluated based on the following informational categories: Life History, including identification information (e.g. physiological description); Origin; Current Global and National Spread; Distribution in L.A. County; Ecological Impact; Human Health Impact; Economic Cost; and Best Management Practices. Information on these aspects was compiled from numerous sources, including academic studies, state agencies, federal agencies, non-governmental organizations, and businesses. Descriptions of distribution of species were largely based on country-level distribution information from the Global Invasive Species Database—a resource managed by the Invasive Species Specialist Group of the International Union for the Conservation of Nature (IUCN) Species Survival Commission—as well as observational database maps including Calflora, U.S. Department of Agriculture, and the UCLA Biodiversity Atlas of LA that sourced their information from the community science platform, iNaturalist.[113,198-202] In evaluating each species, we made efforts to corroborate information by finding consensus or near-consensus among multiple sources. In cases where sources differed or conflicted with respect to an aspect of the species (e.g. the effectiveness of a particular management practice), or in cases where no sources were found that could provide pertinent information regarding an evaluative criterion, we made a note of these occurrences in our full invasive species report (See Appendix).[203]

We assigned each indicator species a rating for its prevalence and its ecological, economic, and public health impacts in L.A. County. We recommend consulting the management briefs and full invasive species report for more specifics on any given species (See Appendix).[204]

All spatial distribution data analyzed and produced for this indicator were done by the UCLA Biodiversity Atlas project led by UCLA professor Dr. Thomas Gillespie.

Fountain Grass (*Pennisetum setaceum*)
Photo: Ashley Kruythoff

Invasive shot-hole borers, *Euwallacea nr. fornicatus* in Los Angeles County (2012-2017)



Map courtesy of the Biodiversity Atlas of Los Angeles. Accessed August 9, 2020.

Data Source: UC Cooperative Extension

FINDINGS

- *Algae* (2 species): Los Angeles County is currently experiencing some negative ecological and economic impacts from the invasive alga *Sargassum horneri*, particularly in sheltered coastal areas and harbors. The most important management step with regards to algae is vigilant monitoring to prevent colonization of new areas.
- *Birds* (2 species): Invasive Eurasian Collared-Doves (*Streptopelia decaocto*) and European Starlings (*Sturnus vulgaris*) are highly prevalent in the County. These birds can be addressed with non-lethal practices (e.g. frightening devices, repellents), lethal practices (e.g. hunting, trapping, poisoning), and land management practices to reduce creating colonizable habitat.
- *Invertebrates* (4 species): Invertebrates are causing significant ecological disruption, especially in the County's aquatic areas, through predation and formation of dense colonies. Infrastructural damage and secondary effects are creating negative economic effects. Effective management practices should largely focus on physical removal and spread prevention.

  Insects (2 species): Argentine Ants (*Linepithema humile*) and Invasive Shot Hole Borers (*Euwallacea sp.*) are causing significant ecosystem disruptions and negative economic effects, particularly through impacts on agriculture. Established management options include minimizing disturbance of healthy native ecosystems and lethal methods (e.g. pesticides and baits).
- *Fish* (3 species): Three species of introduced game fish—Largemouth bass (*Micropterus salmoides*), Common carp (*Cyprinus carpio*), and Bluegill (*Lepomis macrochirus*)—are causing severe ecological impacts on the County's aquatic areas through predation and ecosystem disturbance. Management options include preventing spread to new bodies of water, physical removal (e.g. seining), and chemical or biological controls.
- *Mammals* (1 species): Fox squirrels (*Sciurus niger*) are ubiquitous in the County and are having a significant ecological impact through predation and competition. They are also a notable agricultural pest and may damage infrastructure (e.g. by chewing on power lines). Management can utilize lethal strategies (e.g. trapping, hunting) and non-lethal ones (e.g. sterilization, assistance for native species).
- *Terrestrial Plants* (9 species): L.A. County is heavily impacted by the spread of numerous invasive plant species, particularly in coastal areas. Distribution patterns by number of species can be seen in the accompanying map. Most of the assessed species can crowd out native flora and establish dense monocultures while also causing economic impacts, especially by increasing wildfire incidence and severity. General management options are mechanical removal or herbicidal treatments, though the negative side-effects of the latter should be carefully considered.

RECOMMENDATIONS

Data: To monitor and control the spread of invasive species there needs to be a county-wide effort to report on data of the current most impactful invasive species in the region. This includes the list below as well as feral cats, bullfrogs, star thistles and any other additions that become relevant due to new expert knowledge or new invasions. Community science could be an effective tool to monitor new invasions in sensitive areas. The county should also document the time and money spent on management of these invasive species to justify investment in prevention instead of control after invasion.

Action: There is an additional need to monitor and track future threats, especially at known points of entry, like the port and the airport. Furthermore, there needs to be insect protocols in place to prevent spread from nurseries. There should also be institutional management for invasive plant species within the county, like there is for pest species. Finally, identifying priority areas to target for invasive species removal or monitoring –like areas after a recent burn, on the edge of an invaded/uninvaded area, or in an area known to harbor endangered species– would help streamline management efforts. Additionally, some prioritization of the species based on the ability to remove or control their populations. For some, it's likely not feasible to remove and thus the goal should be to just reduce and not remove.

Policy: An Integrated Pest Management Plan should be standardized for all invasive species and nuisance species in the County. All cities and unincorporated areas should comply. In addition, nurseries should not be allowed to sell any plants on the CAL IPC invasive plant lists.

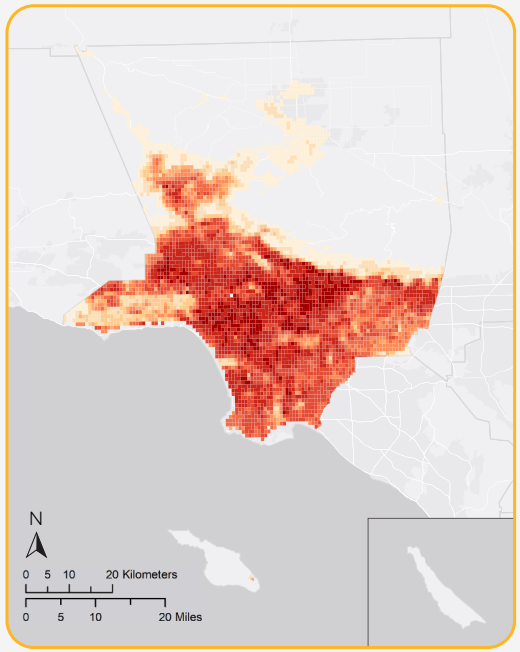
Impact of Invasive Indicator Species (2019)

Taxa Group	Scientific Name	Common Name	Prevalence	Ecological Impact	Economic Impact	Public Health Impact
Algae	*Sargassum horneri*	N/A	Low	Moderate	Low	None
Algae	*Caulerpa taxifolia*	N/A	Not present	None	None	None
Bird	*Streptopelia decaocto*	Eurasian Collared-Dove	Ubiquitous	Low	Low	Low
Bird	*Sturnus vulgaris*	European Starling	High	Moderate	Low	Low
Invertebrate	*Linepithema humile*	Argentine Ant	Ubiquitous	High	Low	None
Invertebrate	*Astocoidea family*	Crayfish	High	High	Low	None
Invertebrate	*Dreissena polymorpha*	Zebra Mussels	Moderate	Moderate	Moderate	None
Invertebrate	*Euwallacea sp*	Polyphagous Shot-Hole Borer	Moderate	Severe	High	None
Invertebrate	*Otala lactea*	Milk Snail	Moderate	Low	Low	None
Invertebrate	*Potamopyrgus antipodarum*	New Zealand Mudsnail	Moderate	Moderate	Moderate	None
Fish	*Micropterus salmoides*	Largemouth Bass	High	Severe	Low to Positive	None
Fish	*Cyprinus carpio*	Common Carp	High	Severe	Low to Positive	Low
Fish	*Lepomis macrochirus*	Bluegill	High	High	Low to Positive	None
Mammal	*Sciurus niger*	Fox Squirrel	Ubiquitous	Low	Moderate	Low
Plant	*Acacia (various)*	Wattles	Moderate	High	Low	None
Plant	*Arundo donax*	Giant Reed	High	Severe	Moderate	None
Plant	*Brassica nigra*	Black Mustard	High	Severe	Moderate	None
Plant	*Cortederia selloana*	Pampas Grass	Moderate	Severe	Moderate	None
Plant	*Euphorbia terracina*	Geraldton Carnation Weed	Moderate	Severe	Moderate	Low
Plant	*Foeniculum vulgare*	Sweet Fennel	Ubiquitous	Severe	Low	None
Plant	*Glebionis coronaria*	Garland Daisy	Moderate	High	Low	None
Plant	*Pennisetum setaceum*	Fountain Grass	High	High	Low	None
Plant	*Ricinis communis*	Castor Bean	High	Severe	Moderate	Moderate

*Species highlighted in gray have iNaturalist observations and have likelihood of presence maps created by the UCLA Biodiversity Atlas of LA (see below)

Impact Scale:
Severe: Species is known to have very strong negative impacts in this sector, where present.
High: Species is known to have strongly negative effects in this sector, where present.
Moderate: Species has some negative impacts in this sector, where present.
Low: Species exhibits few or relatively small negative effects. Disruption to the sector in question is limited.
None: Species has no known negative impacts on this sector.
Positive: Used only for economic impact, this rating indicates that a species' presence may generate net economic benefits.

Eastern Fox Squirrel, *Sciurus niger* in Los Angeles County (2012-2017)



Likelihood of Sighting

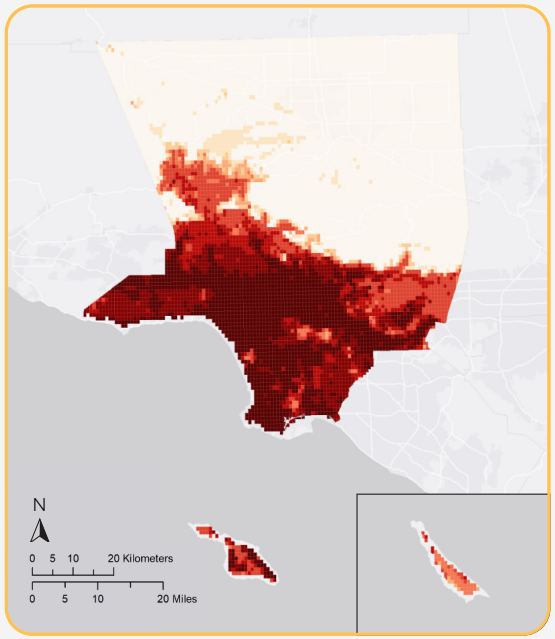
Low

High

Map courtesy of the Biodiversity Atlas of Los Angeles. Accessed August 9, 2020.

Data Source: iNaturalist

Likelihood of Occurrence for Eight Invasive Plant Species in Los Angeles County (2018)



Number of non-native plant species likely to occur

0
1
2
3
4
5
6
7
8

Map courtesy of the Biodiversity Atlas of Los Angeles. Accessed August 9, 2020.

Data Source: iNaturalist; Calflora.

BREAKOUT: NATIONAL PARK SERVICE INVASIVE SPECIES MONITORING PROGRAM

The National Park Service (NPS) conducts monitoring programs for native and invasive plant and aquatic amphibian species in the Santa Monica Mountains National Recreation Area (SAMO) to assess the status of different species and identify population trends to inform management.

The NPS began monitoring aquatic amphibian species in the SAMO in 2000, and has since expanded the effort to include a total of 58 sampling locations, a subset of which are visited twice annually during amphibian breeding season (April – July) to collect data about the occupancy and abundance of the five native stream-breeding amphibians in residence.[205] The native species monitored include the California newts, Pacific treefrogs, California treefrogs, Western toads, and California red-legged frogs. Notably, California red-legged frogs were extirpated from SAMO in the mid-20th century but are now present as part of a re-introduction effort. Non-native aquatic species in SAMO include red swamp crayfish, bullfrogs, and many fish, such as bass, bluegill, and mosquitofish. New Zealand mud snails have also been identified as an invasive species in the area.

Results of the 2017 survey showed that the California newt and the California treefrog were rarely present in streams with invasive crayfish, fish, or bullfrogs. In the same year, Pacific treefrogs were found in habitats alongside crayfish and fish but were less abundant in these locations. Although Western toads were the least detectable of the target species, all four target species were detectable in 2017. Overall, the species' distribution and abundance are associated with the degree of urbanization of the watershed in which they reside. Furthermore, urban run-off to streams facilitates the persistence of non-native invasive species in their habitat.[206]

NPS also monitors plant populations in the SAMO, as well as in the Channel Islands National Park. Distance sampling is used to monitor both native and invasive plants, while the possibility of collecting additional data through opportunistic sampling by visitors, rangers, maintenance staff, and others is being examined.[207] Monitoring is key because preventative measures, and rapid responses to detection, are the most effective approaches for protecting native habitat against invasive plants.

Both the plant and amphibian monitoring efforts exemplify species monitoring of both native and non-native species that is critical for informing the management decisions that protect biodiversity, particularly in a natural area threatened by urbanization, pollution, and non-native species.

California Newt (*Taricha torosa*), found in Ramirez Canyon within the Santa Monica Mountains
Photo: National Park Service

BREAKOUT: CALIFORNIA RODENTICIDE RESTRICTIONS

AB-1788 is a California bill that bans the use of several types of second-generation anticoagulant rodenticides (SGARs) in the state.[208]

On September 29, 2020, the bill was signed into law by Governor Newsom.[209] This legislative action is timely, as recent research has found new evidence of the harm these chemicals cause to L.A. area wildlife. Researchers have identified harmful effects on the immune systems and genetics of bobcats (*Lynx rufus*) resulting from rodenticide exposure, and testing has found numerous local predatory species that can be secondarily poisoned.[210-212] Various studies have found that poisoning is a significant factor in mortality of several bird and mammal species (e.g. coyotes, fishers, bobcats) in California, and testing has shown rates of exposure to SGARs in tested animals as high as 100% in recent years.[213] This bill improves upon the rodenticide restrictions instituted by the City of L.A. in 2014 and represents a significant legal precedent for protecting wildlife against these harmful chemicals.[214]

P-34 was found lying on this trail by a hiker in Point Mugu State Park. Preliminary results from the necropsy indicate she may have died because of rodenticide poisoning.
Photo: National Park Service

Glyphosphate has been used to help control Giant Reed (*Arundo donax*), an invasive species in L.A. County.
Photo: Norm Herr, iNaturalist Photo 42534868

BREAKOUT: LOS ANGELES COUNTY HERBICIDE RESTRICTIONS

Glyphosate—the most widely used herbicide in the world, marketed as RoundUp – is a common tool in the eradication and management of invasive plant species.

While evidence concerning the human health impacts has been historically mixed, recent research found a compelling link between glyphosate exposure and non-Hodgkin lymphoma.[215] The World Health Organization classified the chemical as a "probable carcinogen" in 2015.[216] These findings have been accompanied by lawsuits that have resulted in a total of $10 billion dollars to settle claims by individuals whose health has been ostensibly harmed from exposure to glyphosate.[217] The herbicide's manufacturer was Monsanto, but in 2018 the German drug maker and chemical company Bayer finalized a $66 billion deal to buyout Monsanto, and is thus on the hook for all associated lawsuits. Glyphosate has also been found to accumulate in the environment and is linked to some worrisome ecological phenomena, including adverse effects on amphibians and degradation of microbial communities.[218.219] In response, the L.A. County Board of Supervisors instituted a moratorium on the use of glyphosate in 2019.[220] This restriction constitutes an appropriate precautionary step with respect to public health and ecosystem health in the L.A. area. If the moratorium holds, alternatives will have to be pursued to ensure invasive plant species can be adequately managed.

