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Sea Level Rise Impacts Local Parks

Friends of Harbors, Beaches and Parks (FHBP) evaluated which parklands in Orange County will be impacted by varying degrees of sea level rise. This factsheet outlines the results of our mapping research. We did not analyze the impacts themselves, instead we determined the impact areas. Data was compiled from the state's Cal-Adapt website and publicly available data layers from the National Oceanic and Atmospheric Administration (NOAA).

Background

Climate change is a term that refers to how Earth's temperature is increasing due to greenhouse gases trapped in our atmosphere, including higher average temperatures and more extreme weather events. According to the Union of Concerned Scientists, China is the world leader in greenhouse emissions with 28%. The United States is at 14% in second place, and India is at 7%.[1]

The U.S. Environmental Protection Agency acknowledges there are many sectors that contribute to the greenhouse gas emission problem in the United States. These include: transportation (28.2%), electricity production (26.9%), industry (22%), commercial and residential (12.3%), agriculture (9.9%), and land use and forestry (11.6%).[2]

In the transportation sector, there are three main gasses contributing: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). CO_2 is released during the combustion of fossil fuels (coal, oil, and natural gas) and is by far the gas that causes the greatest concern among all greenhouse gases.

The temperature of both the planet and our oceans is increasing, which has severe and detrimental consequences if it goes unchecked and if it isn't reversed soon.

The range of impacts due to this warming includes an increase in frequency and intensity of droughts, wildfires, killer heat days, and other extreme weather events. This factsheet focuses on sea level rise in Orange County, California and its impacts to parklands along the coast.

Sea Level Rise Overview

There are three ways sea level rise occurs. First, as water gets hotter, the molecules expand in size. Therefore, the same amount of water, when hotter, occupies a larger space. Second, loss of land-based glaciers and ice sheets means oceans have more water because glacial ice formerly held on the land has melted and added to the overall quantity of sea water. Finally, changes in land-based water storage can contribute as well. Water on land, in lakes and rivers, also ends up in the ocean. As temperatures rise, water evaporates, and it circulates through the water cycle.

Historical information on sea level rise goes back more than a century. According to NOAA, the sea has already risen 8-10 inches since 1880. One third of this increase has come in the last 25 years. In fact, NOAA's research indicates that in 2018, the globe saw the highest sea level yet, which represented a 3.2-inch increase since 1993.[3]

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Our Research

FHBP completed an analysis of the coastal impact areas of sea level rise using publicly available digital data from NOAA. This information was overlaid with digital maps of Orange County and associated federal, state, and county parkland ownerships. All together, 133,865 acres of conserved land exist within Orange County, including hundreds of miles of trails for residents and visitors to enjoy. Camping, bird watching, picnicking, hiking, fishing, mountain biking, and horseback riding, are just some of the ways people use these parklands.

This area, and much of the rest of California, is within the California Floristic Province. California has many plant and animal species found only here—making our landscapes biologically unique and important to protect. In fact, many species found here are threatened with development, which has led our region and state to be included as one of 20 global hotspots of biodiversity.

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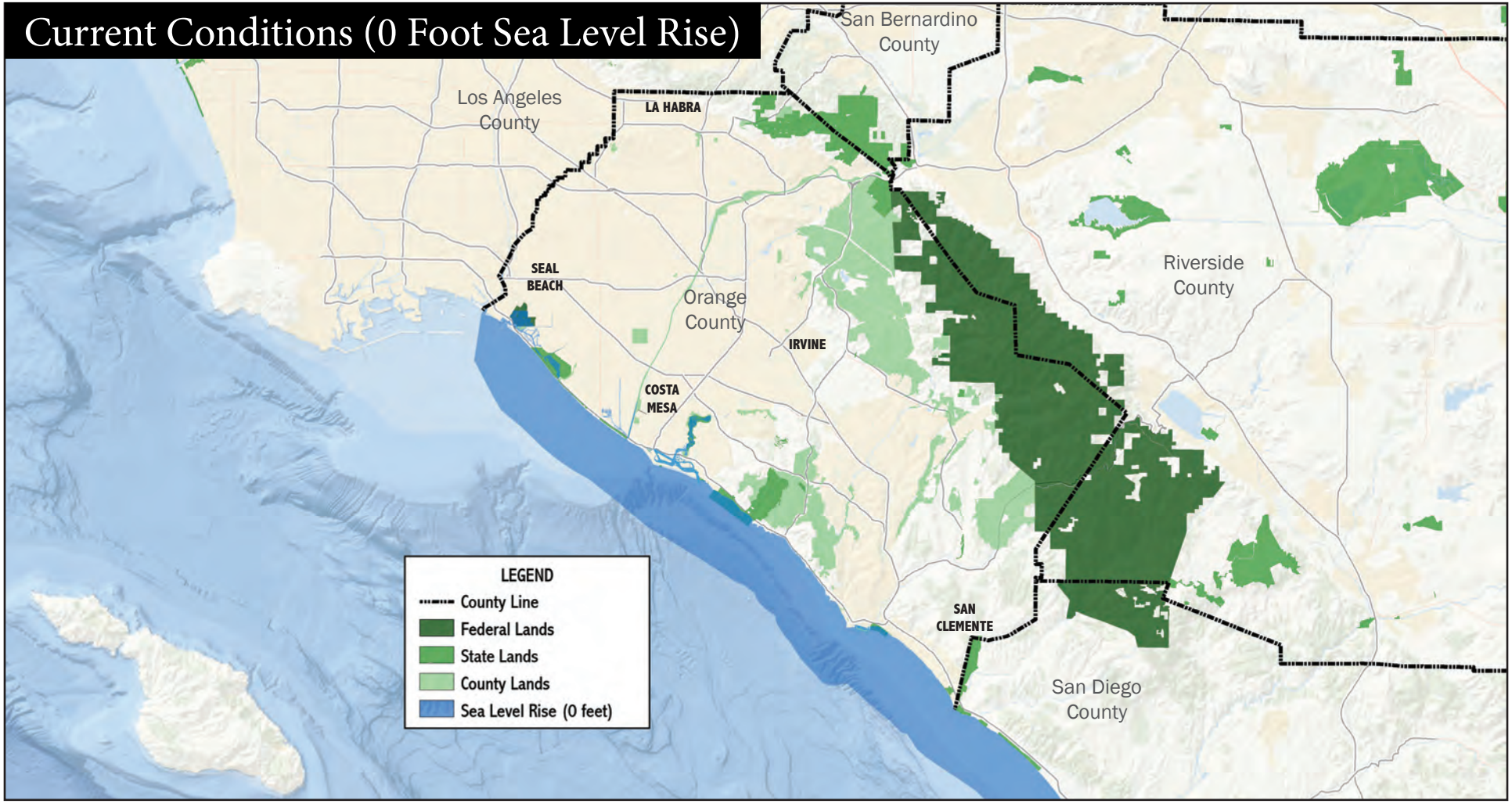
Our parks provide the refuge, nurseries, hunting and foraging areas, and wildlife corridors that these species need to survive. Many of these protected lands include coastal assets like estuaries, beaches, and bays that both wildlife and people rely on. Without these places, our wildlife will struggle to find suitable places to live.

