FACTSHEET:

SEA LEVEL RISE

Climate change is causing the rapid acceleration of sea level rise. The rate of sea level rise in the last century was higher than in the past 3,000 years, with the most dramatic increases beginning in 1970, due to burning fossil fuels. The current scale of human emissions will have long-lasting effects on global sea level for centuries. Even with immediate and dramatic reductions in greenhouse gas emissions, global sea level is still projected to rise 0.9 to 1.6 feet by 2100.

In the United States, relative sea levels are rising much faster than the global average. From 1920 to 2020, sea levels along the U.S. coast have risen about 11 inches, compared to the global mean sea level rise of 6.7 inches. The U.S. is projected to experience as much sea level rise in the next 30 years, as it has in the last 100 years—an increase of 10 to 12 inches on average, with even greater increases along the Gulf and Atlantic coasts. Under the highest emissions scenario, the U.S. could see 3.5 to 7 feet of sea level rise by 2100, relative to 2020 levels.

WHAT IS SEA LEVEL RISE?

GLOBAL MEAN SEA LEVEL RISE

Global mean sea level (GMSL) rise is the change in the average height of the ocean's surface, relative to the Earth's center. Increases in GMSL are caused by changes in the ocean's volume, which are primarily caused by:

- **Melting glaciers and ice sheets:** As the atmosphere above (and the water below) heats up due to global warming, glaciers and ice sheets melt, adding water mass to the ocean.
- **Thermal expansion:** Over 90% of the heat trapped by greenhouse gasses is absorbed by the ocean. As the ocean absorbs heat, it expands and contributes to sea level rise.
- **Land water storage:** Dams and reservoirs can lower global sea level by storing water, while human activity (such as deforestation) reduces the water-holding capacity of lakes, rivers, and wetlands, driving more water into the ocean.

RELATIVE SEA LEVEL RISE

Relative sea level (RSL) rise measures rising seas relative to a particular land mass. Some factors that influence regional and local differences in RSL include:

- **Changes in land height (vertical land motion):** Fossil fuel extraction, groundwater withdrawals, development, and other non-climatic forces cause land to rise, sink, or erode.
- **Changes in ocean dynamics (sterodynamic changes):** Global warming impacts the ocean's circulation (currents) and density (salinity and temperature), causing regional differences in sea level rise.
- **Changes in Earth's gravity, rotation, and deformation (GRD):** Movements of the Earth's crust, changes in the Earth's rotation, and loss of land-based ice mass from melting glaciers and ice sheets affects the distribution of water across the ocean.

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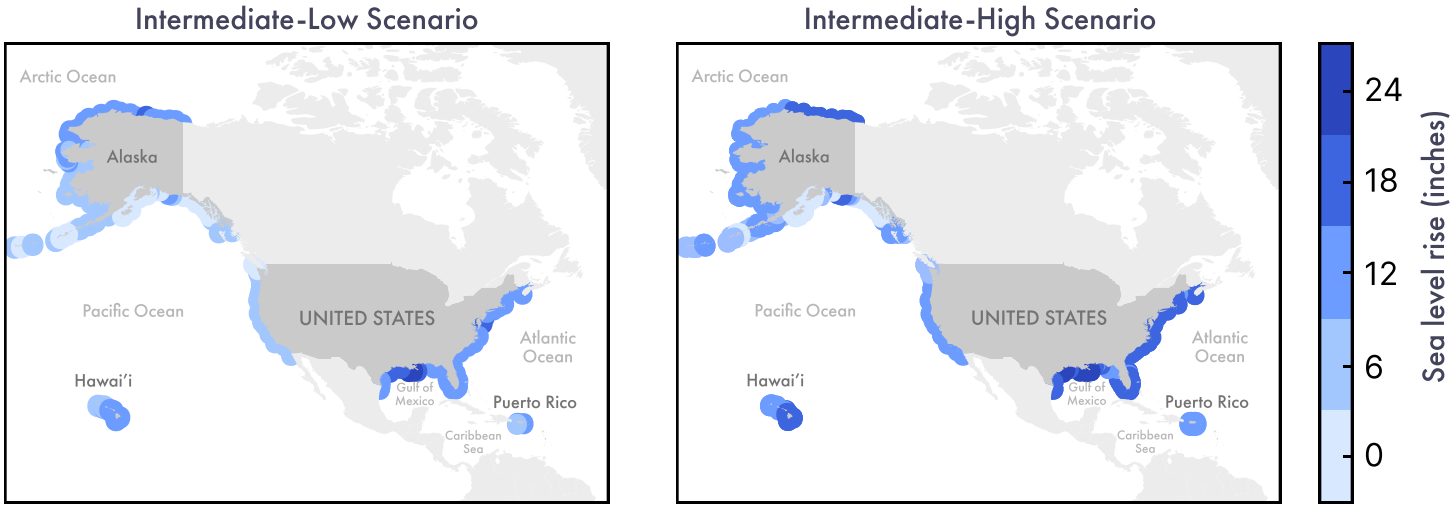
Sea level rise is not uniform, making some locations and populations more vulnerable to rising seas. By 2050, regional differences in sea level rise projections for coastal areas of the U.S. will be 4 to 8 inches for the West Coast, 6 to 8 inches for the Hawaiian Islands, 8 to10 inches for northern Alaska, 8 to 10 inches for the Caribbean, 10 to 14 inches for the East Coast, and 14 to 18 inches for the Gulf Coast. Relative sea level rise is most useful for location-specific estimates and is more often used in local decision-making and adaptation planning.