Trunk of a heavily infested California sycamore by shot hole borer
Photo: Beatriz Nobua-Behrmann, UC Cooperative Extension

GRADE: C

Human reliance on ecosystem health has been vastly undervalued, but current research on the value of natural areas and the flora and fauna that thrive in them demonstrates how essential their existence is for our wellbeing.

Some critical ecosystem services include air and water pollution reduction, resilience to a changing climate, medical treatment advancements, food security (pollination), improved physical and mental health, as well as cultural heritage. Although many of these services are known and valued by communities, the location of ecosystems, or "nature" have historically not been equitably distributed throughout the urban landscape and its surroundings. As such, increasing access to nature and ensuring that nature and ecosystems themselves are healthy is essential to restoring and maintaining community health and improving overall human wellbeing.

KEY FINDINGS

- **In 2005, the rate of heat-related emergency department visits in L.A. County was five per 100,000 people; in 2018, that rate increased to 13 per 100,000 people.**
- **49% of the County population lives within a half-mile walking distance of a local park, regional recreation park, or regional open space (2016).**
- **20% of urban L.A. County is covered by tree canopy (2016).**

GRADING

Emergency department visits due to heat-related illness continue to trend upward, mirroring the number of extreme heat days the region is experiencing with the continued threat of climate change. Innovative adaptation strategies are required to improve health outcomes related to heat. Nearly half of L.A. County residents live within a half-mile of a park or recreation area, yet entire communities lack access to these essential services, illustrating a need for targeted improvements to meet future access goals. Furthermore, access alone does not tell us anything about the quality of parks or recreation areas accessible to these communities. We must do more to ensure access to quality parks and open space for all Angelenos.

RECOMMENDATIONS

Data:

- Analyze the percentage of the population that can access natural areas and cooling centers via public transit and determine areas of highest need.
- Spatially analyze and monitor areas covered by heat-trapping surfaces to inform planning and implementation of urban heat island mitigation strategies.
- Continue to assess access to parks and recreation on a recurring basis and better assess park quality, including ecosystem services provided.
- Regularly collect neighborhood-scale data on urban tree health and maintenance needs.

Action:

- Create an urban heat island management plan for the county that addresses cool pavements and roofs, pavement reduction and urban greening in high need areas and includes an urban tree management plan.
- Ensure all Angelenos have access to green space and reasonable access to beaches; this includes addressing existing public access to beaches.
- Design and run parks to fit the unique needs and values of the surrounding communities.

Policy:

- All community members should have access to a public cooling center within a quarter mile walk and/or a 10-minute transit commute.
- All new parks should include green space and existing parks should be retrofitted to include green space. Green space should be climate appropriate and provide multiple benefits for people and biodiversity.
- All public funds spent on increasing the urban tree canopy should be spent in the highest need areas. The tree canopy should be climate appropriate and provide multiple benefits for people and biodiversity.

Los Angeles
Photo: open access

OURCOUNTY GOALS AND STRATEGIES

Goal 2: Buildings and infrastructure that support human health and resilience.

Strategy 2A: Integrate climate adaptation and resilience into planning, building, infrastructure, and community development decisions.

Strategy 2D: Ensure a climate-appropriate, healthy urban tree canopy that is equitably distributed.

Goal 6: Accessible parks, beaches, recreational waters, public lands, and public spaces that create opportunities for respite, recreation, ecological discovery, and cultural activities.

Strategy 6A: Improve access to parks, beaches, recreational waters, public lands, and public spaces.

INDICATORS

Urban Heat Island and Heat-Related Illness, Urban Heat Island, Park and Recreation Access, Urban Tree Canopy

BREAKOUTS

Urban Agriculture, Park Quality, ParkScore, Mountain Areas Visitation Rates, Heal the Bay Beach and River Report Cards, Street Tree Maintenance

UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

Cool Pavement Work
Photo: Los Angeles Bureau of Street Services

INDICATOR

Urban Heat Island and Heat-Related Illness

OurCounty Targets:

Baseline: Research is currently being conducted to understand how much of L.A. County's land area is covered by heat-trapping surfaces. In 2014 there were seven heat-stress emergency department visits per 100,000 residents.

2025: Convert 10% of heat-trapping surfaces to cool or green surfaces. Reduce by 15% the number of heat-stress emergency department visits per 100,000 residents.

2035: Convert 20% of heat-trapping surfaces to cool or green surfaces. Reduce by 45% the number of heat-stress emergency department visits per 100,000 residents.

2045: Convert 30% of heat-trapping surfaces to cool or green surface. Reduce by 75% the number of heat-stress emergency departments visits per 100,000 residents.

The urban heat island effect occurs in areas where there are significantly more buildings and paved surfaces that cause higher surface temperatures.[221]

Extreme heat impacts are not realized equally across L.A. County; some neighborhoods are more dramatically impacted than others.

Contributing factors include the greater heat absorption and lower sunlight reflectivity, or albedo, of building materials and some groundcover, and a lack of trees and other vegetation, which can provide cooling through shade and evapotranspiration.[222]

An extreme heat day is classified as a day when the average temperature is over 95 degrees Fahrenheit (35 degrees Celsius). Notably, this threshold was far exceeded on September 6, 2020, when the San Fernando Valley community of Woodland Hills reached 121 degrees Fahrenheit, setting a record for the highest temperature recorded at an official National Weather Service station across Los Angeles, Ventura, Santa Barbara, and San Luis Obispo counties.[223] Days like this exemplify the reason for concern about not only the frequency, but also the intensity of extreme heat.

Extreme heat impacts are not realized equally across L.A. County; some neighborhoods are more dramatically impacted than others. Alex Hall of the Center for Climate Science at UCLA's Institute of the Environment and Sustainability conducted a study that projects the number of extreme heat days across different regions of southern California for both mid-century (2041-2060) and the end of the century (2081-2100) under two scenarios: one in which greenhouse gas (GHG) emissions are reduced in the coming decades, and a second in which GHG emissions continue to increase (business as usual). This study also reports the number of extreme heat days during a baseline period (1981-2000) for the same regions.[14] They found that the baseline (1981-2000) average number of extreme heat days per year is six in downtown Los Angeles,four in Long Beach, 36 in Palmdale, 32 in the San Gabriel valley, zero in the San Gabriel Mountains, and zero in Santa Monica. In the business as usual GHG emissions scenario, all areas are projected to see an increase in the number of extreme heat days by mid-century (2041-2060), and an even more severe increase by the end of the century (2081-2100). The areas with the highest baseline number of

extreme heat days (Palmdale and the San Gabriel Valley) are also projected to have the most significant increase in number of extreme heat days under any circumstances, while cooler areas (the San Gabriel Mountains and Santa Monica) are projected to see less dramatic increases.

Prolonged or intense heat exposure can cause or exacerbate health problems. In fact, extreme heat is the number one cause of weather-related deaths annually in the United States, claiming more lives than other disasters such as storms and floods.[224] Those who work outdoors in industries such as construction or agriculture are at a higher risk for heat-related emergency department visits or hospitalizations.[225] Those who lack access to air conditioning, or are unable to afford the energy costs of air conditioning, are also at a higher risk for experiencing heat-related health impacts.

Cooling centers are one tool for addressing the public health challenge presented by increasing temperatures. Cooling centers are air-conditioned indoor spaces that are open to the public at no cost during extreme heat events.[226] Libraries, community centers, senior centers, and similar recreation facilities often serve as cooling centers. Unfortunately, cooling centers retain a proximity barrier to access: only 3% of L.A. residents live near one.[227] 2020 has added yet another challenge to offering and using these cooling centers in the wake of the COVID-19 pandemic since indoor "gatherings" create increased risk of contracting the virus.

Average Number of Extreme Heat Days* Per Year, Los Angeles Region

City/Region	Baseline (1981-2000)	GHG Emissions Reductions Scenario midcentury (2041-2060)	Business as Usual Scenario midcentury (2041-2060)	GHG Emissions Reductions Scenario end of century (2081-2100)	Business as Usual Scenario end of century (2081-2100)
Downtown Los Angeles	6	16	22	15	54
Long Beach	4	11	16	11	37
Palmdale	36	59	71	58	104
San Gabriel valley	32	62	74	61	117
San Gabriel Mountains	0	0	1	0	8
Santa Monica	0	1	1	1	3

Notes:
*Extreme Heat Days refers to days with a daily maximum temperature exceeding 35C (95F).

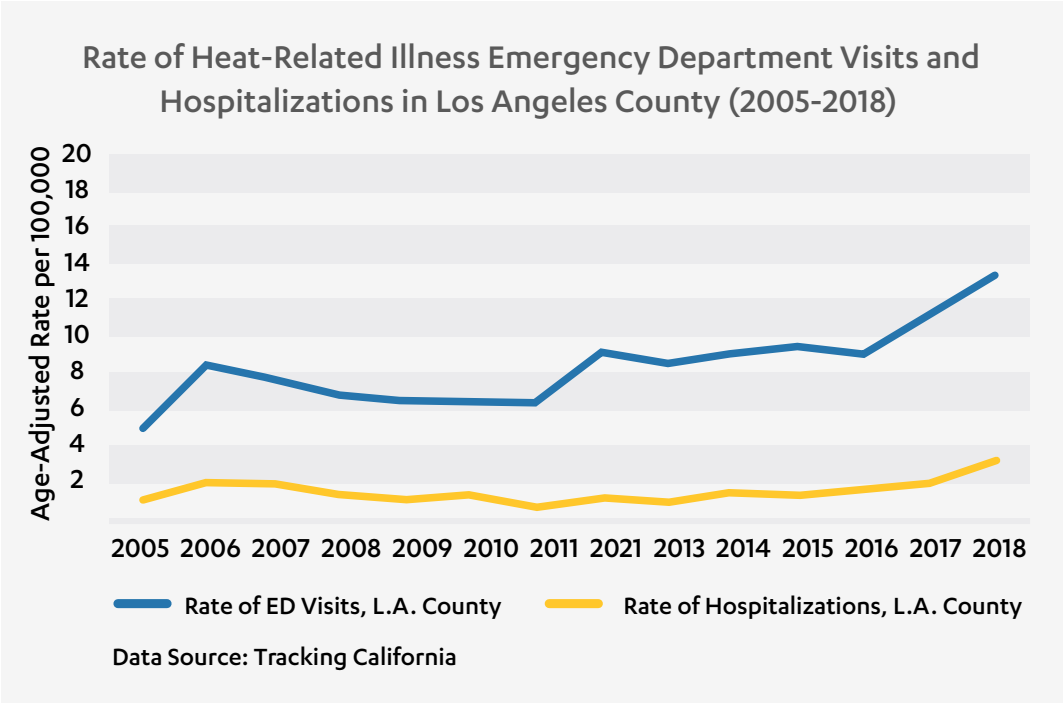
Table courtesy of Alex Hall of the Center for Climate Science at UCLA's Institute of the Environment and Sustainability

Heat-Related Illness in Los Angeles County (2018)

Demographics		Hospitalizations		Emergency Department Visits	
		Age-adjusted rate per 100,000	Total Number	Age-adjusted rate per 100,000	Total Number
Race/ Ethnicity	African-American/ Black	4.8	50	19.3	177
	Asian-American/ Pacific Islander	1.8	36	5.4	95
	Hispanic/ Latino	3.3	129	12.8	590
	European-American/ White	3	123	13.9	459
	Other	14.3	25	63.6	124
Age	18-34	1	24	13	318
	35-64	2.6	122	12.6	532
	65+	14.6	210	32.1	460
Gender	Female	2.1	138	10	572
	Male	4.3	225	17	873
Total		3.2	363	13.4	1445

Note: The race/ethnicity classifications used and reported here were created by the Tracking California data set and do not represent U.S. census norms.

Data Source: Tracking California



Heat-related emergency department visits and hospitalizations both increased from 2005 to 2018, with African-American/ Black men and older adults impacted the most.

DATA AND METHODS

To assess the impact of the urban heat island effect in L.A. County, we used data from Tracking California's database on emergency department (ED) visits and hospitalizations due to heat-related illness for 2005-2018. We reported on the age-adjusted rate per 100,000 people of heat-related illness ED visits and hospitalizations. We also documented the ED visits and hospitalizations due to heat-related illness in 2018 by race, age, and gender as reported by Tracking California's database. Additional data collection and analyses on cooling centers in the county were conducted by Robert Cudd from California Center for Sustainable Communities at UCLA's Institute of the Environment and Sustainability. L.A. County and L.A. City websites for county cooling centers, L.A. City recreation centers, and L.A. City year-round pool locations were pulled directly from city and county websites.[228,229] Site addresses were then geocoded with Google Geocoding API and point data were added to create a context map in ArcMap.

FINDINGS

- In 2005, the rate of heat-related ED visits in L.A. County was five per 100,000 people. In 2018, that rate increased to 13 per 100,000 people. The specified demographic groups (excluding "Other") with the highest rates of heat related ED visits in L.A. County were African-American/ Black (19.3/100,000), 65 and older (32.1/100,000) and men (17/100,000).
- In 2005, the rate of heat-related hospitalizations in L.A. County was one per 100,000 people. In 2018, that rate increased to three per 100,000 people. The specified demographic groups (excluding "Other") with the highest rates of heat related hospitalizations in L.A. County were African-American/ Black (4.8/100,000), 65 and older (14.6/100,000) and men (4.3/100,000).
- There were 267 cooling centers total within L.A. County in 2019. Two hundred fifty six of these centers were south of Santa Clarita, and only eight county cooling centers exist north of Acton.

RECOMMENDATIONS

Data: L.A. County should report on the percentage of the community that has access to a cooling center within a quarter mile walk and/or a 10-minute transit commute. Additional data should be collected to determine areas of highest need including degree of urban heat island effect, socioeconomic status, and percentage of residences that have air conditioning units. County land area that is covered by heat-trapping surfaces should be mapped to inform planning and implementation of urban heat island mitigation strategies.

Action: An urban heat island mitigation plan should be developed for the county that addresses cool pavements and roofs, pavement reduction, shade structures, and urban greening.

Policy: All community members, especially in areas of highest need, should have access to a public cooling center within a quarter mile walk and/or a 10-minute transit commute.

DATA LIMITATIONS

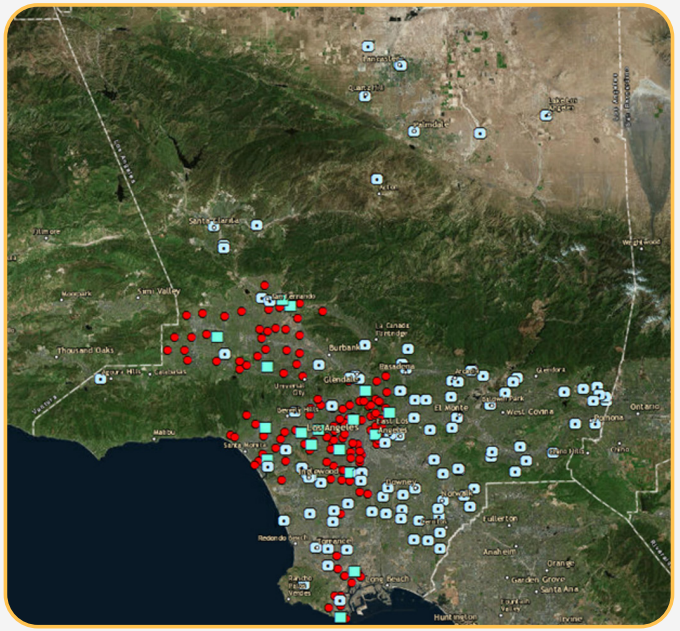
Health records do not factor in persons who cannot get to a hospital or ED and therefore are inherently underreporting the actual health impacts experienced by the community.