NOAA's digital data set included a range of sea level rise conditions between 0 feet up to 10 feet. Per NOAA's *Sea Level Rise Viewer*, "water levels are relative to Mean Higher High Water (MHHW) (excludes wind driven tides)."[4] There were four conditions reviewed: 0 feet of sea level rise, as well as 3, 6, and 9 feet. This provided current conditions, intermediate, high, and extreme sea level rise forecasts.

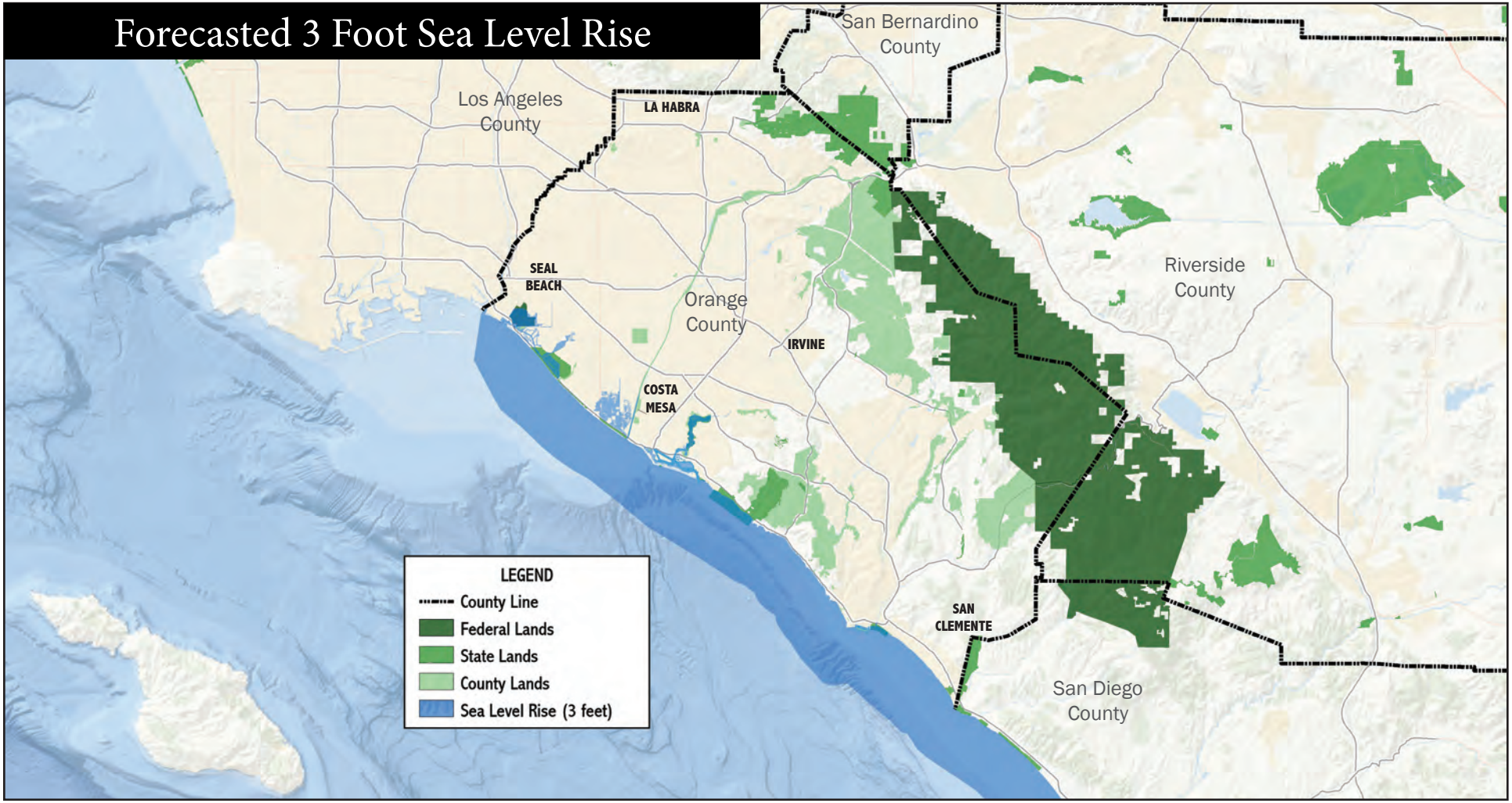
The amount of actual sea level rise at any given time is dependent on how much water is in the ocean, how warm it is, and how much glacial melt there is, coupled with tidal influences, wind, and other factors. For example, if the entirety of the ice sheet over Greenland melts, it would raise sea levels worldwide by more than 22 feet.