Figure 1: Regional variations in sea levels across the U.S. estimated for 2050



Assumes that global sea level rises an average of 1.6 feet by 2100

Assumes that global sea level rises an average of 4.9 feet by 2100

Source: NOAA 2022 Sea Level Rise Technical Report

Due to uncertainties in emissions and natural processes, estimates for future sea levels are based on a range of possible outcomes. Estimates for future sea levels along the coastal U.S. are based on five scenarios for global mean sea level in the year 2100 (ranging from low to high). However, if sea levels continue to rise at their current rate over the next thirty years, most regions in the United States can expect sea levels to fall within the intermediate-low to intermediate-high range by 2050. Estimates provided are relative to sea levels in the year 2000.

WHY DOES THIS MATTER?

Sea level rise has serious and often disastrous implications for coastal communities, ecosystems, and infrastructure. Even small increases in sea level can amplify other coastal hazards. In the U.S., 1 foot of sea level rise could make moderate floods[1] 10 times more frequent, and severe floods 5 times more frequent. Sea level rise can also cause floods and high tides to reach further inland, converting land to open water and expanding the reach of hurricanes and storms.

[1] Moderate floods cause damage to areas that are about 2.75 to 3 feet above average high tide. In comparison, minor floods are disruptive to about 1.75 to 2.23 feet above average high tide, and major floods are destructive to about 4 feet above average high tide.

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IT AFFECTS MILLIONS OF PEOPLE IN THE U.S.

Globally, 1 billion people live less than 33 feet above current high tide lines, and 230 million within 3 feet. This means 12.5% of the global population could face moderate to severe sea level rise impacts in the near future.[2] In the U.S., nearly 40% of the population (128 million people) lives along the coast, and 20% (65 million people) in coastal cities. In 2020, about 240,000 people lived below the high tide mark, directly exposing them to the impacts of sea level rise. By 2100, up to 1.2 million people are projected to live below the hide tide mark, and up to 13.1 million people could be displaced by sea level rise. Additionally, sea level rise threatens human health as coastal flooding increases the risk of drinking water contamination and wastewater infrastructure failure, exposing coastal communities and ecosystems to pathogens and harmful chemicals. At 6 feet of sea level rise, an estimated 31 million people in the U.S. could lose access to wastewater services.

IT IS A CLIMATE JUSTICE ISSUE.

In the U.S., 60% of coastal city residents identify as BIPOC, compared to the national average of 37%, and the effects of sea level rise are disproportionately borne by low-income populations and people of color. Because of a legacy of discriminatory housing and economic policies, such as "redlining", these populations often face greater risks and live in low-lying, flood-prone coastal areas. Nationally, nearly two-thirds of the population living in formerly redlined neighborhoods (generally concentrated in urban areas) are people of color, and three-quarters have low-to-moderate household incomes. The value of homes at high risk of flooding is 25% greater in previously redlined neighborhoods than in non-redlined areas. By 2050, the number of affordable housing units exposed to coastal flooding is expected to triple.