Heat-related illness can be exacerbated by the urban heat island effect, but it is not unique to areas impacted by said effect. Cases reflect the overall impact of rising global temperatures, and, in some specific areas, the urban heat island effect combined with the lack of access to air conditioning and cooling centers.

The race/ethnicity classifications used and reported here were created by the Tracking California data set and do not represent U.S. census norms.

There were 267 cooling centers total within L.A. County in 2019.

Cooling Centers in Los Angeles County (2019)



Map courtesy of Robert Cudd from California Center for Sustainable Communities at UCLA's Institute of the Environment and Sustainability

BREAKOUT: URBAN AGRICULTURE

In 2015, 561,000 households across L.A. County experienced food insecurity and faced barriers to purchasing healthy food.[230]

In response to increasing levels of food insecurity, L.A. officials have promoted urban agriculture (UA) as a community strategy to support public health, environmental sustainability, economic development, and social cohesion across the region.

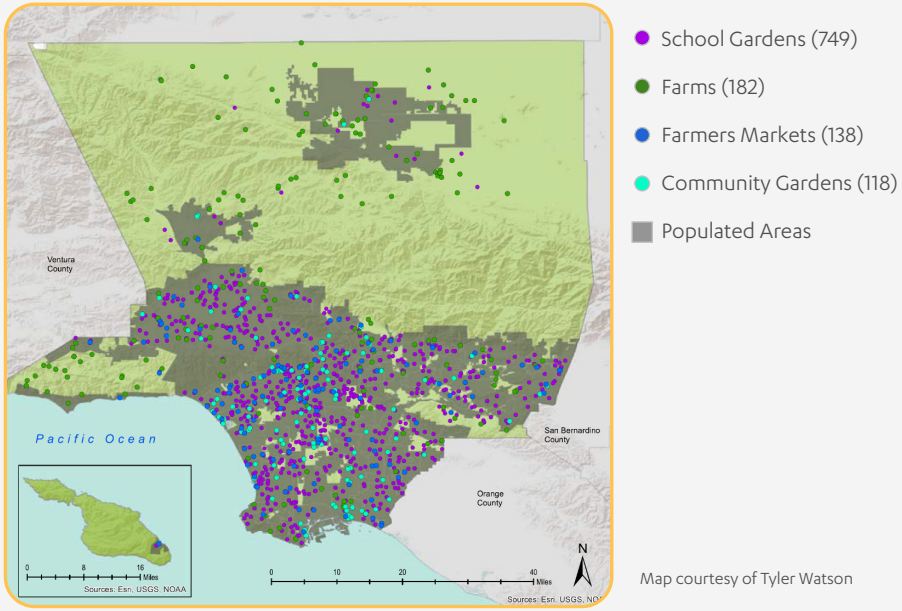
Despite the promotion of UA across L.A. County, little data on regional UA activity exists.[231] As such, in 2016, Sustainable LA Grand Challenge fellow Tyler Watson assessed L.A.'s existing and potential UA production and distribution, and how UA has affected the health and food security of local communities. In this study, UA included school gardens, farms, farmers markets, and community gardens within L.A. County.

Watson conducted (1) semi-structured interviews to collect local UA perspectives and farm/ garden data; (2) calculations of potential growing area and volume; (3) a geospatial analysis of the distribution of UA sites and vacant land relative to underserved communities; and (4) an analysis of municipal UA policies and recommendations to further support potential UA development across L.A. County.

This study demonstrated that community building was a primary motivation of UA in the region and discovered innovative approaches to food production in urban environments. Watson found that only a fraction of total city vegetable consumption could be theoretically met by UA production, but that it could provide enough vegetables to meet the nutrition needs of the city's food insecure population if all UA production across the county was distributed to those most in need.

The implementation of successful UA sites requires a lot more than assessing available land. To ensure equitable access, who gets access to the garden and who gets access to the products that it produces should be determined upfront. Properties that are near known pollution sources like freeways and industrial sites should not be considered as sites unless they are indoor greenhouses. The soil must be remediated from toxins, fertility needs should be enhanced by compost and there must be volunteer or paid labor for management to maintain the garden. These commitments must be long-term, and as such, successful UA requires eminent domain by the city or county to ensure investments are not wasted on properties that are later sold for alternate uses. Furthermore, maintenance concerns like pesticide and herbicide use, as well as runoff and subsidized water in perpetuity should be considered before implementation. Finally, communal investment requires classes in UA to maximize effective engagement and participation.[232]

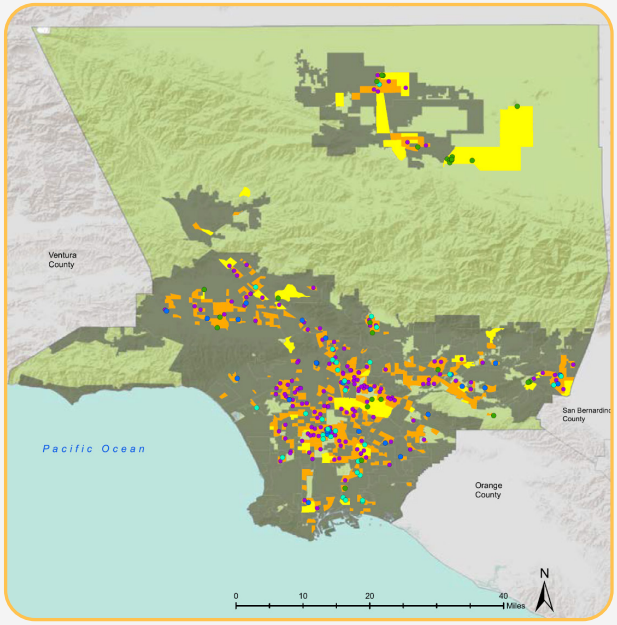
Total Urban Agriculture Sites Verified in Los Angeles County (2016)



Map courtesy of Tyler Watson

Number of Urban Agriculture Sites in Los Angeles County (2020)	
Community Gardens	168
Farms	200
Nurseries	401
School Gardens	444
Data Source: Cultivate LA	

Urban Agriculture Sites Within 1 Mile of a Food Desert in Los Angeles County (2016)



- School Gardens (164)
- Farms (28)
- Farmers Markets (27)
- Community Gardens (32)
- Food Desert (1mi)
- Food Desert (0.5mi)
- Populated Areas
- Other Areas

Map courtesy of Tyler Watson

Top: Tomatoes at Two Dog Organic Nursery
Photo: Ashley Kruythoff
Bottom: Get Planted Community Garden
Photo: Ashley Kruythoff

Watson's study also found that existing UA sites are irregularly distributed across the L.A. region, with fewer sites in the San Fernando Valley and the urban core as well as fewer sites in communities with less access to fresh food, relative to the rest of the city. Based on these findings, Watson suggested that although recent policies and planning changes have shown support for UA in L.A., additional efforts will need to be made to more fully realize its potential such as prioritizing and supporting UA development in communities that currently have little or no UA activity.

Cultivate Los Angeles has played a large role in increasing awareness and understanding L.A.'s UA landscape with the publication of their interactive map of the region's UA sites.[233] In addition, the 2019 OurCounty Sustainability Plan called for the use of public and private land for urban and peri-urban agriculture as well as providing technical and financial support to urban agriculture entrepreneurs in adopting regenerative agricultural practices.[26] This is a good start, but an expanded understanding of UA in the L.A. region could further inform and guide policies and practices to achieve the goals of UA and ultimately aid food insecure families and communities.

INDICATOR

Park and Recreation Access

OurCounty Targets:

2025: Increase to 65% the proportion of residents within 1/2 mile of parks and open space.

2035: Increase to 75% the proportion of residents within 1/2 mile of parks and open space.

2045: Increase to 85% the proportion of residents within 1/2 mile of parks and open space.

Access to parks and open space promotes health and well-being in urban communities by providing opportunities for outdoor recreation, community engagement, and access to nature.[234]

This is particularly important in underprivileged communities lacking access to private open spaces such as backyards, and the mobility to access peri-urban spaces. Parks and open space also mitigate air pollution in L.A. County, providing additional associated public health benefits.[235] Measures of park accessibility and park pressure are necessary for quantifying and determining the distribution of park need throughout the County, as funding for parks and recreational facilities is limited.

According to The Trust for Public Land, most pedestrians are willing to walk 1/2 mile (~10 minutes) to access parks and recreational facilities.[236] This is evident in the City of Los Angeles, where parks contribute to population-level physical activity for residents living within 1/2 mile.[237] The farther the distance from parks, the higher the need. Population density also affects park need, as parks with a small number of acres per 1,000 nearby residents are likely to be more heavily used than parks with a larger number of acres per 1,000 nearby residents. Both measures are critical for ensuring that communities have adequate access to parks.

Los Liones Hike
Photo: Ashley Kruythoff

DATA AND METHODS

We used data from the Los Angeles Countywide Parks and Recreation Needs Assessment.[238] The assessment was initiated in 2015 and completed in 2016 to help inform planning and decision-making regarding future funding for park projects. Publicly accessible data on the size and location of all existing parks in the County were collected through collaboration between the Los Angeles County Department of Parks and Recreation with 86 of 88 incorporated cities to complete the first countywide parks and open space inventory.

Four types of parks and open space were used for the inventory and are unique to the Park Needs Assessment: local parks, regional recreation parks, regional open space, and natural areas.

To determine physical park accessibility, the distance from each household to the access points of all adjacent parks was calculated along the pedestrian network. This method takes barriers such as highways or freeways into consideration and provides a more accurate assessment of the distance a pedestrian would need to travel to reach a park.

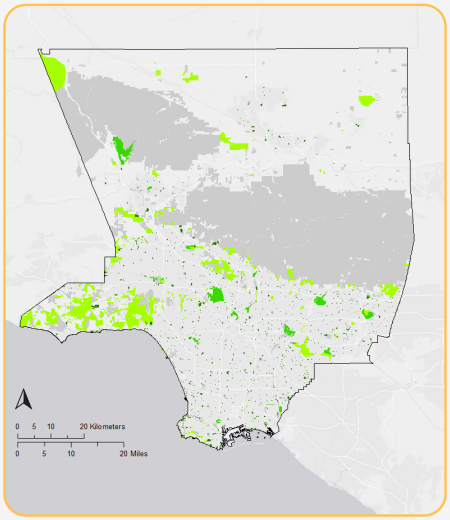
Park pressure examines park size in relation to population density and quantifies how population density affects parks by capturing the potential demand if each resident of the County were to use the park closest to them.

Access to mountain destinations, beaches, and parks via transit was assessed by Metro's Transit to Parks Strategic Plan in 2019.[239] All data was directly pulled from the report.

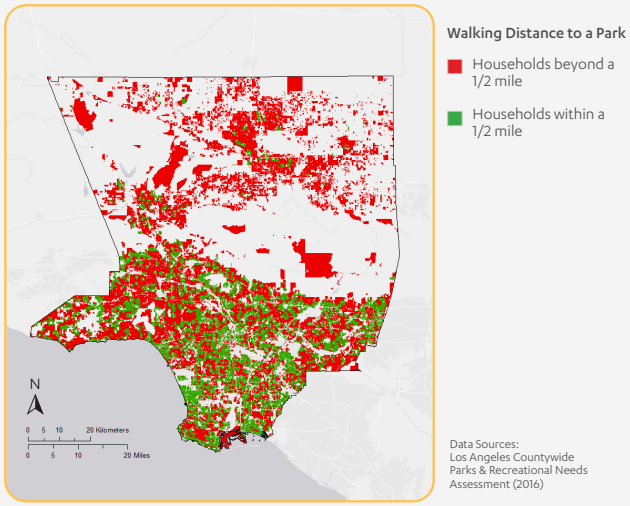
FINDINGS

- A total of 3,023 parks and open spaces were inventoried countywide in 2016, representing a total of 901,647 acres.
- In 2016, 49% of the County population lived within a half-mile walking distance of a local park, regional recreation park, or regional open space.
- Approximately 80% of local parks and regional recreation parks had less than 3.3 acres of land available per 1,000 nearby residents in 2016. These parks offered less land than the countywide average of 3.3 acres per 1,000 residents.
- In 2016, park pressure ranged from a low pressure of 16,581 acres per 1,000 nearby residents to a high pressure of 0.004 acres per 1,000 nearby residents.
- Only five existing transit lines served mountain open space destinations in 2019.
- Three percent of County residents lived within a half-mile of bus stops or routes that go to mountain destinations.
- For 60% of County residents, it took one hour or more to get to mountain destinations.
- Only 30 transit lines served existing beach parks of interest in 2019.
- Twenty-two percent of the County population lived within a half-mile of bus stops or routes that service beach parks.
- For 69% of the County, it took at least one hour to get to the beach.
- Overall, 22% of high-quality parks (as defined by Metro) did not have direct public transportation access in 2019.

Los Angeles County Parks and Open Space (2016)



Access to Local Parks and Open Space in Los Angeles County (2016)



Los Angeles County Parks Inventory (2016)

Type		Description	Count	Acreage
	Local Parks	Includes all parks under 5 acres and parks under 100 acres that contain active amenities such as athletic courts and fields, playgrounds, and swimming pools. Local parks identified in the inventory are sometimes called community parks or regional parks by the agencies that operate them. County and City-owned tot lots, pocket parks, neighborhood parks, and community parks are included in this category. These parks are included in the analysis of park access and park pressure.	1,602	15,723
	Regional Recreation Parks	Includes parks over 100 acres that contain active amenities such as athletic courts and fields, playgrounds, and swimming pools. Locally administered "regional parks" under 100 acres in size are not included in this category, and are included as local parks in the inventory instead. These parks are included in the analysis of park access and park pressure.	17	18,248
	Regional Open Space	Includes facilities that are more than 5 acres and generally contain only passive amenities such as visitor centers, trails, picnic shelters, or restrooms. This category includes state parks, state recreation areas, and national park service land. These facilities are included in the analysis of park access, but are excluded in the analysis of park pressure.	329	98,977
	Natural Areas	Generally larger than 100 acres and contain no reported amenities. This category includes agricultural land, habitat conservation lands, ecological reserves, military lands, Bureau of Land Management public land, golf courses, and beaches. These facilities are excluded in the analysis of park access and park pressure.	1,075	768,699

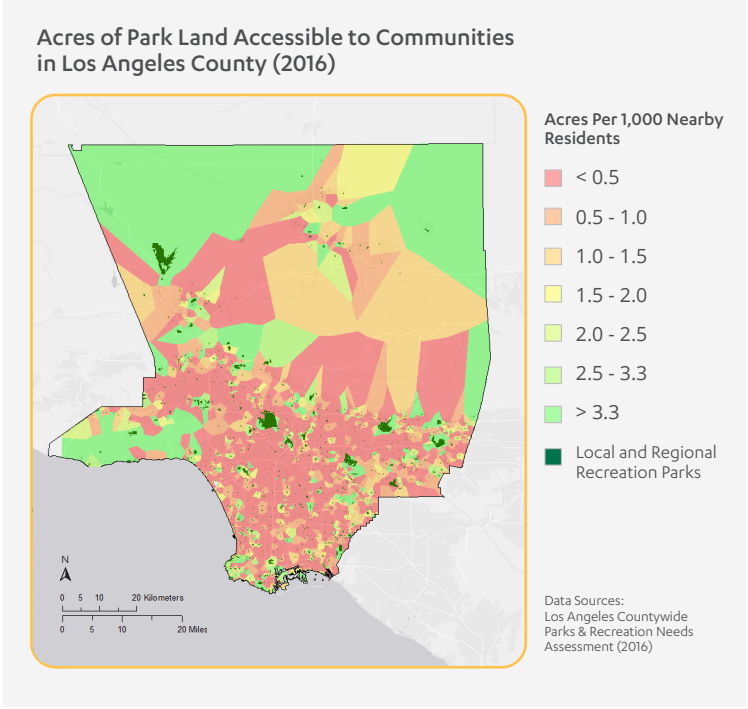
Data Source: Los Angeles Countywide Parks & Recreation Needs Assessment (2016)

RECOMMENDATIONS

Data: Measures of park access and park pressure do not capture the associated public health benefits of pollution mitigation around parks and open space. Additional information on park quality including the types of recreational facilities, the amount of greenspace, the type of vegetation, tree canopy and other natural features are needed to quantify the ecosystem services that each park provides. Thus, although this provides a foundational understanding of the communities that do not have access to any facilities, it does not fully characterize the specific benefits within communities that currently do have access to one or more of these facilities. Further research is necessary to differentiate between facilities that provide recreational benefits versus natural area benefits to better understand which ecosystem services each community has access to.