That said, it is important to note that there is an accumulation effect with emissions and sea level rise. What we are witnessing right now, is from greenhouse gas emissions years and even decades ago, plus current emissions. Greenhouse gases have a long-lifespans. Therefore, our actions today won't be seen as having a significant effect for many years to come. Thus, the sooner we act, the earlier we will see the results.

Sea Level Rise Maps



Digital Data Sources: U.S. Fish and Wildlife Service, California Department of Fish and Wildlife, California State Parks, OC Parks, Orange County Transportation Authority, and National Ocean and Atmospheric Administration



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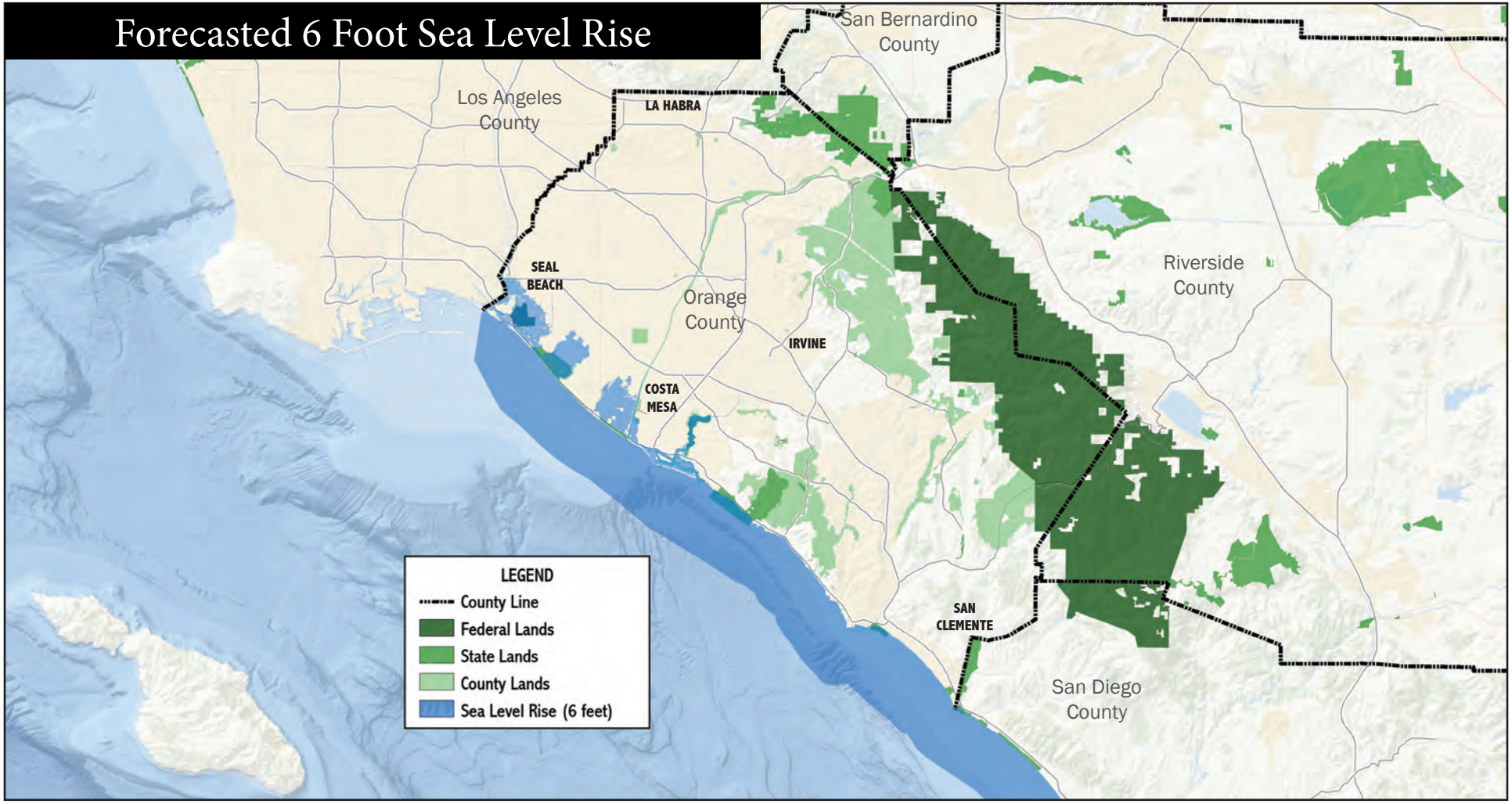

