

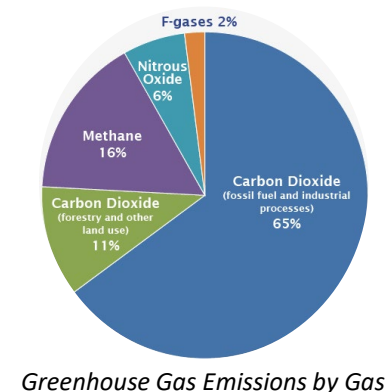
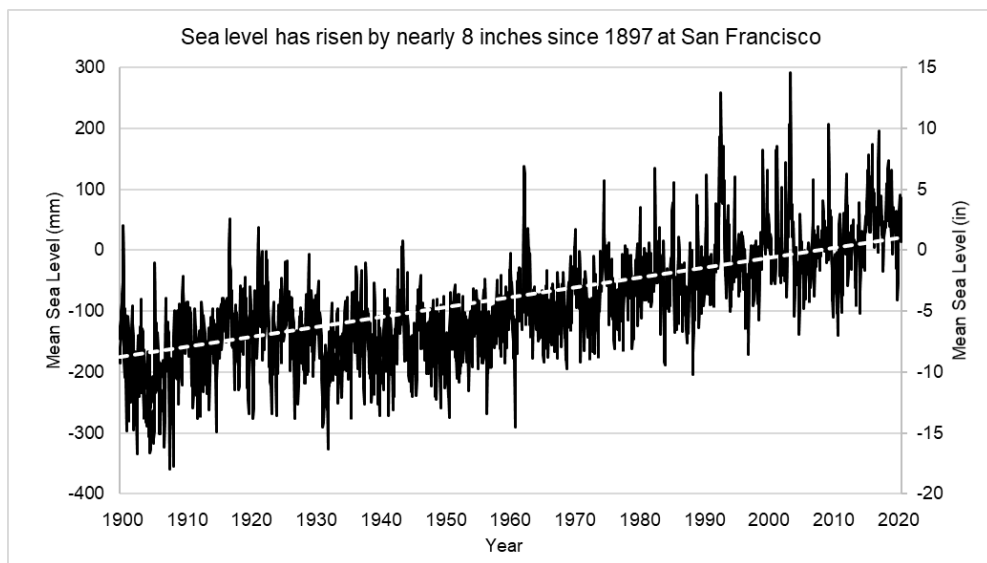


Sea levels are rising.

Two phenomena related to climate change contribute to accelerated global sea level rise:

- Thermal expansion: global atmospheric and ocean temperatures are rising, and water expands as it absorbs heat
- Ice melt: melting glaciers and ice sheets increase freshwater runoff into oceans

Greenhouse gases trap heat in our atmosphere resulting in rising ocean temperatures. Sources of greenhouse gases include the use of fossil fuels such as coal, oil, and natural gas to power our societies, which releases carbon dioxide and methane into the atmosphere; methane sources also include emissions from landfills and agriculture.



Since 1897, sea level has risen nearly 8 inches at San Francisco Maritime National Historical Park based on data from the San Francisco, CA tide gauge (operated by the National Oceanic and Atmospheric Administration; NOAA). Sea level could rise by as much as 5.71 feet by 2100.

What is the future of sea level rise at San Francisco Maritime?

NOAA Projections ¹	2050	2100
Intermediate Low	+0.72 ft	+1.57 ft
Intermediate	+1.18 ft	+3.41 ft
Intermediate High	+1.67 ft	+5.71 ft

This table shows projected sea level heights at the park compared to today's mean sea level. These projections were developed by NOAA in 2022 based on different climate change scenarios. Projections are a way of visualizing a range of possible futures. They can aid in park planning by helping managers determine which resources are most threatened by sea level rise.



From left to right, these images show the park with its current water level, with 2 feet of sea level rise, and with 6 feet of sea level rise.



How is sea level rise impacting San Francisco Maritime?

San Francisco Maritime National Historical Park is located at the edge of San Francisco Bay and features a fleet of historic ships, five of which are registered as National Historic Landmarks. The park also provides a place of recreation for visitors, including the Aquatic Park Municipal Pier, Cove beach, and Promenade. Challenges related to sea level rise and increased storm wave heights, such as frequent flooding and damage to infrastructure, can negatively impact these historic places and lead to fewer opportunities for recreation and visitor access.

- The park is already experiencing substantial damage to several of their National Historic Landmark ships, like the 1890 steam ferry boat Eureka on the right. Damage is often a result of king tides, exceptionally high tides occurring during new or full moons, that occur at the park annually during the winter months. These events usually result in restricted visitor access to some of the National Historic Landmark ships. With higher average sea levels, king tides will be even higher than normal and will likely begin to cause greater damage.
- The Municipal Pier is the first true barrier between the bay and the developed city, acting as a breakwater to waves in the bay and creating a calm cove behind it. It is also one of the most popular visitor locations at the park. However, intensifying storms combined with sea level rise have already caused structural damage to the pier. It will likely need to be completely replaced in the future or otherwise permanently closed.
- The Promenade at Aquatic Park Cove beach is another area of the park that is threatened by rising seas. This area often floods during storm events. When storm events combine with high tides, waves have swept up to the edge of the Promenade's Bathhouse, which is a National Historic Landmark. With higher average sea levels, storm events could mean that waves will start to directly hit the Bathhouse. A new barrier or other protective measures may need to be established in place of the current bulkhead on the Promenade to tolerate rougher conditions.



Damage to Eureka's deck caused by storm swells [NPS].



Municipal Pier has been damaged by storms [NPS].



Pier 14 in San Francisco floods during a king tide event in 2011. These flooding events will only become more common and more severe as sea levels continue to rise [USGS].

What can you do to help?

- Reduce your carbon footprint: power down electronics or reduce your thermostat. Go to carbonfootprint.com to calculate your carbon footprint and find ways to make changes.
- Volunteer with organizations working to protect coastal habitats that provide natural defenses against sea level rise.
- Support climate mitigation and adaptation policies. Contact your representatives in Congress to let them know you care.
- Visit coastal areas and support the parks and communities that are taking actions to prepare for sea level rise.

Additional Resources

1. <https://coast.noaa.gov/slr/>: A NOAA SLR viewer tool to access local sea level rise projections at tide gauges and visualize sea level rise scenarios (20 17).
2. <https://tidesandcurrents.noaa.gov/>: Access water levels, tide predictions, and other conditions along coasts.
3. [NOAA Coastal Flood Exposure Mapper](#): A tool to visualize coastal hazards as well as societal, infrastructure, and ecosystems exposure to those hazards

Note: The sea level rise projections, storm surge projections, and other information presented here are for general educational and awareness purposes only. They should not be used for site-specific analysis, navigation, permitting, or legally binding activities.