Action: Ensure all Angelenos have access to green space, not just recreational facilities within a half-mile walk and areas of higher density should be prioritized first. Address existing public access issues related to beaches including private development, illegal encroachments or blockades, and beach curfews. Make sure that the design and programming of parks fits the needs of surrounding communities, considering demographic information such as age and cultural values in order to better serve underrepresented groups to increase psychological accessibility of parks for these groups.

Policy: All new parks should incorporate green space into their design, even if their primary purpose is recreational services, and all regional parks should be retrofitted to include green space. Green space should be appropriate for the region's climate and also contribute to improving biodiversity. No park should be placed within 1,000 feet of a freeway.



Los Liones Canyon Trail, Los Angeles
Photo: Ashley Kruythoff

DATA LIMITATIONS

Beaches were not included in the Countywide Parks Needs Assessment. As a result, certain coastal areas and households appear to have low park access despite living near beaches due to the structural inequities in housing and transportation.[240] The Los Angeles County Department of Parks and Recreation will be conducting a Regional Recreation, Beaches, Rural Areas, and Open Space Assessment in 2020/ 2021, which will in part examine access to beaches.[239]

Although not currently addressed by the Countywide Parks Needs Assessment, access to natural areas by public transit is another important analysis that will be conducted as part of the Regional Recreation, Beaches, Rural Areas and Open Space Assessment in 2020/ 2021.

Regional open space and natural areas were not included in the analysis of park pressure. As a result, certain coastal areas and households near regional open space appear to have high park pressure.

BREAKOUT: PARK QUALITY

In March 2015, the L.A. County Board of Supervisors approved a motion to initiate the county-wide Comprehensive Parks and Recreation Needs Assessment in an effort to document the actions needed to ensure all L.A. County residents have adequate access to thriving parks.

This represented the first comprehensive assessment of L.A. County's parks and recreation facilities. The final report was released in May 2016.[23]

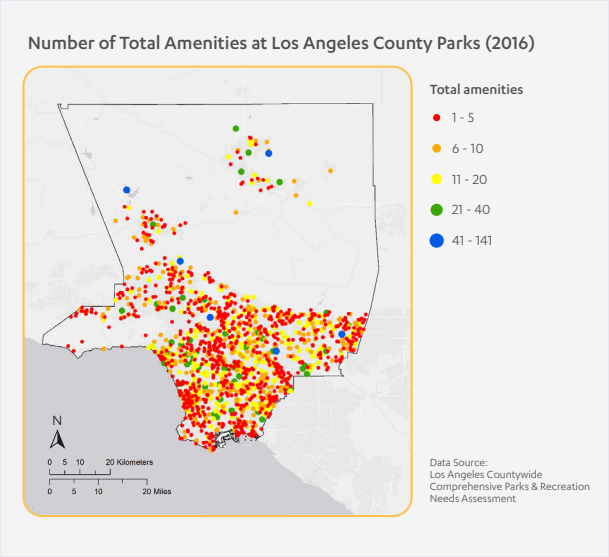
The Park Needs Assessment proposed a new and innovative way to understand and think about parks, recreation, and open space by considering parks as key infrastructure to maintain and improve the quality of life for L.A. County residents; using a new series of metrics to address park needs; supporting a need-based allocation of funding for parks and recreation; and simultaneously prioritizing community priorities and deferred maintenance projects.

The assessment inventoried 3,023 parks of four types across the county. These included 1,602 local parks (all those under five acres, any parks under 100 acres that contain active amenities, or schools with joint-use agreements); 17 regional recreation parks (those over 100 acres containing at least three active amenities); 329 regional open spaces (those over five acres containing only passive amenities); and 1,075 natural areas (those over 100 acres containing no reported amenities, which were not included in the needs analyses).

In order to gain a multi-dimension understanding of park need in the region, five metrics were utilized in the assessment: park land availability, park land availability to residents, the number of amenities, park conditions, and the percentage of population with access to parks. These metrics were combined to create a framework to assess countywide park need.

Echo Park, Los Angeles
Photo: open access

BREAKOUT: PARK QUALITY



Park Amenities, Los Angeles County (2016)	
Amenity Type	**Count**
Baseball Fields	1,068
Tennis Courts	1,022
Basketball Courts	940
Multipurpose Fields	510
Soccer Fields	424
Playgrounds	1,452
Fitness Zones	373
Skate Parks	96
Dog Parks	51
Picnic Shelters	1,251
Restrooms	1,190
Senior Centers	518
Gymnasiums	187
Community Rec Centers	90
Swimming Pools	218
Splash Pads	82
Unique Amenities*	367
Total Amenities Inventoried	9,472
*Unique amenities include equestrian arenas, volleyball courts, amphitheaters, community gardens, concession stands, gazebos, etc.	
Data Source: Los Angeles Countywide Comprehensive Parks & Recreation Needs Assessment	

The Parks Needs Assessment shows that many areas in the county that lack vacant land to develop new traditional parks are also in high park need areas.

Sixteen different types of amenities, plus unique amenities, were counted in the Park Needs Assessment. The map shows the number of amenities (of the 16 types) at each park in L.A. County. This information has been used to help assess park need across the region.

The Parks Needs Assessment shows that many areas in the county that lack vacant land to develop new traditional parks are also in high park need areas. In response to the findings of the assessment and the needs of the county, the report recommends that local agencies develop innovative solutions to provide essential park infrastructure by developing joint use and reuse with existing facilities or using underutilized land, utility corridors, alleys, and other public lands. Non-park recreation areas can also be redesigned to increase urban access to green space through projects such as Studio-MLA's Green Schoolyards initiative, which involves converting primarily asphalt urban schoolyards into recreation-ready living landscapes.[241]

The County values the Park Needs Assessment as a singular source for park need data across its entire jurisdiction, and states its desire to keep the Park Needs Assessment data up to date going forward. The results of the Parks Needs Assessment will continue to guide the L.A. County Department of Parks and Recreation's decision-making regarding allocation of future funding, including prioritizing areas of greatest need and tailoring planning to meet each community's specific needs. The assessment provided important scaffolding for the passage of the county's Measure A in November 2016, which imposed a parcel tax to fund park creation and maintenance.[242-244]

BREAKOUT: PARKSCORE

The Trust for Public Land (TPL)'s ParkScore® is an index designed to evaluate how well the largest 100 U.S. cities are meeting the need for parks.[245]

The index is based on TPL's database of local parks in almost 14,000 census-defined urban areas. Parks include publicly-owned local, state, and national parks, trails, and open space; school parks with a joint-use agreement; and privately owned parks managed for public use. The annually-updated ParkScore® index includes L.A. County's two most populous cities, Los Angeles and Long Beach; current and historical data is available on the TPL's website.[246] The ParkScore® index can be used in conjunction with the L.A. Countywide Parks and Recreation Needs Assessment to further inform planning and decision-making.[23]

The ParkScore® analysis is based on four characteristics of an effective park-system, as described below: access, investment, acreage, and amenities.[245]

1. **Access:** ParkScore® determines by the portion of residents who live within a half-mile walking distance of a park. In 2019, L.A. scored 45 out of 100, and Long beach scored 77.5 out of 100.
2. **Investment:** ParkScore® grants cities points for investment in their park system based on total spending per resident. The figure is a sum of public spending, non-profit spending, and volunteer hours. In 2019, L.A. scored 62.5 out of 100, and Long Beach scored 100 out of 100.
3. **Acreage:** ParkScore® grants each city points for acreage based on the following equally weighted measures: parkland as a percentage of city area and median park size. In 2019, L.A. scored 55 out of 100, and Long Beach scored 40 out of 100.

ParkScore Metrics, City of Los Angeles (2019)	
Metric	Score (out of 100 points)
Access	45
Investment	62.5
Acreage	55
Amenities	28
Data Source: Trust for Public Land	

ParkScore Metrics, City of Long Beach (2019)	
Metric	Score (out of 100 points)
Access	77.5
Investment	100
Acreage	40
Amenities	50
Data Source: Trust for Public Land	

Clover Park, Santa Monica
Photo: Ashley Kruythoff

BREAKOUT: PARKSCORE

4. **Amenities:** ParkScore® grants cities points for accessibility to the following six park amenities on a per capita basis: basketball hoops, dog parks, playgrounds, bathrooms, recreation and senior centers, and splashpads. In 2019, L.A. scored 27.5 out of 100, and Long Beach scored 50 out of 100. Note that the amenities described here are limited to six types, whereas 16 types are counted in the L.A. County Park Needs Assessment.

As of 2019, L.A. had a total of 632 parks, and 13% of the city's land was used for parks and recreation. Long Beach had a total of 168 parks, and 10% of the city's land was used for parks and recreation. In 2019, 61% of residents in L.A. and 83% of residents in Long Beach lived within walking distance (an approximately half-mile, 10-minute walk) of a park.[247,248]

The ParkScore® presents a valuable quantification of the need for parks and a comparison of park access between cities across the U.S. While the metrics account for physical access to the park via distance, as well as quantifications of aspects of quality (investment, size, and amenities), the score does not evaluate programs, safety, or natural resources in parks. In addition, because it is a nationwide metric, it may not reflect specific local needs. Nonetheless, expanding TPL's ParkScore® to areas beyond the cities of L.A. and Long Beach would be beneficial for communities advocating for greater access to parks and would provide a standardized rubric to compare cities within the county.

ParkScore, City of Los Angeles (2012-2020)

Year	Total Points (out of 100)	Rank (out of total number of cities)
2012	43.5	25/40
2013	42.5	34/50
2014	42	45/60
2015	46	51/75
2016	45	65/100
2017	41.5	74/100
2018	42.8	66/100
2019	47.5	55/100
2020	--	49/100

Data Source: Trust for Public Land

ParkScore, City of Long Beach (2012-2020)

Year	Total Points (out of 100)	Rank (out of total number of cities)
2012	51.5	19/40
2013	52.5	22/50
2014	54	24/60
2015	63.5	18/75
2016	64	22/100
2017	62.5	24/100
2018	64.1	21/100
2019	67	19/100
2020	--	23/100

Data Source: Trust for Public Land

BREAKOUT: MOUNTAIN AREAS VISITATION RATES

The Angeles National Forest (ANF) and the Santa Monica Mountains National Recreation Area (SMMNRA) represent a large portion of L.A. County's natural areas.

Visitor use is reported separately by the U.S. Forest Service and the National Park Service. The ANF covers about 650,000 acres of the San Bernardino Mountains and hosts an estimated 3.3 million visits per year.[165] The SMMNRA encompasses more than 150,000 acres of coastline in the Santa Monica Mountains and hosts nearly a million visits per year.[249] The SMMNRA was on track to surpass the number of visits from the previous year, but unfortunately, visits to the SMMNRA decreased after the Woolsey fire in November 2018.[250] Many mountain destinations, such as the ANF and the SMMRNA are inaccessible via public transit despite their close proximity to the existing network of bus and rail.[239] Improving access to these natural areas could elevate visitor numbers and ensure all Angelenos have the opportunity to experience and enjoy these local mountain areas.

BREAKOUT: HEAL THE BAY BEACH AND RIVER REPORT CARDS

Beaches provide open space and recreation for L.A. County residents and visitors.

They also provide critical coastal habitat for numerous species. As such, beach water quality is important for both the health of beachgoers and coastal ecosystem species.

On June 30, 2020, the local nonprofit organization Heal the Bay released its 30th annual Beach Report Card, reporting grades for beach water quality along the west coast of the United States.[251] These grades make water quality data easily accessible so beachgoers can understand their risk of getting sick from water contact, and scientists and policy-makers can make important decisions about coastal species habitats and health.

Grades are determined based on testing for fecal indicator bacteria (FIB), the detection of which can indicate the presence of disease-causing pathogens. FIB are typically present in rivers due to urban runoff, wastewater system leaks or spills, illegal pollutant discharges, or septic system failures.[252] For ocean beaches, runoff from storm drains is the largest source of pollution.[251] This runoff can contain toxic heavy metals, pesticides, fertilizers, petroleum hydrocarbons, animal waste, human waste, and trash.[251] Beyond the human health impacts, these substances threaten marine species. Furthermore, when excessive sewage is deposited into the ocean, it can lower the water's oxygen level, resulting in a dead zone in which most marine organisms cannot survive.[253]

From July 2019 to June 2020, 91% of L.A. County beaches received A or B grades during summer dry weather (April – October), and 92% received A or B grades during winter dry weather (November – March). This was good, but slightly below average for summer, which has a five-year average of 94% A's and B's; and noticeably above average for winter's five-year average of 83% A's and B's. Wet weather grades remained poor and matched the five-year average of only 42% of county beaches receiving A's and B's.

Surfers at Venice Beach
Photo: Ashley Kruythoff

Only three L.A. County beaches, all from the Palos Verdes area, made the "Honor Roll," receiving an A+ all year long.

Unfortunately, but not surprisingly, one L.A. County beach made the "Beach Bummer" list, which includes the ten worst beaches during summer dry conditions. Topanga Beach, monitored at the creek outlet, has been a regular on the Bummer list. A 2014 study determined that overflow from the Topanga Lagoon, which receives high amounts of bird and dog fecal matter, is likely the source of high bacteria concentrations. Fortunately, a lagoon restoration project is underway.[254,255]

Heal the Bay recently expanded their monitoring efforts to include 28 freshwater recreation sites throughout the county. In their second annual River Report Card, released July 14, 2020, they report that 66% of sites were Green (zero water quality parameters exceeded), 23% were Yellow (one to half parameters exceeded), and 11% were Red (more than half of parameters exceeded).[252] The grades correlate to a low, medium, and high risk of illness when there is water contact, respectively.[256]

INDICATOR

Urban Tree Canopy

OurCounty Targets:

2025: Increase urban tree canopy cover by 10% of baseline.

2035: Increase urban tree canopy cover by 15% of baseline.

2045 Increase urban tree canopy cover by 20% of baseline.

Tree canopy contributes to human health and well-being by mitigating the urban heat island impacts associated with climate change and other environmental co-benefits.[257,258]

These results are significant even when controlling for socioeconomic status.[259] As a result, measures to increase urban tree canopy have become essential to regional planning efforts. However, due to the fact that urban tree canopy has historically been inequitably distributed among communities of color and low-income communities because of structural racism, it is critical to prioritize areas that are most in need.[260-262]

Once the areas of need have been identified, tree species selection becomes the next barrier to implementation. An important component of this process is community engagement. Government mandated plantings that are not informed by community preferences are intrusive and only exacerbate the inequities that currently exist.[263] In addition to gaining community support through inclusive planning practices, there are extensive management concerns to consider. These include the extent to which tree species actually contribute to air-quality benefits, which requires holistic evaluations of tree traits associated with air pollution mitigation and climate resilience.[264] For example, many trees produce wind-dispersed pollen (an allergen) and VOCs, gases that take part in photochemical reactions forming ozone (a greenhouse gas in the lower atmosphere). Furthermore, restraints with regards to infrastructure (root damage to sidewalks/water lines) and public safety (falling branches) motivate the need for a site-specific approach to ensure tree species are chosen to optimize human and wildlife benefits. For instance, street trees should minimize maintenance costs and promote public health, whereas trees planted in open space, at the wildland interface or natural area parks could be selected for their benefits to native animals.