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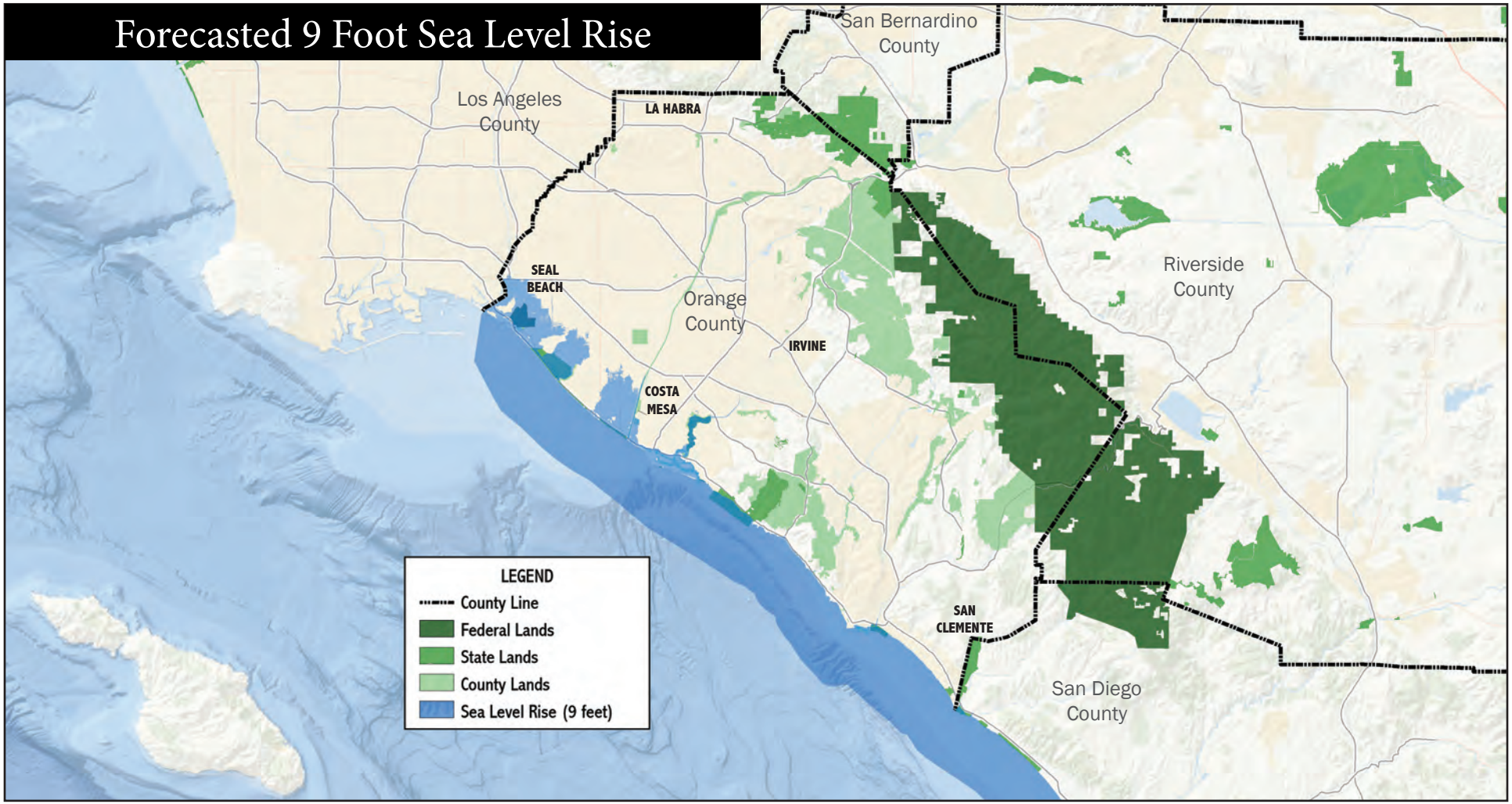

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Impacts to Parklands

Orange County's coastline is one of its most important assets as a site for recreation, tourism, high-value real estate, and ecosystems that are home to many of California's unique plants and animals. Orange County is also part of the Pacific Flyway where birds from across the globe stop over as they migrate north or south. Beaches and parks are situated all along this coastline, and sea level rise puts these valuable assets at risk. Already, at least 21 of these sites, under current conditions are known to experience impacts from coastal erosion, storm surges, high tides, and wave action that will only increase as sea level rises.

REGIONAL PARKS

Since many of Orange County's regional park assets already sit along the beach or bayfront. Impacts from normal coastal processes are already felt in 13 locations managed by OC Parks. With a three-foot increase in sea level rise, the number of parks impacted increases to 14. At six and nine feet of rise, it increases to 16 locations.