IT THREATENS COASTAL ECOSYSTEMS.

Coastal ecosystems provide natural shoreline protection, enhance food security, and support coastal economies, all while absorbing tons of carbon. To adapt to rising seas, coastal ecosystems need to migrate inland but are blocked by development—a phenomenon known as "coastal squeeze"—and are degraded and destroyed. Following a 2023 U.S. Supreme Court ruling, nearly half of the nation's wetlands could lose protection under the Clean Water Act. Without adequate protection, the U.S. could lose 97% of its coastal wetlands to sea level rise and development by 2100. Sea level rise also exacerbates coastal erosion and saltwater intrusion, threatening ecosystem health and biodiversity. As coastal wetlands are permanently submerged, they lose their ability to store carbon and protect shorelines.

IT HAS A MASSIVE PRICE TAG.

In the U.S., over $1 trillion worth of real estate is located within 700 feet of the coast, and over 60,000 miles of roads and bridges are located in coastal floodplains. In the next 30 years, nearly 4.4 million acres of land in the U.S. (an area roughly the size of Connecticut) and $35 billion of real estate could be submerged. Sea level rise alone can negatively impact municipal budgets by both reducing property values and increasing costs for recovery and adaptation. Sea level rise also amplifies the damage of hurricanes and storms. During Hurricane Sandy in 2012, an additional 71,000 people were impacted by flooding as a result of sea level rise, causing $8.1 billion of damages (nearly 13% of total damages). Sea level rise also deteriorates coastal infrastructure through frequent inundation and exposure to corrosive saltwater.

[2] Using a global population estimate of 8 billion.

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WHAT CAN WE DO?

IMMEDIATELY REDUCE GREENHOUSE GAS EMISSIONS.

Sea level rise projections vary dramatically depending on future emissions scenarios. By 2100, global sea level could rise up to 2 feet (under a low emissions scenario) and up to 3.6 feet (under a high emissions scenario). If global temperatures reach 2 to 3 degrees celsius by 2100, global sea level could rise up to 33 feet over the next 2,000 years. To avoid catastrophic sea level rise and keep global warming below 2 degrees celsius by 2100, human-induced greenhouse gas emissions need to be halved by the end of the decade and completely eliminated by 2050.

CENTER EQUITY IN ADAPTATION.

Flood adaptation, like seawalls, home elevations, and home buyouts, have long favored wealthier and whiter neighborhoods, widening existing racial-wealth gaps in the U.S. We need to avoid "colorblind" adaptation planning, which ignores the ways in which structural inequality affects coastal communities. Instead, we must acknowledge and address the historical patterns that make people of color in coastal communities more vulnerable to the effects of sea level rise.

PRIORITIZE NATURE-BASED SOLUTIONS.

Protect and restore coastal ecosystems, which act as natural buffers to the impacts of storms. They reduce wave energy, absorb floodwaters, and prevent shoreline erosion, and often offer better coastal protection than hard structures, like seawalls, and are significantly less expensive. Coastal ecosystems can also sequester several times more carbon per acre than tropical forests. The White House recognized the importance of nature-based solutions for coastal ecosystems, and Congress has allocated over $4 billion ($2.6 billion through the Inflation Reduction Act and $1.5 billion through the Climate Ready Coasts Initiative) specifically for coastal communities to implement nature-based solutions and better protect coastal ecosystems.

THINK BEFORE WE (RE)BUILD.

Across the U.S., coastal areas are seeing the highest rates of population growth and development, resulting in the (re)construction and densification in risky waterfront areas that have been repeatedly damaged. Sea level rise mitigation can only go so far. In some places, it may not make sense to (re)build and climate-driven relocation may be unavoidable. Local governments can prevent development in high-risk areas, through climate-smart zoning and land-use planning. In addition, several federal agencies, such as the Federal Emergency Management Agency, offer some resources to coastal communities seeking to relocate. In 2022, the White House allocated $115 million for 11 Indigenous communities to relocate in response to climate impacts.

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