Finally, tree selection needs to be aligned with the desired ecosystem benefit. If the intention is that the trees will produce shade, then the species selected should have a big canopy. Trees with big canopies tend to have large trunks and large trunked trees need space. So, there is an inherent conflict with the narrow planting strips that currently exist and the goal of increased tree canopy. The problem is that reduced traffic congestion has historically been prioritized in L.A. County. Roads specifically designed for cars take up most of the space in neighborhoods, inhibiting healthy growing conditions for trees and healthy walking and biking spaces for people. It is naïve to think that we can achieve the goals of a reduced urban heat island effect without altering the urban design of neighborhoods as we know them today.[265]

Residential Street in Brentwood
Photo: Ashley Kruythoff

DATA AND METHODS

This analysis was conducted using statistics calculated from the Los Angeles Region Imagery Acquisition Consortium (LARIAC) 4 Program in 2014, courtesy of TreePeople, SavATree, the Center for Urban Resilience at Loyola Marymount University, and the University of Vermont (UV) Spatial Analysis Lab.[185] LARIAC provides access to high-resolution aerial imagery and LiDAR-derived datasets for L.A. County, captured roughly every three years. The LARIAC LiDAR land cover imagery data was used to create a map of tree canopy cover area and percentage for L.A. County's various administrative boundaries, including, among others, tax assessor's parcels and census tracts and block groups. The data product produced by the UV Spatial Analysis Lab included tree canopy area, area percentage, and possible canopy areas for the reference geographies.

Further analyses of tree canopy, limited to urban areas of the County, as well as in disadvantage communities, were conducted using 2010 census tract data by Robert Cudd of the California Center for Sustainable Communities at UCLA's Institute of the Environment and Sustainability.

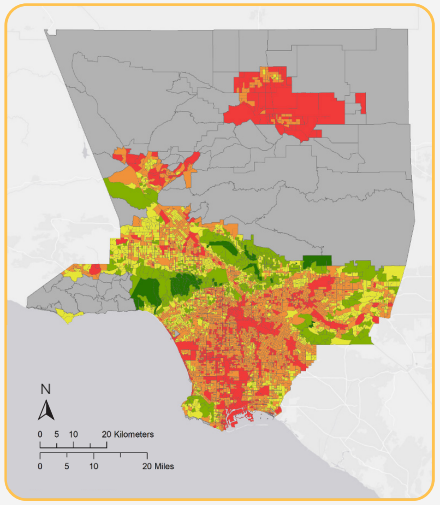
It is naïve to think that we can achieve the goals of a reduced urban heat island effect without altering the urban design of neighborhoods as we know them today.

Juvenile Cooper's Hawk in Clover Park, Santa Monica
Photo: Ashley Kruythoff

The extent of urban L.A. County was defined using 2010 census block group designations. Assessor's parcels were then intersected with the urban area extent. Public property and parks were removed using parcel use codes. Privately owned properties in the Santa Monica Mountains were removed using a 50% hill shade gradient mask. The remaining parcels were then intersected with city, census tract, and census block group layers to produce estimates for private tree canopy. Census tract, block group, and city layers provided by the UV Spatial Analysis Lab were intersected with the urban extent to calculate total tree canopy estimates for those geographies.

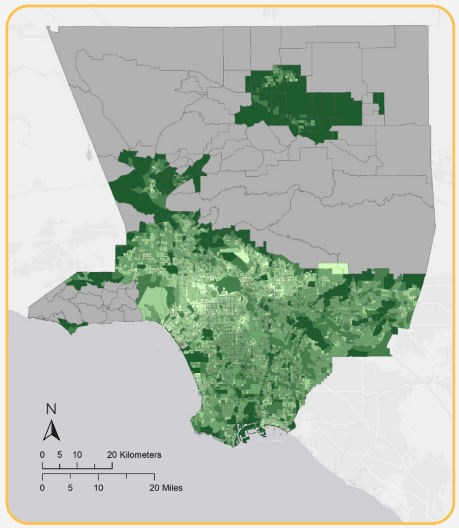
Disadvantaged status was defined using CalEnviroScreen 3.0. Census tracts with a CalEnviroScreen score in the top quartile (≥75) are formally considered "disadvantaged" by the state of California.

Tree Canopy Cover (2014) of Urban Census Block Groups (2010) in Los Angeles County



Map courtesy of Robert Cudd and of SavATree Consulting Group, University of Vermont Spatial Analysis Laboratory, TreePeople, & Loyola Marymount University Center for Urban Resilience

Possible Tree Canopy Cover (2014) of Urban Census Block Groups (2010) in Los Angeles County



Map courtesy of Robert Cudd and of SavATree Consulting Group, University of Vermont Spatial Analysis Laboratory, TreePeople, & Loyola Marymount University Center for Urban Resilience

FINDINGS

- **Approximately 20% of urban L.A. County was covered by tree canopy in 2016.**
- **Incorporated cities in L.A. County had an average tree canopy cover percentage of 20% in 2016. More than half of all cities in the County (54 out of 88), however, had a lower than average tree canopy cover percentage.**
- **Tree canopy cover percentage in cities ranged from a minimum of 1% (Vernon, CA) to a maximum of 53% (Duarte, CA) in 2016.**
- **Tree canopy cover is positively correlated with median household income by census tract (i.e. greater in high income areas and lower in low income areas).**
- **The mean tree canopy in disadvantaged communities (census block groups with CalEnviro Screen percentile equal to or greater than 75%) was 16.6%.**
- **Average tree canopy cover percentage among incorporated cities in L.A. County can potentially increase from 20% to 49%. That is, residential land uses have the greatest potential for more trees.**

RECOMMENDATIONS

Data: Neighborhood scale data collected regularly to show longitudinal trends on tree health and maintenance should ensure that the canopy is well-managed.

Action: Cities should invest more money in tree canopy maintenance programs with a prioritization in areas that currently have low tree canopy percentages. Practices should be standardized by species to ensure they align with the best available knowledge for long-term health and community safety. In addition, cities should pursue working relationships with rental property owners to ensure that renters have access to the benefits of street trees. Such partnerships would allow for city-managed tree donation programs to include rental properties.

Policy: All public funds committed to increasing the urban tree canopy should be allocated to areas that currently have the lowest tree canopy. There should also be a standardized approach to street maintenance that works across departments to guarantee that tree canopy provides multiple benefits while ensuring more efficient use of funds. That is to say, anytime a sidewalk or median is being updated, it should be seen as an opportunity to provide better design for the current trees and/or design around the planting of new trees.

DATA LIMITATIONS

Tree canopy does not distinguish between native and nonnative species. A complete inventory of street trees would allow for a more accurate quantification of ecosystem services by neighborhood and assist with the development of site specific management plans.

BREAKOUT: STREET TREE MAINTENANCE

In 2018 UCLA Geography students used satellite observational data to inventory parkway trees in the Holmby Westwood Residential Neighborhood, located east of the UCLA campus.

The Holmby Westwood Tree Project produced species- and street-level data on tree distribution in the neighborhood, along with spatial data on tree health, height, and age.[266] The project identified some key areas with high numbers of missing, small, or unhealthy trees. Residents, in partnership with local NGO TreePeople, subsequently began a multi-year effort to replant trees in high-need areas.[267] These developments come at a time when urban tree management and renewal is a high priority in the L.A. area and urban centers around the world, with the potential to deliver a variety of economic, environmental, and public health benefits.[268] The Holmby Westwood Tree Project demonstrates the utility of spatial analysis in identifying high-priority urban areas for tree canopy renewal, and its techniques could prioritize critical areas as L.A. continues to make progress on the Million Trees LA endeavor.[269]

Street in South Los Angeles
Photo: Ashley Kruythoff

Despite L.A. County's C+ grade for Ecosystem Health, there is hope for the region as we start to realize some of the recent state and local commitments to protecting habitat and biodiversity and ensuring equitable access to all of the benefits that these resources provide.

L.A. County is truly unique. It is so much more than just the concrete jungle that typifies a common perception of the region. Instead, it is filled with many natural resources and natural lands that span a variety of ecosystems from the coast to the mountains. This diverse topography has supported many different species assemblages, some of which are not found anywhere else in the world. It also provides a number of opportunities for the county's 10 million residents to live, work, play and rest in and around nature.

However, land conversion, urban sprawl and climate change have all contributed to the extinction of species and the degradation of what was once here. If we want to preserve our remaining resources and restore some of our most critical habitats to their original function, dramatic improvements are needed, including a shift to higher density development, legal protection for all remaining habitats and natural lands, fiscal investment in habitat monitoring and restoration projects and resilient wildfire management, just to name a few. Los Angeles County will face major challenges, including a growing human population, impacts from our changing climate, invasive species and disease. But, if these challenges are met with innovative solutions and investments are made now, our region will be on its way to becoming a leader in urban ecosystem management, and the first sustainable megacity in the world.

It is imperative to note that all current and future commitments to ecosystem health are moot without an intentional commitment to equity. Restorative justice is integral to the future resilience of our region. We need to address the most detrimental environmental health burdens that our communities of color are unjustly harboring, and we need to ensure that with every investment we make, we are first listening to the needs and desires of these communities and elevating those with the greatest need. We also need to broaden our understanding of how we value the natural world. For too long there has been a barrier between biologists and the community. The beauty in our region lies within the diversity of its people and its environment. Until we acknowledge and celebrate these differences through meaningful engagement, storytelling, and valued partnerships, we will continue to work in silos and witness the continued degradation of our natural world. The UCLA Sustainable LA Grand Challenge is invested in breaking down the barriers between research institutions and the broader community because we recognize that meaningful engagement yields collective knowledge that guarantees success. The SLA GC looks forward to working with all Angelenos to realize the changes our region needs.

This 2021 Sustainable LA Grand Challenge Sustainability Report Card on L.A. County Ecosystem Health demonstrates that despite the promise of progressive policy with defined targets and goals, L.A. County has a long way to go to implement these plans before earning an A grade.

ABOUT THE UCLA SUSTAINABLE LA GRAND CHALLENGE

Los Angeles is changing in ways that threaten its iconic way of life. The 10 million residents of L.A. County already feel the effects of climate change: hotter temperatures, unpredictable precipitation, a rising sea level and increasing wildfire risk. Traffic congestion, air pollution, vulnerable water and energy supplies, social and environmental inequalities and continued sprawl directly threaten the region's health, wellbeing, ecosystems and economic vitality — especially for the most vulnerable populations.

University of California, Los Angeles (UCLA) research predicts that L.A. County will be hotter by 2050. It will also be more crowded, with a potential increase of 1.5 million residents.[12] To ensure a thriving future for the region in a changing climate, UCLA Chancellor Gene Block launched the first-ever university-led Grand Challenge in 2013 — the Sustainable LA Grand Challenge, thriving in a hotter Los Angeles (SLA GC).[270]

SLA GC is an interdisciplinary university-wide initiative aimed at applying UCLA research, expertise and education to help transform Los Angeles into the world's most sustainable megacity by 2050 — making it the most livable, equitable, resilient, clean and healthy megacity, and an example for the world.

SLA GC catalyzes interdisciplinary teams and funding for research and education that advance L.A.'s sustainability; connects UCLA's faculty, students and research internally and also to external partners; and creates the next generation of sustainability leaders and problems solvers through undergraduate and graduate education programs.

With topical areas in energy, transportation, water and ecosystems, SLA GC emphasizes the cross-cutting themes of equity, access and justice; climate and the environment; law, policy and economics; human health and well-being; culture, design and land use; and science, technology and innovation.

Unlike traditional campus-wide research initiatives, SLA GC provides a framework to organize research, education and partnerships around ambitious long-term, time-bound implementation goals. Together, SLA GC — made up of more than 200 faculty members — and its partners are transforming the climate crisis and urban sustainability from challenges into opportunities for Los Angeles and beyond, and serving as a model for other universities and urban areas around the globe.

Photo: Nurit Katz

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CHAPTER 2. BIODIVERSITY

CHAPTER 3. THREATS TO ECOSYSTEM HEALTH

CHAPTER 4. COMMUNITY HEALTH AND WELLBEING

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APPENDICES

APPENDICES TABLE OF CONTENTS

APPENDIX 1: EXTENDED METHODOLOGY FOR INDICATOR ANALYSES

CHAPTER 1: LAND USE AND HABITAT QUALITY

Indicator: Land Cover and Natural Areas

To quantify a baseline percentage of natural areas and other land use types that cover all of L.A. County, we manipulated and merged multiple datasets. The ultimate output resulted in one vector dataset derived from several CALVEG datasets (2004) and the USGS GAP land cover data (2011). Two CALVEG geodatabases were downloaded for the South Coast and South Interior regions. The data was reprojected into the California Teale Albers 1927 coordinate system. The two vector datasets were merged and dissolved based on Regional Dominance Type. The merged CALVEG dataset was then clipped to the L.A. County boundaries. To fill in the gap of coverage north of the San Gabriels, the GAP land cover raster was used. Due to discrepancies in data format (i.e. feature class polygons and raster data), the GAP data was first converted. The GAP raster data uses raster values to correspond to dominant vegetation type, with a range of approximately 0 to 600 statewide (the L.A. subset contains a smaller sampling of those values). After clipping the raster to L.A. County, the dataset was converted to polygons, using cell values to differentiate dominant vegetation type. The GAP polygons were then merged with the CALVEG polygons to complete coverage for L.A. County, and the merged dataset was then used for all subsequent analyses. This method was ideal for these analyses because polygons were grouped by dominant vegetation type, and multi-part polygons allowed for viewing a single vegetation alliance (see descriptions in table below) at the county-wide scale.

Once the merged vector dataset was completed, a simple calculation of geometry in the attribute table was conducted. The output field provides area in square kilometers for each vegetation dominance type. To accurately assess native vegetation, the land cover data was organized into seven categories: agriculture, bare soil, non-native grasses, non-native shrubs and trees, natural area, urban developed and water, as defined in the 2018 Biodiversity Report from the City of L.A.'s Department of Sanitation and the Environment (see table below). While non-native vegetation and agriculture are a form of open space, we did not want those dominance types to count toward natural areas because they do not provide the same ecosystem services and habitats that native vegetation does.

From this original assessment of land cover, we assessed the percent natural area protected as reported by the California Protected Areas Database (2018). In addition, we assessed the percent natural area data layer categorized as a Significant Ecological Area by L.A. County (2018).