Land Manager	Amount of Sea Level Rise			
County of Orange	**0 feet**	**3 feet**	**6 feet**	**9 feet**
Aliso Beach		✓	✓	✓
Bayside Drive Beach	✓	✓	✓	✓
Capistrano Beach	✓	✓	✓	✓
Dana Point Harbor	✓	✓	✓	✓
Dana Point Harbor Island	✓	✓	✓	✓
Harriett Wieder Regional Park			✓	✓
Newport Dunes Waterfront Resort	✓	✓	✓	✓
Newport Harbor	✓	✓	✓	✓
Newport Harbor Island	✓	✓	✓	✓
Poche Beach	✓	✓	✓	✓
Salt Creek Beach	✓	✓	✓	✓
Santa Ana River Greenbelt	✓	✓	✓	✓
South Laguna Beaches	✓	✓	✓	✓
Sunset Harbour	✓	✓	✓	✓
Talbert Regional Park			✓	✓
Upper Newport Bay Nature Preserve	✓	✓	✓	✓

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STATE PARKS, BEACHES, AND PRESERVES

The State of California also owns many assets (beaches, nature preserves, piers, etc.) within Orange County and these locations already endure normal coastal processes too. The baseline with current conditions is 10 impacted locations. It increases by one more with a nine-foot sea level rise.

This nine-foot rise becomes increasingly detrimental to the federally listed endangered California Least Tern. Sea level rise at nine feet will inundate the Least Tern Nature Preserve and remove the breeding, foraging, and nesting grounds for this sensitive species.

Land Manager	Amount of Sea Level Rise			
State of California	**0 feet**	**3 feet**	**6 feet**	**9 feet**
Bolsa Chica Ecological Preserve	✓	✓	✓	✓
Bolsa Chica State Beach	✓	✓	✓	✓
Corona del Mar State Beach	✓	✓	✓	✓
Crystal Cove State Park	✓	✓	✓	✓
Doheny State Beach	✓	✓	✓	✓
Huntington City Beach	✓	✓	✓	✓
Huntington State Beach	✓	✓	✓	✓
Least Tern Nature Preserve				✓
San Clemente State Beach	✓	✓	✓	✓
Seal Beach Fishing Pier	✓	✓	✓	✓
Upper Newport Bay Ecological Preserve	✓	✓	✓	✓

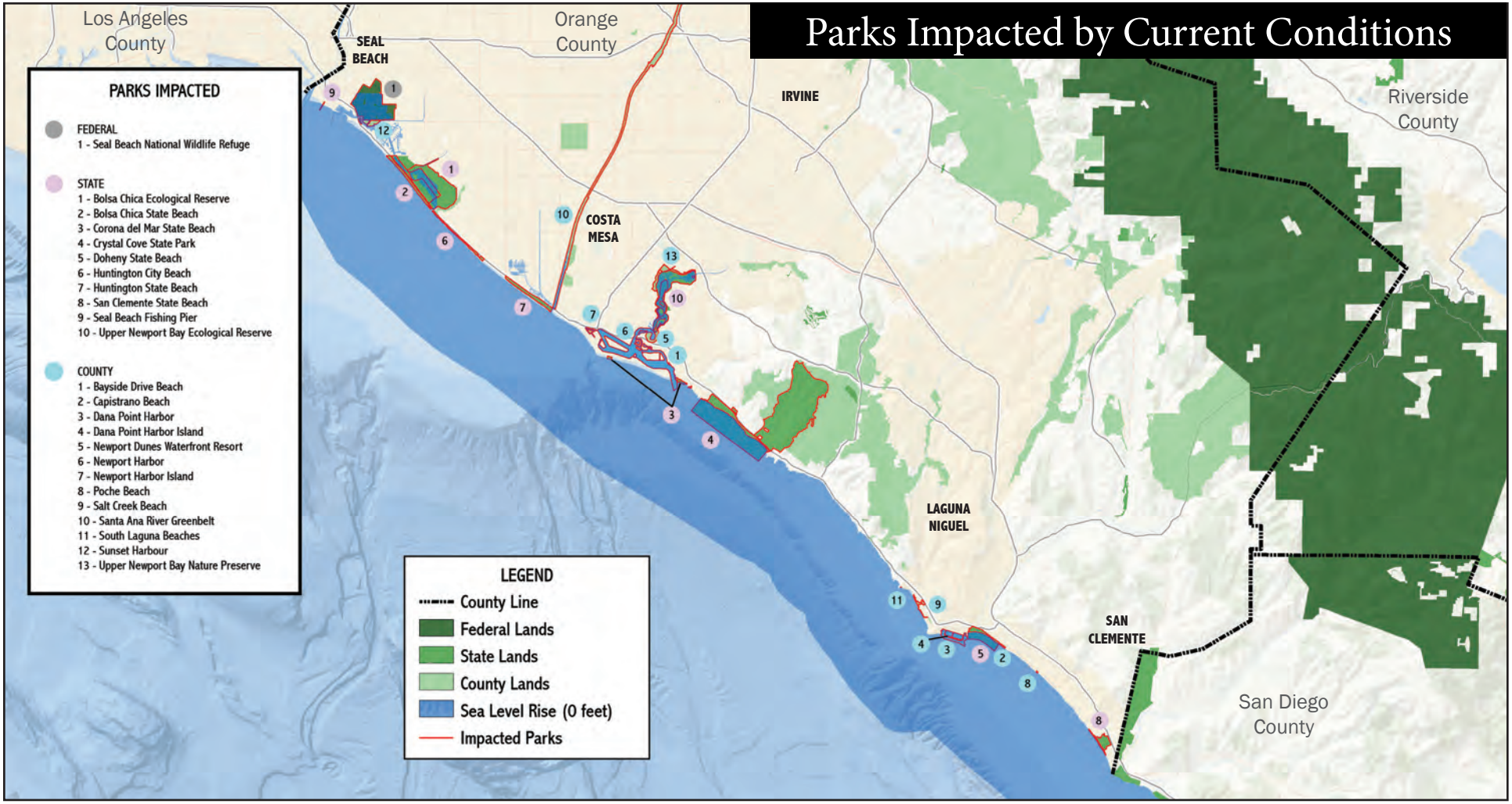
FEDERAL WILDLIFE REFUGES

On the federal side, the Seal Beach National Wildlife Refuge is the only property that is currently impacted and will continue to be impacted now and in the future by sea level rise.