We also roughly assessed access to natural areas by determining the percentage of census tracts within L.A. County that contain at least one natural area fragment. To conduct our access analyses we first consolidated all of these polygons based on location using the Aggregate Polygons tool (ArcToolbox/Cartography Tools/Generalization/Aggregate Polygons). The natural areas layer was used as the input feature and the aggregation distance was set at 100 meters with a minimum area of 1000

CALVEG 2000-2010 VEGETATION ALLIANCES IN THE CITY OF LOS ANGELES 2018 BIODIVERSITY REPORT RECLASSIFICATION

CALVEG Code	Veg Alliance	SI Classification
A1	CONIFER AGRICULTURE	Agriculture
A3	TILLED EARTH AGRICULTURE	Agriculture
A4	ORCHARD AGRICULTURE	Agriculture
A6	GRAIN AND CROP AGRICULTURE	Agriculture
A8	AGRICULTURAL NURSERIES	Agriculture
HG	ANNUAL GRASSES AND FORBS ALLIANCE	Natural (Degraded)
BA	BARREN	Natural
IB	URBAN-RELATED BARE SOIL	Bare Soil
OS	BEACH SAND	Natural (Degraded)
CA	CHAMISE ALLIANCE	Natural
CC	CEANOTHUS CHAPARRAL ALLIANCE	Natural
CK	COYOTE BRUSH ALLIANCE	Natural
CQ	LOWER MONTANE MIXED CHAPARRAL	Natural
CS	SCRUB OAK ALLIANCE	Natural
DM	BIGCONE DOUGLAS-FIR ALLIANCE	Natural
DU	DUNE	Natural
EX	COASTAL MIXED HARDWOOD ALLIANCE	Natural
HC	PICKLEWEED - CHORDGRASS ALLIANCE	Natural
HM	PERENNIAL GRASSES AND FORBS ALLIANCE	Natural
HT	TULE - CATTAIL ALLIANCE	Natural
LS	SCALEBROOM ALLIANCE	Natural
ML	BACCHARIS (RIPARIAN) ALLIANCE	Natural
NM	RIPARIAN MIZED SHRUB ALLIANCE	Natural
NR	RIPARIAN MIXED HARDWOOD ALLIANCE	Natural
NX	INTERIOR MIXED HARDWOOD ALLIANCE	Natural
QA	COAST LIVE OAK ALLIANCE	Natural
QB	CALIFORNIA BAY ALLIANCE	Natural
QC	CANYON LIVE OAK ALLIANCE	Natural
QE	WHITE ALDER ALLIANCE	Natural
QF	FREMONT COTTONWOOD ALLIANCE	Natural
QL	VALLEY OAK ALLIANCE	Natural
QO	WILLOW ALLIANCE	Natural
QP	CALIFORNIA SYCAMORE ALLIANCE	Natural
QV	BLACK WALNUT ALLIANCE	Natural
RS	RIVERSIDEAN ALLUVIAL SCRUB ALLIANCE	Natural
SB	BUCKWHEAT ALLIANCE	Natural
SE	ENCELIA SCRUB ALLIANCE	Natural
SM	SUMAC SHRUB ALLIANCE	Natural
SO	COASTAL CACTUS ALLIANCE	Natural
SQ	SOFT SCRUB - MIXED CHAPARRAL ALLIANCE	Natural
SS	CALIFORNIA SAGEBRUSH ALLIANCE	Natural
WL	WILLOW (SHRUB) ALLIANCE	Natural
WM	BIRCHLEAF MOUNTAIN MAHOGANY ALLIANCE	Natural

square meters. This process resulted in a new layer of 1,389 spatially aggregated polygons. We then used U.S. Census data (2017) that estimates L.A. County population at 10,272,648 to calculate all the census tracts that contained at least one polygon of natural area. This method was used to calculate the percentage of census tracts that contained natural area and the corresponding percentage of L.A. County residents that live within those census tracts.

CALVEG Code	Veg Alliance	SI Classification
IG	NON-NATIVE/ORNIMENTAL GRASS ALLIANCE	Non-Native Perennial Grasses
IA	GIANT REED/PAMPUS GRASS ALLIANCE	Natural (Degraded)
IC	NON-NATIVE/ORNIMENTAL CONIFER	Non-Native Shrubs and Trees
IH	NON-NATIVE/ORNAMENTAL HARDWOOD	Non-Native Shrubs and Trees
IM	NON-NATIVE/ORNEMENTAL	Non-Native Shrubs and Trees
IS	NON-NATIVE/ORNAMENTAL SHRUB ALLIANCE	Non-Native Shrubs and Trees
QZ	EUCALYPTUS ALLIANCE	Non-Native Shrubs and Trees
UB	URBAN OR DEVELOPED	Urban or Developed
IW	DEVELOPED WATER FEATURES	Water
W2	SEASONAL WATER?	Water
W3	SEASONAL WATER?	Water
WA	WATER	Water

CHAPTER 2: BIODIVERSITY

Indicator: Native Plants and Animals

Indicator Species Methodology			
Indicator Type	Monitorable	Emblematic	Indicates high quality habitat
Rare, Threatened or Endangered		x	x
Common Natural Areas Species	x	x	x
Common Urban Areas Species	x	x	

1. Rare, Threatened or Endangered
2. Common Natural Area Species
3. Common Urban Area Species

a. Monitorable
b. Emblematic
c. Indicates high quality habitat

2abc = ideal indicator species

Indicator Species List from UCLA Biodiversity Expert Group (2018)					
Ecological Group	Taxa Group	Scientific Name	Common Name	Ranking	iNaturalist # observations (6/3/2018)
Common Native Flora - Natural Areas - Monitorable, Emblematic, Indicator of Quality Habitat	Plant	*Abronia umbellata*	Sand Verbena	2 a b c	17
	Plant	*Artemisia californica*	California sagebrush	2 a b c	252
	Plant	*Baccharis pilularis*	Coyote brush	2 a b c	124
	Plant	*Baccharis salicifolia*	Mulefat	2 a b c	184
	Plant	*Carnissoniopsis cheiranthifolia*	Beach evening-primrose	2 a b c	1
	Plant	*Castilleja exserta*	Purple owls-clover	2 a b c	11
	Plant	*Distichlis spicata*	Salt grass	2 a b c	12
	Plant	*Encelia californica*	Coast sunflower	2 a b c	260
	Plant	*Eriogonum fasciculatum*	California buckwheat	2 a b c	329
	Plant	*Heteromeles arbutifolia*	Toyon	2 a b c	420
	Plant	*Juglans californica*	S. California black walnut	2 a b c	136
	Plant	*Malosma laurina*	Laurel sumac	2 a b c	302
	Plant	*Mimulus aurantiacus*	Bush monkeyflower	2 a b c	247
	Plant	*Nassella pulchra*	Purple needle grass	2 a b c	11
	Plant	*Platanus racemosa*	Western sycamore	2 a b c	219
	Plant	*Prunus ilicifolia*	Hollyleaf cherry	2 a b c	81
	Plant	*Quercus agrifolia*	Coast live oak	2 a b c	295
	Plant	*Rhus integrifolia*	Lemonadeberry	2 a b c	145
	Plant	*Salicornia pacifica*	Pickleweed	2 a b c	29
	Plant	*Salix lasiolepis*	Arroyo willow	2 a b c	68
	Plant	*Salvia leucophylla*	Purple sage	2 a b c	94
	Plant	*Salvia mellifera*	Black sage	2 a b c	192
	Plant	*Salvia spathacea*	Humminbird sage	2 a b c	39
	Plant	*Schoenoplectus spp*	Bulrush	2 a b c	23
	Plant	*Typha spp*	Cattail	2 a b c	73

Indicator Species List from UCLA Biodiversity Expert Group (2018)					
Ecological Group	Taxa Group	Scientific Name	Common Name	Ranking	iNaturalist # observations (6/3/2018)
Common Native Fauna - Natural Areas - Monitorable, Emblematic, Indicator of Quality Habitat	Amphibian	*Pseudacris hypochondria*	Baja California Tree Frog	2 a b c	63
	Bird	*Agelaius phoeniceus*	Red-winged Blackbird	2 a b c	138
	Bird	*Aphelocoma* californica	Calif. Scrub-jay	2 a b c	273
	Bird	*Ardea herodias*	Great Blue Heron	2 a b c	345
	Bird	*Baeolophus inornatus*	Oak Titmouse	2 a b c	40
	Bird	*Bubo virginianus*	Great Horned Owl	2 a b c	56
	Bird	*Buteo jamaicensis*	Red-tailed Hawk	2 a b c	423
	Bird	*Callipepla californica*	California Quail	2 a b c	50
	Bird	*Chondestes grammacus*	Lark Sparrow	2 a b c	23
	Bird	*Melospiza melodia*	Song Sparrow	2 a b c	185
	Bird	*Nycticorax nycticorax*	Black Crowned Night Herin	2 a b c	182
	Bird	*Picoides nuttallii*	Nutall's Woodpecker	2 a b c	135
	Bird	*Sialia mexicana*	Western bluebird	2 a b c	128
	Bird	*Spinus psaltria*	Lesser Goldfinch	2 a b c	375
	Bird	*Toxostoma redivivum*	California thrasher	2 a b c	53
	Invertebrate	*Anthopleura elegantissima*	Aggregating Anemone	2 a b c	26
	Invertebrate	*Pisaster ochraceus*	Ochre Sea Star	2 a b c	17
	Invertebrate	*Stenopelmatus spp.*	Jerusalem Cricket	2 a b c	102
	Invertebrate	*Strongylocentrotus purpuratus*	Pacific Purple Sea Urchin	2 a b c	108
	Mammal	*Lynx rufus*	Bobcat	2 a b c	44
	Mammal	*Sylvilagus audubonii*	Desert Cottontail	2 a b c	170
	Reptile	*Crotalus oreganus*	Southern Pacific Rattlesnake	2 a b c	135
	Reptile	*Pituophis catenifer*	Gopher Snake	2 a b c	162
	Reptile	*Sceloporus occidentalis*	Western fence lizard	2 a b c	3148
	Reptile	*Uta stansburiana ssp. elegans*	Western Side-blotched Lizard	2 a b c	307
Common Native - Urban Areas - Monitorable, Emblematic	Bird	*Accipiter cooperii*	Cooper's Hawk	3 a b	242
	Bird	*Corvus brachyrhynchos*	American Crow	3 a b	321
	Bird	*Junco hyemalis*	Dark-eyed Junco	3 a b	321
	Bird	*Melozone crissalis*	California Towhee	3 a b	403
	Bird	*Psaltriparus minimus*	Bushtit	3 a b	180
	Bird	*Sayornis nigricans*	Black Phoebe	3 a b	613
	Bird	*Selasphorus sasin*	Allen's Hummingbird	3 a b	421
	Bird	*Zonotrichia leucophrys*	White-crowned Sparrow	3 a b	207
	Butterfly	*Danaus plexippus*	Monarch	3 a b	852
	Butterfly	*Gray Hairstreak*	Gray hairstreak	3 a b	163
	Butterfly	*Leptotes marina*	Marine blue	3 a b	240
	Insect	*Araneidae*	Orb Weaver	3 a b	420
	Insect	*Xylocopa varipuncta*	Valley Carpenter Bee	3 a b	118
	Mammal	*Canis latrans*	Coyote	3 a b	385
	Reptile	*Elgaria multicarinata*	Southern alligator lizard	3 a b	1209

Indicator Species List from UCLA Biodiversity Expert Group (2018)					
Ecological Group	Taxa Group	Scientific Name	Common Name	Ranking	iNaturalist # observations (6/3/2018)
Rare Native - Natural Areas - Emblematic, Indicator of Quality Habitat	Amphibian	*Spea hammondii*	Western Spadefoot Toad	1 a b c	2
	Amphibian	*Taricha torosa torosa*	Coast Range Newt	1 a b c	94
	Bird	*Aimophila ruficeps*	Rufous-crowned Sparrow	1 c	11
	Bird	*Campylorhynchus brunneicapillus*	Cactus Wren	1 a b c	2
	Bird	*Charadrius alexandrinus nivosus*	Western snowy plover	1 a b c	17
	Bird	*Cistothorus palustris*	Marsh Wren	1 a b c	2
	Bird	*Filter By Place*	California gnatcatcher	1 b c	11
	Bird	*Icteria virens*	Yellow-breasted Chat	1 b c	8
	Bird	*Ixobrychus exilis*	Least bittern	1 c	5
	Bird	*Passerculus sandwichensis*	Belding's Savannah Sparrow	1 a c	37
	Bird	*Plegadis chihi*	White-faced Ibis	1 a	29
	Bird	*Setophaga coronata*	Yellow-rumped Warbler	1 a b c	32
	Bird	*Sterna antillarum browni*	California least tern	1 a b c	1
	Butterfly	*Chlosyne gabbii*	Gabb's checkerspot	1 a b c	2
	Butterfly	*Euphilotes battoides ailyni*	El Segundo blue	1 a b c	2
	Butterfly	*Euphydryas chalcedona*	Variable checkerspot	1 a b c	46
	Invertebrate	*Haliotis cracherodii*	Black abolone	1 a c	0
	Mammal	*Puma concolor*	Mountain Lion	1 a b c	7
	Mammal	*Sciurus griseus*	Western gray squirrel	1 a b c	180
	Plant	*Abronia maritima*	Sticky sand verbena	1 a b c	6
	Plant	*Astragalus brauntonii*	Braunton's milkvetch	1 a b c	3
	Plant	*Berberis nevinii*	Nevin's barberry	1 a b c	7
	Plant	*Calochortus catalinae*	Catalina mariposa	1 a b c	11
	Plant	*Calochortus clavatus*	Yellow mariposa lily	1 a b c	4
	Plant	*Calochortus plummerae*	Plummer's mariposa lily	1 a b c	19
	Plant	*Eriogonum parvifolium*	Dune buckwheat	1 a b c	29
	Plant	*Lepechinia fragrans*	Pitcher sage	1 a c	6
	Plant	*Lilium humboldtii ssp. ocellatum*	Humboldt lily	1 a b c	0
	Plant	*Phacelia hubbyi*	Hubby's phacelia	1 a b c	4
	Plant	*Quercus engelmannii*	Engelmann oak	1 a b c	1
	Reptile	*Actinemys marmorata*	Pacific pond turtle (pallada)	1 a b c	24
	Reptile	*Aspidoscelis tigris stejnegeri*	Coastal whiptail	1 a b c	61
	Reptile	*Lempropeltis zonata*	California mountain kingsnake	1 a b c	0
	Reptile	*Phrynosoma blainvillii*	Blainsville's horned lizard	1 a b c	61
	Reptile	*Thamnophis hammondii*	two-striped garter snake	1 a b c	8

CHAPTER 3: THREATS TO ECOSYSTEM HEALTH

Indicator: Wildfire

Fire hazard severity zones were identified by the Fire Hazard Severity Zones maps, available through CAL FIRE's website. For these analyses, we focused on those areas that represented the Highest Fire Hazard category. The proportion of total area of L.A. County (12,310 km^2) that was categorized as High Fire Hazard was 2,611 km^2, or approximately 21.2%.

To estimate the number of residents that could be affected by High Fire Hazard Areas, we calculated the number of Census Tracts and the total number of people living in those Census Tracts that either contained High Fire Hazard areas, or were within a half mile to areas categorized as High Fire Hazard. This was done by using the Select by Location feature in ArcMAP (under the Selection tab in the main menu toolbar), and selecting those Census Tracts that either contained, or were 1/10, 1/4, or 1/2 of a mile from any pixel that was categorized as High Fire Hazard from the layer provided.

A total of 869 Census Tracts (31%) in L.A. County were within 1/2 of a mile of High Fire Hazard areas, representing a total of 2,939,954 (29%) residents living within these areas. A total of 736 Census Tracts (26%) were within 1/4 of a mile of High Fire Hazard areas, and 2,456,074 (24%) of residents within the county were living in these areas. A total of 670 Census Tracts (24%) were within 1/10 of a mile of High Fire Hazard areas, with 2,207,323 (21.5%) residents living within these areas. Finally, a total of 600 Census Tracts (21%) within the county had at least one pixel categorized as High Fire Hazard within the tract, and 1,959,415 residents (19%) within the county lived in these High Fire Hazard areas.

To assess the percentage of natural areas at high fire risk, we used the smallest level of spatially explicit polygon layer representing natural areas (aggregation distance of 1 meter, no minimum area requirement) from the Natural Areas Indictor, to examine the overlap between these areas and areas that were categorized as High Fire Hazard. This natural area layer resulted in a total of 10,516 polygons.

We then used the Select by Location feature in ArcMAP (under the Selection tab in the main menu toolbar), and selected from the natural areas layer those polygons that either contained, or were 1/10, 1/4, or 1/2 of a mile from any pixel that was categorized as High Fire Hazard from the layer provided.

A total of 1,311 (12%) Natural Area polygons contained areas of High Fire Hazard. A quick glance revealed an obvious discrepancy here: it seems as if a much larger than 12% area of overlap occurs between Natural Areas and High Fire Hazard Areas. This is correct, and is due to the fact that large tracts of land are represented by single polygons in the northern region of the county. Conversely, very small polygons may be scattered in the southern region of the county, and many of these may not contain High Fire Hazard Areas. To alleviate this bias, we also calculated the total area represented by natural areas (6,829 km^2) and calculated the percentage of that total area that contained, or was close to, High Fire Hazard Areas. A total of 5,317 km^2, or nearly 78% of all natural areas in the county, included at least some High Fire Hazard area.

Similar analyses were conducted for those natural areas that were in close proximity to High Fire Hazard Areas. A total of 1,511 (14%) natural area polygons were within a 1/10 of a mile from High Fire Hazard Areas. This represented 78.1% of the total natural area in the county. A total of 1,680 (16%) natural area polygons were within 1/4 of a mile from High Fire Hazard Areas, which represented almost 78.2% of the total natural area within the county. Finally, a total of 1,994 polygons (19%) representing natural areas were within 1/2 of a mile from High Fire Hazard Areas, which represented 78.3% of the total area represented by natural areas in the County. Please note that the area percent estimates do not change drastically, while the polygon counts do. These proximity analyses reinforce the idea that the latter analyses are picking up smaller area polygons in the southern portion of the county.

APPENDIX 2: GRADING METHODOLOGY AND CALCULATIONS

I. DEFINITIONS

Data

- **Temporal Data Availability:** last year the data were collected and frequency of updates
- **Spatial Data Availability:** area of L.A. County the data covers
- **Financial Data Availability:** cost to access and use the data
- **Data Alignment:** data's interpretive power as it relates to the indicator

Policy Target: any relevant target from the OurCounty sustainability plan (2019); Note that only near-term targets are evaluated

Change Over Time

- **Ecological:** comparison to past years of data or to an historical precedent
- **Positive Accumulation:** for indicators where growth is the desired outcome, percent increase from baseline
- **Negative Accumulation:** for indicators where a decrease is the desired outcome, percent decrease from baseline

II. RUBRIC

Weighting between rubric categories: one of three options, listed here in descending order of preference, selected based on the existence of policy targets and the availability of historical data

- Change over time (0.5), Policy Target (0.3), Data (0.2)
- Change over time (0.8), Data (0.2)
- Policy Target (0.8), Data (0.2)

Weighting between indicators: determined by a selection of internal and external experts

- Higher weights are given to indicators that measure the end goal rather than necessary actions to achieve the end goal
- Higher weights are given to indicators with high interpretive power related to the chapter

Incomplete status: two or more relevant indicators missing from chapter due to unavailable or unprocessed data

Ecosystem Heath Grading Rubric										
Category	Sub-Category	A+ (100%)	A (95%)	A- (92%)	B+ (89%)	B (85%)	B- (82%)	C+ (79%)	C (75%)	C- (72%)
Data	Temporal Availability	Collected and reported on re-occuring basis	Available within the last year	Available within the last 2 years	Available, but 3 years out of date	Available, but 4 years out of date	Available, but 5 years out of date	Available, but 6 years out of date	Available, but 7 years out of date	Available, but 8 years out of date
	Spatial Availability	Collected and reported countywide	Collected and reported for approx. 95% of the County			Collected and reported for approx. 85% of the County			Collected and reported for approx. 75% of the County	
	Financial Availability	Free and accessible to the public							Free for academic institutions	
	Alignment	Directly aligns with indicator; high interpretive power							Aligns adequately with indicator; average interpretive power	
Policy Targets (near-term)	NA	Meets or exceeds near-term target; target has already been met	Meets 95% of target	Meets 92% of target	Meets 89% of target	Meets 85% of target	Meets 82% of target	Meets 79% of target	Meets 75% of target	Meets 72% of target
Change over time	Ecological	Meets or exceeds historical levels	96% change in historical levels	92% change in historical levels	89% change in historical levels	85% change in historical levels	82% change in historical levels	79% change in historical levels	75% change in historical levels	72% change in historical levels
	Positive Accumulation	Increased (≥100%)	Increased (≤100%)	Increased (≤80%)	Increased (≤65%)	Increased (≤50%)	Increased (≤35%)	Increased (≤20%)	Stayed the same	Decreased (≤20%)
	Negative Accumulation	Decreased (≥100%)	Decreased (≤100%)	Decreased (≤80%)	Decreased (≤65%)	Decreased (≤50%)	Decreased (≤35%)	Decreased (≤20%)	Stayed the same	Increased (≤20%)

Ecosystem Heath Grading Rubric								
Category	Sub-Category	D (65%)	D- (62%)	F+ (59%)	F (55%)	F (52%)	F- (50%)	NA
Data	Temporal Availability	Available, but 10 years out of date	Available, but 11 years out of date	Available, but 12 years out of date	Available, but 13 years out of date	Available, but 14 years out of date	Available, but 15 or more years out of date	
	Spatial Availability	Collected and reported for approx. 65% of the County			Collected and reported for approx. 55% of the County		Collected and reported for select cities within the county	
	Financial Availability						Costs money to gain access	
	Alignment						Does not align well with indicator; very low interpretive power	
Policy Targets (near-term)	NA	Meets 65% of target	Meets 62% of target	Meets 59% of target	Meets 55% of target	Meets 52% of target	Meets 50% or less of target	Does not have a target
Change over time	Ecological	65% change in historical levels	62% change in historical levels	59% change in historical levels	55% change in historical levels	52% or less change in historical levels	No longitudinal data - anecdotal negative trend	No longitudinal data (no assumed trend)
	Positive Accumulation	Decreased (≤50%)	Decreased (≤65%)	Decreased (≤80%)	Decreased (≤100%)		Decreased (≥100%)	No longitudinal data (no assumed trend)
	Negative Accumulation	Increased (≤50%)	Increased (≤65%)	Increased (≤80%)	Increased (≤100%)		Increased (≥100%)	No longitudinal data (no assumed trend)

III. GRADING CALCULATIONS

Chapter 1: Land Use and Habitat Quality: C (76%) – Incomplete

- **Incomplete:** Missing data on habitat quality across all vegetation types as well as habitat connectivity data for multiple different types of taxa.
- **Data:** Overall the data is out of date and there are currently no plans to collect new data.
- **Policy Targets:** We are not far off from our near-term goal of protecting 55% of our natural areas, and 75% our habitat corridors, but that is because these targets were based on the baselines calculated in this report. Meeting our long-term goal of 70% protection for our natural areas and 100% for our wildlife corridors will be more difficult.
- **Change Over Time:** This shows a consistent pattern of decreased natural area as well as habitat quality across all indicators. These natural resources have been severely degraded over time from urban sprawl, unsustainable development, pollution and resource extraction. Protection of the remaining natural resources as well as restoration of many degraded habitats is essential to building a sustainable natural landscape for future generations to enjoy.

Chapter 1: Land Use and Habitat Quality									
Indicator or (breakout)	Data Source	Data Grade (20%)	Policy Target Grade (30%)	Change Over Time Grade (50%)	Average Grade	Weighting %	Weighted Grade	Chapter Grade %	Chapter Grade
Land Cover and Natural Areas	USGS GAP Analysis	NA	NA	NA	NA	NA	NA	76%	C/ Incomplete
	CALVEG	0.818	0.92	0.646	0.763	0.20	0.153		
Rare Vegetation (breakout)	-	-	-	-	-	-	-		
U.S. Fish and Wildlife Service Critical Habitat (breakout)	USFWS	0.875	NA	0.50	0.575	0.125	0.072		
Protected Areas	CPAD	1.00	NA	0.79	0.832	0.125	0.104		
	SEAs	0.875	NA	1.00	0.975	0.125	0.122		
Habitat Connectivity and Fragmentation	Missing Linkages	0.826	0.77	0.72	0.756	0.125	0.095		
	USGS GAP Analysis	-	-	-	-	-	-		
	CALVEG	-	-	-	-	-	-		
Liberty Canyon Wildlife Crossing (breakout)	-	-	-	-	-	-	-		
Rim of the Valley National Park Survey (breakout)	-	-	-	-	-	-	-		
Ventura County Habitat Connectivity and Wildlife Corridor Ordinance (breakout)	-	-	-	-	-	-	-		
Riparian Conditions	CRAM	1.00	NA	0.74	0.792	0.10	0.079		
	CSCI	1.00	NA	0.77	0.816	0.10	0.082		
Historical Wetland Habitat (breakout)	-	-	-	-	-	-	-		
Kelp Canopy Coverage	CRKSC	1.00	NA	0.43	0.544	0.10	0.054		
State of the Bay Report (breakout)	-	-	-	-	-	-	-		
Restoration Recommendations (breakout)	-	-	-	-	-	-	-		

Chapter 2: Biodiversity									
Indicator or (breakout)	Data Source	Data Grade (20%)	Policy Target Grade (30%)	Change Over Time Grade (50%)	Average Grade	Weighting %	Weighted Grade	Chapter Grade %	Chapter Grade
Native Plant and Animal Diversity	USFWS	0.844	1.00	0.59	0.764	0.40	0.306	86%	B
	iNaturalist	-	-	-	-	-	-		
California Conservation Genomics Project (breakout)	-	-	-	-	-	-	-		
Santa Monica Mountains Species Restoration Program (breakout)	-	-	-	-	-	-	-		
Bird Population Trends	eBIRD	0.792	NA	0.87	0.854	0.25	0.214		
	BBS	-	-	-	-	-	-		
	CBC	-	-	-	-	-	-		
UCLA's Counterforce Lab: Biophilia Treehouse (breakout)	-	-	-	-	-	-	-		
Rocky Intertidal Species Population Trends	MARINe	1.00	NA	1.00	1.00	0.10	0.10		
Marine Fish and Invertebrate Population Trends	Reef Check	1.00	NA	1.00	1.00	0.20	0.20		
Community Science	iNaturalist	1.00	0.50	1.00	0.85	0.05	0.043		
CALeDNA (breakout)	-	-	-	-	-	-	-		

Chapter 2: Biodiversity: B (86%)

- **Data:** Of the data sets analyzed, most met our standards for an ideal indicator. Comprehensive species monitoring should be conducted to improve population trend data for select native indicator species across the entire county, and to fill in potential gaps in community science data sources.
- **Policy Targets:** Unfortunately, the region has already extirpated 16 species since 1900. This highlights the importance of the ongoing target of "no loss of native biodiversity," as well as the resource investments needed to achieve it. Notably, an even more extensive amount of resources are required to reintroduce species. We continue to see increased participation in the City Nature Challenge each year, but to meet the County's relative ranking goal, we will need to increase engagement efforts.
- **Change Over Time:** While all the biodiversity indicators show a trend in the right direction in the near-term, this does not reflect a comparison to historical data that reveals longer-term declines in biodiversity. Thus, it is important to continue to prioritize protection of our native wildlife, and their associated habitat.

Chapter 3: Threats to Ecosystem Health: C (73%)

- **Data:** There are minor issues with data availability and access, but overall these data sets are updated and available within the last five years.
- **Policy Targets:** Unfortunately, there are no policy targets related to these indicators.
- **Change Over Time:** The increasing frequency and severity of wildfires is a major threat to our region. Furthermore, the increased number and spread of invasive species poses an additional threat, primarily as a result of having two major ports (air and sea). Both of these indicators negatively impact human health, our regional economy, our natural resources and species' habitats. Effective mitigation and management strategies are needed to halt these trends. On the other hand, nighttime light pollution shows a positive trend that reflects effective management strategies to reduce light pollution in critical habitat areas. As for imperviousness, there is ample opportunity to turn this trend around through innovative stormwater and green space infrastructure projects, especially in high-need areas. Finally, drought stress is a direct reflection of climate change and thus the only way to turn this trend around is through aggressive policies that reduce greenhouse gas emissions.

Chapter 3: Threats to Ecosystem Health									
Indicator or (breakout)	Data Source	Data Grade (20%)	Policy Target Grade (30%)	Change Over Time Grade (50%)	Average Grade	Weighting %	Weighted Grade	Chapter Grade %	Chapter Grade
Wildfire	CALFire	1.00	NA	0.50	0.60	0.30	0.18	73%	C
Ecological Recovery after Fire (breakout)	-	-	-	-	-	-	-		
Pairing Environmental DNA with Remote Sensing to map Biodiversity after Wildfire (breakout)	-	-	-	-	-	-	-		
Nighttime Light Pollution	NCEI	0.90	NA	0.95	0.94	0.15	0.141		
Impervious Surfaces	LARIAC 4	0.823	NA	0.81	0.813	0.25	0.203		
Vegetation Greenness	NASA - NDVI	1.00	NA	0.84	0.872	0.10	0.087		
Invasive Species	iNaturalist	1.00	NA	0.50	0.60	0.20	0.12		
National Park Service Invasive Species Monitoring Program (breakout)	-	-	-	-	-	-	-		
California Rodenticide Restrictions (breakout)	-	-	-	-	-	-	-		
Los Angeles County Herbicide Restrictions (breakout)	-	-	-	-	-	-	-		

Chapter 4: Community Health and Wellbeing									
Indicator or (breakout)	Data Source	Data Grade (20%)	Policy Target Grade (30%)	Change Over Time Grade (50%)	Average Grade	Weighting %	Weighted Grade	Chapter Grade %	Chapter Grade
Urban Heat Island and Heat-Related Illness	Tracking California	1.00	0.595	0.50	0.629	0.30	0.189	77%	C
Urban Agriculture (breakout)	Cultivate L.A.	0.938	NA	0.805	0.832	0.10	0.083		
Park and Recreation Access	L.A. County Parks Needs Assessment	0.975	0.75	NA	0.795	0.30	0.239		
	Metro's Transit to Parks Strategic Plan	NA	NA	NA	NA	NA	NA		
Park Quality (breakout)	-	-	-	-	-	-	-		
ParkScore (breakout)	Trust for Public Land	0.875	NA	0.79	0.807	0.10	0.081		
Mountain Area Visitation Rates (breakout)	-	-	-	-	-	-	-		
Heal the Bay Beach and River Report Cards (breakout)	Heal the Bay	1.00	NA	NA	NA	NA	NA		
Urban Tree Canopy Cover	LARIAC 4	0.823	0.90	NA	0.885	0.20	0.177		

Chapter 4: Community Health and Wellbeing: C (77%)

- **Data:** The data sets analyzed met a majority of our standards for an ideal indicator.
- **Policy Targets:** The target to increase the urban tree canopy by 10% by 2025 will have to be assessed during the next report card because the baseline calculated here is what informed that target. Adaptive measures are critical to reverse the increasing trend in heat-stress emergency department visits and achieve the target of a 15% reduction in the number of visits per 100,000 residents by 2025. Significant work is also needed to reach the target of 65% of residents living within a half-mile walk of a park, up from 49% in 2016.
- **Change Over Time:** Emergency room visits and hospitalizations due to heat-related illness are rising. This mirrors the region's increasing extreme heat days and will continue to rise unless we invest in adaptation strategies that are accessible to all Angelenos. As for access to parks and urban tree canopy, there are major inequities throughout the region leading to entire communities without access to these essential services. It is important to prioritize investment in the areas with the highest need and work together with those communities to identify and implement solutions.