Land Manager	Amount of Sea Level Rise			
United States of America	**0 feet**	**3 feet**	**6 feet**	**9 feet**
Seal Beach National Wildlife Refuge	✓	✓	✓	✓

While other parklands and coastal assets exist, they were excluded from this impact list because their inland location or higher elevations meant they weren't taking a direct hit from sea level rise.

Parks Impacted by Sea Level Rise Maps



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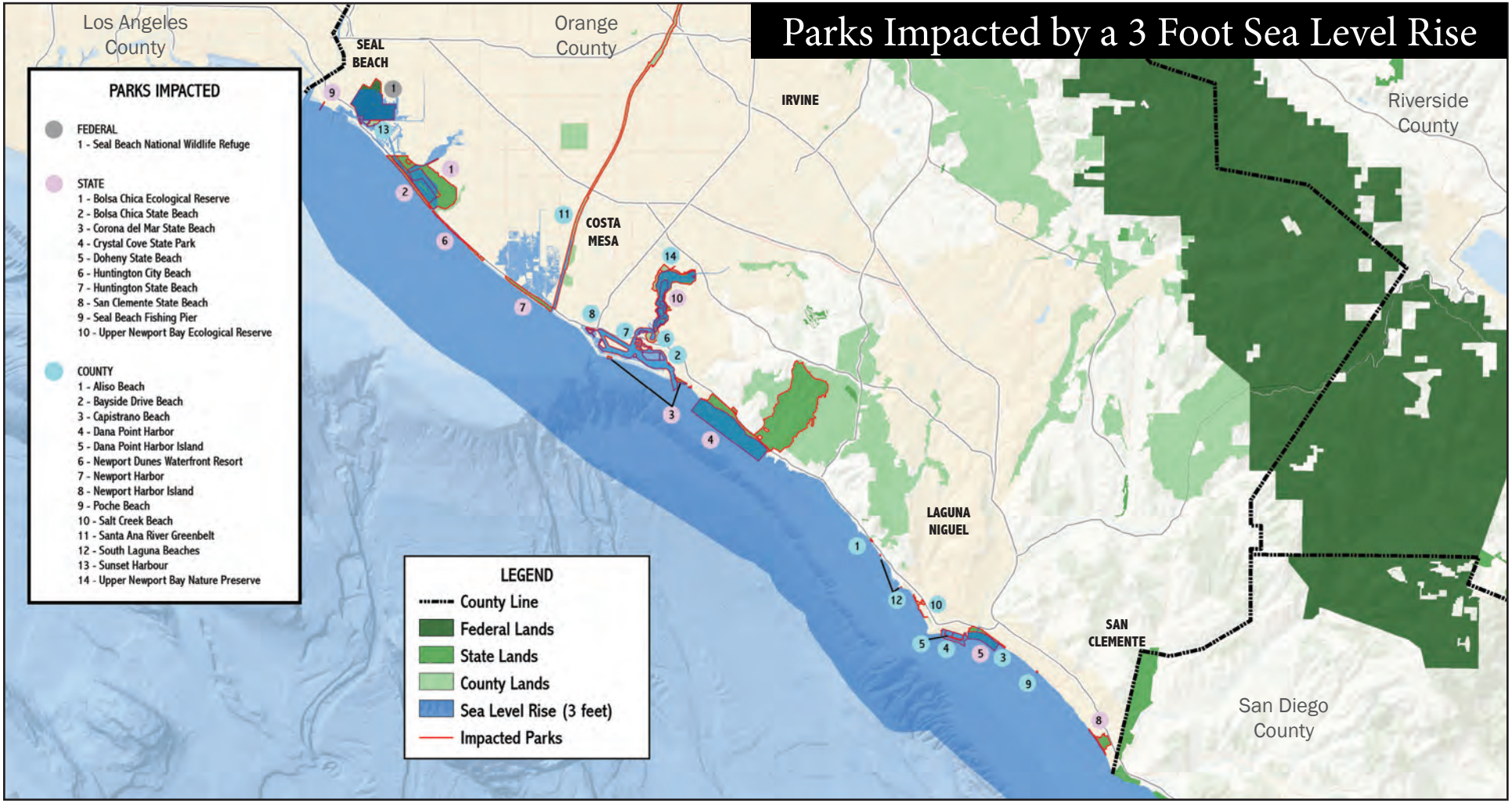