APPENDIX 3: SUMMARY OF RECOMMENDATIONS FOR TARGETS/ ACTIONS TO IMPROVE ECOSYSTEM HEALTH IN L.A. COUNTY

Summary of Recommendations for Targets/Actions to Improve Ecosystem Health in L.A. County			
	Indicator and Breakout Titles	Relevant OurCounty Ecosystem Health Targets	Summary of recommendations for improving ecosystem health targets/ actions for Los Angeles County
Ch. 1: Land Use and Habitat Quality	Land Cover and Natural Area	**2025:** Increase to 55% the percentage of protected natural area **2035:** Increase to 65% the percentage of protected natural area **2045:** Increase to 70% the percentage of protected natural area	• Clarification to existing target that the percentage of protected natural area is measured against an existing baseline (define year) of natural area • Increase to 100% the percentage of protected natural area by 2045 • 100% of the natural areas identified in this report card (baseline) should be protected against development • 100% of the natural areas identified in this report card should be assessed for degradation to determine where restoration efforts are most needed
	Rare Vegetation (breakout)	**2025:** Increase to 55% the percentage of protected natural area **2035:** Increase to 65% the percentage of protected natural area **2045:** Increase to 70% the percentage of protected natural area **Ongoing:** No loss of native biodiversity	• Preserve and protect habitat in rare vegetation alliances to ensure the most vulnerable species are protected
	Endangered Species Habitats (breakout)	**2025:** Increase to 55% the percentage of protected natural area **2035:** Increase to 65% the percentage of protected natural area **2045:** Increase to 70% the percentage of protected natural area	• Preserve and protect all critical habitat to support endangered species
	Protected Areas	**2025:** Increase to 55% the percentage of protected natural area **2035:** Increase to 65% the percentage of protected natural area **2045:** Increase to 70% the percentage of protected natural area	• Local governments should restrict all public development in SEAs and dedicate funding to monitor SEAs across all jurisdictions
	Habitat Connectivity and Fragmentation	**2025:** Increase the percentage of protected wildlife corridors to 75% **2035:** Increase the percentage of protected wildlife corridors to 100%	• Protect all habitat linkages as well as existing large patches of habitat and prevent development that causes further fragmentation • Classify remaining and any new-designated missing linkages as protected or Significant Ecological Areas, in accordance with the SEA Program goal of reducing fragmentation and preserving connectivity

	Indicator and Breakout Titles	Relevant OurCounty Ecosystem Health Targets	Summary of recommendations for improving ecosystem health targets/ actions for Los Angeles County
Ch. 1: Land Use and Habitat Quality	Liberty Canyon Wildlife Crossing (breakout)	**2025**: Increase the percentage of protected wildlife corridors to 75% **2035**: Increase the percentage of protected wildlife corridors to 100%	• Support construction and maintenance of Liberty Canyon Wildlife Crossing • Assess need for additional wildlife crossings and implement where needed
	Rim of the Valley National Park Survey (breakout)	**2025**: Increase the percentage of protected wildlife corridors to 75% **2035**: Increase the percentage of protected wildlife corridors to 100%	
	Ventura County Habitat Connectivity and Wildlife Corridor Ordinance (breakout)	**2025**: Increase the percentage of protected wildlife corridors to 75% **2035**: Increase the percentage of protected wildlife corridors to 100%	
	Riparian Habitat Condition	NA	• No development within 100 feet of a channelized river/ stream and 300 feet of a soft bed river/ stream
	Historical Wetland Habitat (breakout)	NA	• No loss or degradation of remaining wetland area • Conduct ongoing monitoring and maintenance for existing wetland restoration project sites • Increase recovery and area of wetlands through restoration projects
	Kelp Canopy Coverage	NA	• Kelp bed restoration should occur when a bed is lost
	State of the Bay Report (breakout)	NA	
	Restoration Recommendations (breakout)	**2025**: Increase to 55% the percentage of protected natural area **2035**: Increase to 65% the percentage of protected natural area **2045**: Increase to 70% the percentage of protected natural area	• Ensure that restoration projects at these sites are prioritized for support • Expand protection to areas that have undergone restoration

	Indicator and Breakout Titles	Relevant OurCounty Ecosystem Health Targets	Summary of recommendations for improving ecosystem health targets/ actions for Los Angeles County
Ch. 2: Biodiversity	Native Plant and Animal Diversity	**Ongoing:** No loss of native biodiversity	• A regional indicator species list should be solidified that prioritizes species that indicate quality habitat and have available data • All critical habitat for the remaining threatened and endangered species should be protected against development and should be a priority for restoration efforts
	California Conservation Genomics Project (breakout)	**Ongoing:** No loss of native biodiversity	• Areas identified as genetic variation hotspots through this research should be protected to ensure ecosystem resilience
	Santa Monica Mountains Species Monitoring (breakout)	**Ongoing:** No loss of native biodiversity	
	Bird Population Trends	**Ongoing:** No loss of native biodiversity	• Prioritize specific and targeted conservation of habitats known to support California Special-status Species, including wetlands, coastal sage scrub, sandy beaches, and others • For migratory species breeding in L.A. County, collaborate with partners to better understand and conserve their migratory pathways and wintering grounds, as preserving L.A. County habitat will do little to protect these species if their full life cycle habitat is not considered
	UCLA's Counterforce Lab: Biophilia Treehouse (breakout)	**Ongoing:** No loss of native biodiversity	• Support innovative and creative approaches to engage the public and communities in improving ecosystem resiliency

	Indicator and Breakout Titles	Relevant OurCounty Ecosystem Health Targets	Summary of recommendations for improving ecosystem health targets/ actions for Los Angeles County
Ch. 2: Biodiversity	Rocky Intertidal Species Population Trends	**Ongoing:** No loss of native biodiversity	• Establish a set of standards for anthropogenic activity (including recreational and developmental activity) for all rocky intertidal habitats across the County • Implement local enforcement of take limits at the most visited tide pool sites • Regulate the Port of L.A. to reduce impact on rocky intertidal systems
	Marine Fish and Invertebrate Population Trends	**Ongoing:** No loss of native biodiversity	• Expand the no-take areas for sites that continue to show population declines across species • Improve coastal regulations; e.g., increase regulations on fishing practices that have high bycatch
	Community Science	**2025:** L.A. County continues to place within the top three participating jurisdictions in the City Nature Challenge	• Instead of a comparative metric across jurisdictions, update target to encourage increases in participation in L.A. County. Increased participation will increase awareness and contribute to a culture of knowing and protecting biodiversity. • **Baseline:** In 2016, L.A. reported 10,353 observation, 1,601 species, and 574 participants in the City Nature Challenge. • **2025:** Increase participation by 100% over baseline. • **2035:** Increase participation by 200% over baseline. • **2045:** Increase participation by 300% over baseline.
	CALeDNA (breakout)	**Ongoing:** No loss of native biodiversity	

	Indicator and Breakout Titles	Relevant OurCounty Ecosystem Health Targets	Summary of recommendations for improving ecosystem health targets/ actions for Los Angeles County
Ch. 3: Threats to Ecosystem Health	Wildfire	NA	• Conduct controlled burns and removal of invasive species to help prevent fire • Prioritize natural areas with mixed dominance of native and non-native plants for fire suppression and management to ensure that non-native species do not out-compete and overtake native species • Establish a program for retrofitting existing power lines that prioritizes underground installation in high fire hazard areas • Modify general plans to maintain high fire risk areas as undevelopable open space; Restrict new development in high fire hazard zones to minimize the population at risk • Discourage redevelopment and impose mandatory redevelopment requirements that include risk mitigation strategies such as fire-resistant structures, only native plants, and regular brush clearance
	Ecological Recovery After Fire (breakout)	NA	
	Pairing Environmental DNA with Remote Sensing to Map Biodiversity After Wildfire (breakout)	NA	
	Nighttime Light Pollution	NA	• Continue managing nighttime light pollution to ensure all protected areas (CPAD and SEAs) have a mean radiance of < 0.5 (nanowatts/cm^2/sr x 1E9) • Monitor nighttime light pollution in all protected areas and provide annual reports for natural resource managers • Create standards that regulate the mean radiance at the wildland interface as well as the urban core, especially around urban parks that provide habitat for native biodiversity

	Indicator and Breakout Titles	Relevant OurCounty Ecosystem Health Targets	Summary of recommendations for improving ecosystem health targets/ actions for Los Angeles County
Ch. 3: Threats to Ecosystem Health	Impervious Surfaces	**Baseline:** Research is currently being conducted to understand how much of L.A. County's land area is covered by heat-trapping surfaces; In 2014 there were seven heat-stress emergency department visits per 100,000 residents **2025**: Convert 10% of heat-trapping surfaces to cool or green surfaces; Reduce by 15% the number of heat-stress emergency department visits per 100,000 residents **2035**: Convert 20% of heat-trapping surfaces to cool or green surfaces; Reduce by 45% the number of heat-stress emergency department visits per 100,000 residents **2045**: Convert 30% of heat-trapping surfaces to cool or green surface; Reduce by 75% the number of heat-stress emergency departments visits per 100,000 residents	• Create a plan to increase pervious surfaces in neighborhoods that currently have the highest percentage of impervious surfaces; This plan should reflect the work that is already being conducted in this space including Southern California Coastal Water Research Project (SCCWRP)'s "Hydromodification Assessment and Management in California" Plan and the county's "Low Impact Development Standards Manual" • Any transformed impervious to pervious surface land should be land cover that is appropriate to the local ecosystem and climate, and designed to improve or increase habitat to support native biodiversity • Set percentage limits of impervious surfaces for different land use types (residential, open space, recreational, commercial, industrial, etc.)
	Vegetation Greenness	**Baseline:** Research is currently being conducted to understand how much of L.A. County's land area is covered by heat-trapping surfaces; In 2014 there were seven heat-stress emergency department visits per 100,000 residents **2025**: Convert 10% of heat-trapping surfaces to cool or green surfaces; Reduce by 15% the number of heat-stress emergency department visits per 100,000 residents **2035**: Convert 20% of heat-trapping surfaces to cool or green surfaces; Reduce by 45% the number of heat-stress emergency department visits per 100,000 residents **2045**: Convert 30% of heat-trapping surfaces to cool or green surface; Reduce by 75% the number of heat-stress emergency departments visits per 100,000 residents	• To increase vegetation greenness, require that all new developments or redevelopments include "best" practices to accompany low impact development ordinances that require rainwater from a three-quarter inch rainstorm to be captured, infiltrated and/or used onsite at most developments and redevelopments where more than 500 square feet of hardscape is added

	Indicator and Breakout Titles	Relevant OurCounty Ecosystem Health Targets	Summary of recommendations for improving ecosystem health targets/ actions for Los Angeles County
Ch. 3: Threats to Ecosystem Health	Invasive Species	**Ongoing:** No loss of native biodiversity	• An Integrated Pest Management Plan should be standardized for all invasive species and nuisance species in the County; All cities and unincorporated areas should comply • Nurseries should not sell any plants on the CAL IPC invasive plant lists; they also should not sell any plants that contribute to harming native animal species (e.g., non-native milkweed and its impact on the monarch butterfly)
	National Park Service Invasive Species Monitoring Program (breakout)	**Ongoing:** No loss of native biodiversity	
	California Rodenticide Restrictions (breakout)	NA	• Building on the 2020 passage of California's AB-1788, which prohibits most uses of several types of second-generation anti-coagulant rodenticides (SGARs), continued research on rodenticide impacts should be supported • Strategies for implementing integrated pest management best practices should be developed
	Los Angeles County Herbicide Restrictions (breakout)	NA	• The L.A. County Board of Supervisors' 2019 moratorium on the use of glyphosate should be upheld as a precautionary step with respect to public health and ecosystem health in the L.A. area; Alternative tools for invasive species management should be identified

	Indicator and Breakout Titles	Relevant OurCounty Ecosystem Health Targets	Summary of recommendations for improving ecosystem health targets/ actions for Los Angeles County
Ch. 4: Community Health and Wellbeing	Urban Heat Island and Heat-Related Illness	**Baseline:** Research is currently being conducted to understand how much of L.A. County's land area is covered by heat-trapping surfaces; In 2014 there were seven heat-stress emergency department visits per 100,000 residents **2025**: Convert 10% of heat-trapping surfaces to cool or green surfaces; Reduce by 15% the number of heat-stress emergency department visits per 100,000 residents **2035**: Convert 20% of heat-trapping surfaces to cool or green surfaces; Reduce by 45% the number of heat-stress emergency department visits per 100,000 residents **2045**: Convert 30% of heat-trapping surfaces to cool or green surface; Reduce by 75% the number of heat-stress emergency departments visits per 100,000 residents	• An urban heat island mitigation plan should be developed for the county that addresses cool pavements and roofs, pavement reduction, shade structures, and urban greening • All community members, especially in areas of highest need, should have access to a public cooling center within a quarter mile walk and/or a 10-minute transit commute
	Urban Agriculture (breakout)	The 2019 OurCounty Sustainability Plan called for the use of public and private land for urban and peri-urban agriculture as well as providing technical and financial support to urban agriculture entrepreneurs in adopting regenerative agricultural practices	• Support the sustainability of urban agriculture so that it contributes to environmental health, economic profitability for local residents and social equity
	Park and Recreation Access	**2025:** Increase to 65% the proportion of residents within 1/2 mile of parks and open space **2035:** Increase to 75% the proportion of residents within 1/2 mile of parks and open space **2045:** Increase to 85% the proportion of residents within 1/2 mile of parks and open space	• All new parks should incorporate multi-purpose green space that serves both the needs of the community and local biodiversity into the its design • All regional parks should be retrofitted to include adequate green space • No park should be placed within 1,000 feet of a freeway

	Indicator and Breakout Titles	Relevant OurCounty Ecosystem Health Targets	Summary of recommendations for improving ecosystem health targets/ actions for Los Angeles County
Ch. 4: Community Health and Wellbeing	Park Quality (breakout)	NA	• Modify parks and open space target to include language about park quality (not all parks and open space are equal) • Conduct regular monitoring to identify and prioritize improvements in existing park infrastructure so that park quality increases, especially in areas of highest need • Increase access to green space in dense urban areas by developing joint use plans that identify underutilized spaces where quality park space and amenities can be added or improved
	ParkScore (breakout)	NA	
	Mountain Areas Visitation Rates (breakout)	**2025:** Increase to 65% the proportion of residents within 1/2 mile of parks and open space **2035:** Increase to 75% the proportion of residents within 1/2 mile of parks and open space **2045:** Increase to 85% the proportion of residents within 1/2 mile of parks and open space	• Evaluate public transport access to natural mountain areas in L.A. County and improve access so that all Angelenos have the opportunity to experience and enjoy these areas
	Heal the Bay Beach and River Report Cards (breakout)	NA	
	Urban Tree Canopy	**2025**: Increase urban tree canopy cover by 10% of baseline **2035**: Increase urban tree canopy cover by 15% of baseline **2045**: Increase urban tree canopy cover by 20% of baseline	• Allocate all public funds committed to increasing urban tree canopy to areas that currently have the lowest tree canopy • Work closely with communities to understand their needs and desires around trees and maintenance to ensure the success of tree planting
	Street Tree Maintenance (breakout)	**2025**: Increase urban tree canopy cover by 10% of baseline **2035**: Increase urban tree canopy cover by 15% of baseline **2045**: Increase urban tree canopy cover by 20% of baseline	• Standardize an approach to street maintenance that works across departments to guarantee that tree canopy provides multiple benefits (including benefits to biodiversity) while ensuring more efficient use of funds; That is, anytime a sidewalk or median is updated, there is an opportunity to provide better design for the current trees and/or design around the planting of new trees