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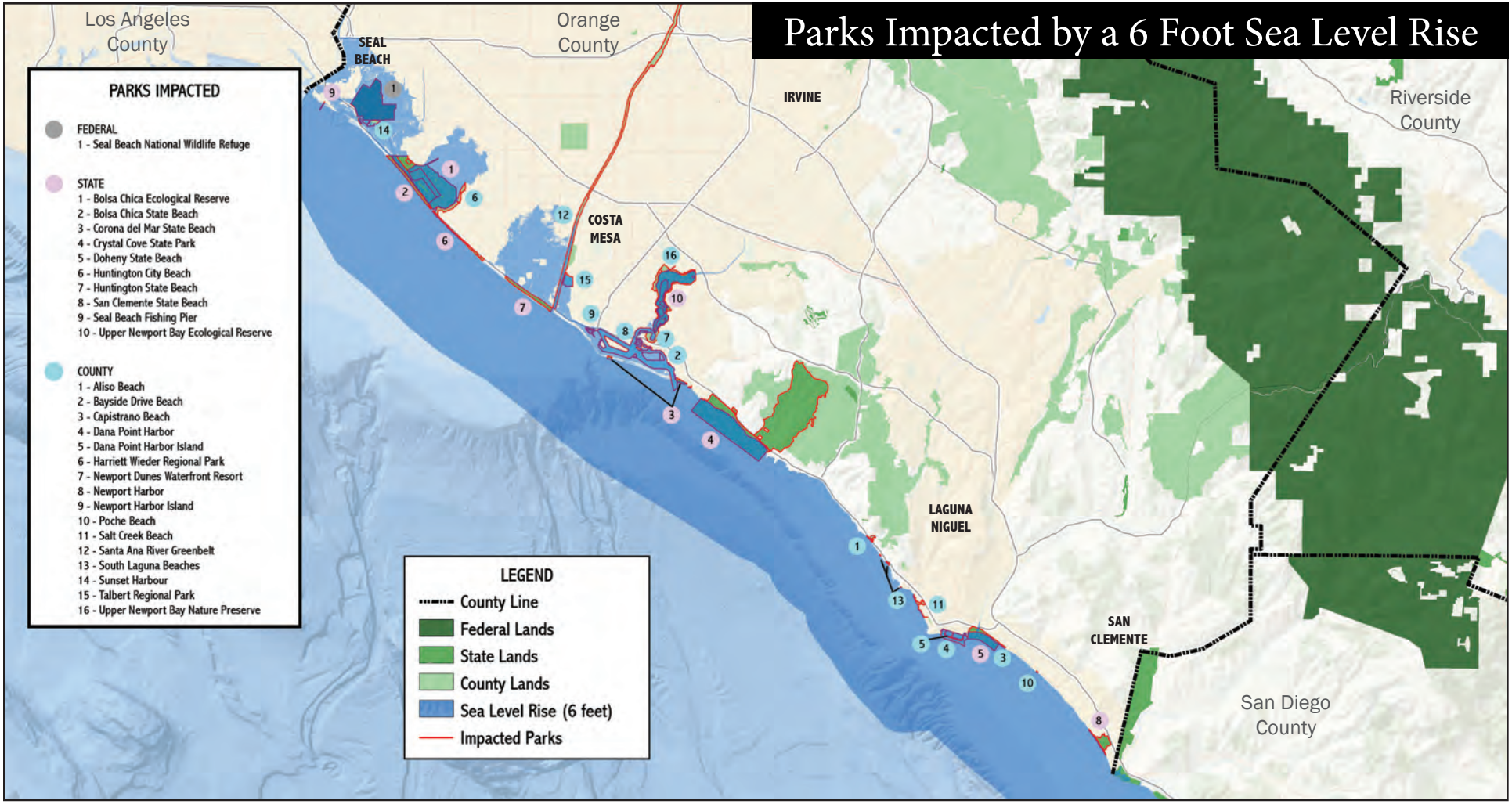

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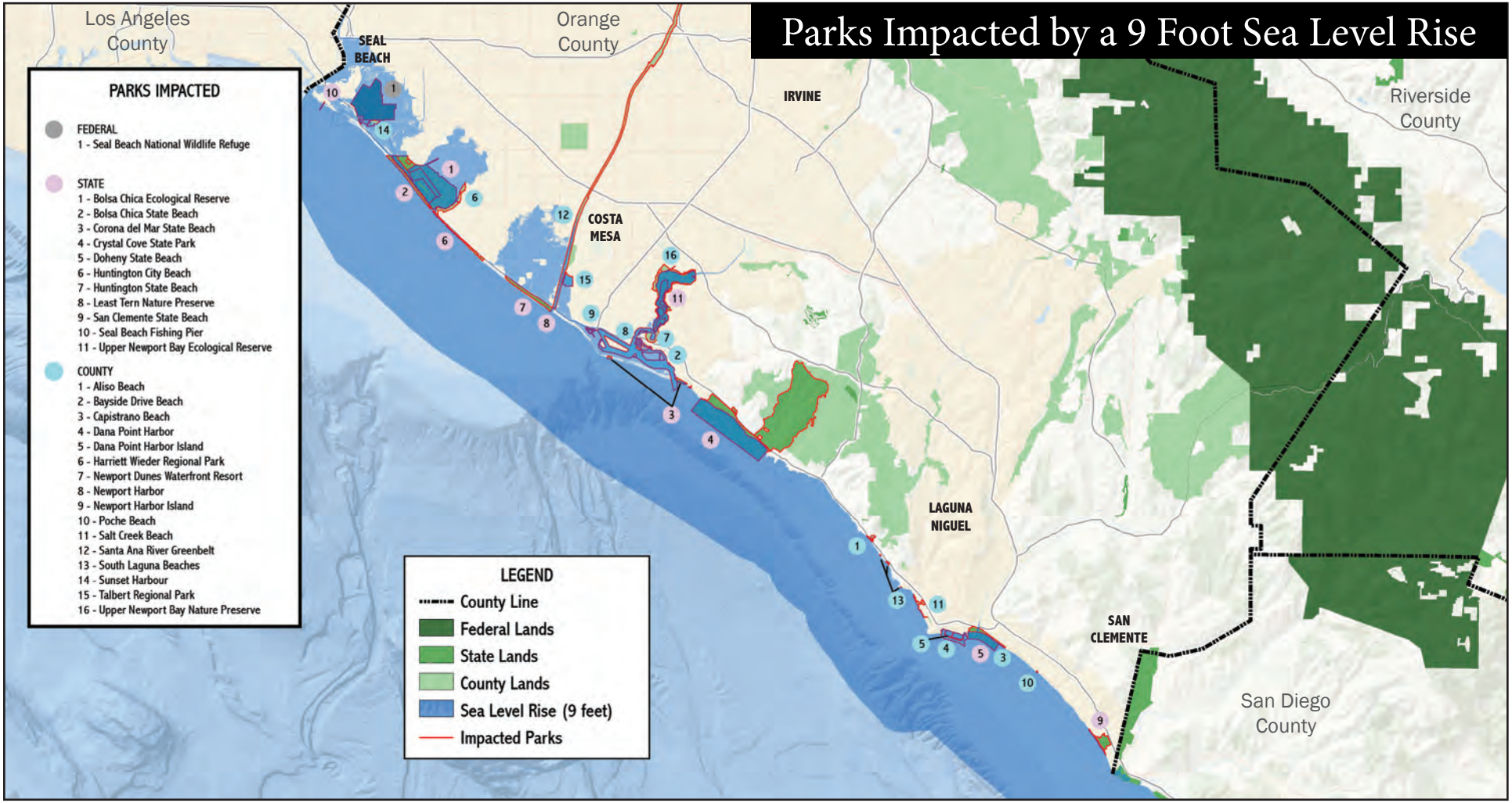

Digital Data Sources: U.S. Fish and Wildlife Service, California Department of Fish and Wildlife, California State Parks, OC Parks, Orange County Transportation Authority, and National Ocean and Atmospheric Administration

Conclusion

We have no way of knowing exactly when the sea level rise will become more permanent or how quickly it will happen. The Intergovernmental Panel on Climate Change (IPCC), which studies the scientific impacts of climate change to the Earth, notes in its Fifth Report that over the last two centuries the highest rate of mean sea level increase has occurred mostly due to human influence. The Report states that, "[by] the end of the 21st century, it is very likely that sea level will rise in more than about 95% of the water area. About 70% of the coastlines worldwide are projected to experience a sea level change within ±20% of the global mean." [5] Further, even if immediate action is taken to reverse the trajectory of our greenhouse gas emissions, the ocean acidification, warming, and sea level rise will continue to occur—even if temporarily—because the effect is cumulative and the gasses are long lasting.

It appears that our coastal park managers—not to mention infrastructure, homes, and businesses—must begin to take seriously the impacts of sea level rise. While studying impacts to the man-made environment was outside the scope of this study, the maps show clear impacts from sea level rise, especially in northern coastal Orange County where there are fewer cliffs at the ocean's edge. There are many parts of Huntington Beach, Seal Beach, Costa Mesa, and other communities that will be flooded as the sea level increases. Coastal towns are faced with options like sea walls, managed retreats, modifying buildings to withstand coastal flooding, and strengthening "green infrastructure" including wetlands, beaches, reefs, and parks. However, each of these modifications comes with its own set of environmental impacts.

Some agencies and decision makers are taking the threat of sea level rise seriously. Assemblymember Cottie Petrie-Norris' Assembly Bill (AB 65) was signed into law in 2019 and provides for improved coastal adaptation by prioritizing green infrastructure. And, in 2019, the Orange County Transportation Authority received a grant to look at impacts and possible mitigation measures from climate change on its transit system. In 2020, the Southern California Association of Governments' Sustainable Communities Strategy Plan included constraints for building in risk prone locations, such as wildfire zones, coastal flooding, and sea level rise areas.

None of these measures or plans are long term solutions, but they are steps toward acknowledging the threat that something needs to be done immediately. If we do not act, when the sea rises, we may simply lose our beaches and usable coastline—part of what has always defined California.

This report was released in May 2020.

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[1] Union of Concerned Scientists. "Each Country's Share of CO_2 Emissions." Last retrieved 26 May 2020 from the Union's website: h*ttps://www.ucsusa.org/resources/each-countrys-share-co2-emissions.*

[2] United States Environmental Protection Agency. "Sources of Greenhouse Gas Emissions." Last retrieved 26 May 2020 via the Agency's website: *https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions*.

[3] National Oceanic and Atmospheric Administration. "Climate Change: Global Sea Level." Last retrieved 26 May 2020 via the Administrations website: *https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level.*

[4] National Oceanic and Atmospheric Administration. "Sea Level Rise Viewer." Last retrieved 26 May 2020 via the Administrations website: *https://coast.noaa.gov/slr/*.

[5] Intergovernmental Panel on Climate Change. "Climate Change 2014: Synthesis Report." Page 13. Last retrieved 26 May 2020 via the Panel's website: *https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf.*