

Global warming basics for the Bay Area –for 2021-2 King Tides walks

Background on Albany Bulb and local history at [Love the Bulb's Monument to Extraction](#)

What is global warming? Since the late 19th Century, Earth's surface temperature has risen about 2 ° F (1.2° C), with rates increasing. Evidence is overwhelming that this is due to human activities that increase the atmosphere's content of greenhouse gases – mainly carbon dioxide but also others including methane and nitrous oxide. These gases reflect infrared energy back to the earth, essentially forming a heat-trapping blanket.

This warming climate is undermining earth's systems in many ways, including melting glaciers and ice caps; loss of snow cover; changing patterns of rainfall, storms, and drought; sea-level rise due to both melting ice and expansion of warming sea water; and increasingly acidic ocean waters as the seas absorb more carbon dioxide.

What does global warming mean for the Bay Area? For the Bay Area, likely effects include stronger storms, longer and more extreme hot spells and droughts, more and fiercer wildfires, less fog (though trends in rainfall are uncertain), uncertain water supplies due to lessened and earlier snowmelt, and change and loss in plant and animal communities. As offshore waters become more acidic, marine animals from microscopic floating creatures to corals, clams, oysters, and crabs find it harder to form shells. Most of these are occurring now.

Economic and public-health effects could range from dangerous heat waves and new epidemics; through decline of agriculture ; to destruction of infrastructure and natural areas by storms, fire, and especially because transportation, utilities, and industry are clustered along shorelines. Low-income communities are particularly likely to suffer effects from job loss to flooding of low-lying neighborhoods, air pollution, and lack of cooling.

The Bay Area's most visible effects may come from sea-level rise. After rising about 8" since 1880, Bay Area sea level is expected to rise another ½ to 2-3 ft. by 2050 and 2 to 6-7 feet by 2100 (or up to 10 feet if the Greenland and Antarctic Ice Sheets melt quickly). See "Resources" below for online mapping projects that let you explore likely flooding under different conditions. (These are not perfect; they generally miss inland flooding along tidal channels and in low-lying neighborhoods.) San Francisco and Oakland airports, the Bay Bridge toll plaza, San Francisco's Ferry Building, Highway 37 across the North Bay are just a few landmarks likely to flood regularly without costly measures. Thousands more homes and businesses are in similar situations. Rising seas also can flood wetlands vital to wildlife, carbon storage, and protecting inland areas.

Oceans do not just rise quietly, like a filling bathtub. Most damage comes when high tides, storms, large waves, and heavy freshwater runoff coincide, accelerating erosion. Rising sea level can make these worse: Waves become more powerful as they move across longer stretches of deeper water. Coastal marshes that tamp down waves are drowned. A 2019 study by US Geological Survey researchers estimated that these factors could about triple damage done by rising seas alone. Aside from beaches washing away, bluffs collapsing, and loss of many of our loveliest natural areas, coastal erosion could release pollutants buried in dozens of old landfills and capped industrial sites along the Bay shore. A [recent UC Berkeley study covering only likely surface flooding documented dozens of low-lying hazardous-materials sites in the Bay Area](#) likely to flood regularly by 2100. Rising groundwater tables, salt infiltrating inland, and erosion will bring other problems.

To protect the people and places we love from challenges faced by sea-level rise, we will need some mix of all of the following:

- **Slow climate change by reducing emissions of greenhouse gases:** We can generate energy with sun, wind, tides, or other methods that produce little or no greenhouse gases. We can use low-emissions transportation and build to reduce transportation needs. We can improve energy efficiency of buildings, industry, and farming. We can reduce waste, avoiding both energy-wasting overproduction and methane emissions from burial in landfills. We can increase carbon storage (sequestration), in soil and plants or as-

yet-undeveloped engineered methods. We can take political action, for example with regulations, a carbon tax, or cap-and-trade programs. Significant effects will require collective action.

- ***Harden and build higher and drier:*** We can build, raise, or strengthen levees. We can build dams, gates, or locks to control tidal flows. We can strengthen bridges, docks, and seawalls against higher waves and storm surge, and strengthen and protect tunnels and pipes that are below high-tide levels. We can elevate building pads or other surfaces. This will cost billions and require unprecedented cooperation. In just one example, seawalls or levees in one place increase flooding elsewhere.
- ***Accommodate:*** We can build floating buildings, docks, and bridges. We can build to accommodate floods, from building on piers to using ponds and permeable surfaces to manage floodwaters. This likely means that some roads, parks, etc. would be temporarily inaccessible.
- ***Maintain and increase tidal marshes and “living shorelines”*** that can absorb waves and surges. Coastal wetlands, such as salt marshes, also can capture and store carbon. We can provide corridors or move plants and animals deliberately to areas where they can survive. These efforts can ease or delay problems but cannot solve them.
- ***Move:*** We can move houses, roads, and critical infrastructure such as pipelines, railroads, and airports away from the Bay shore, low-lying areas that can flood, and areas that have subsided below sea level (mainly in the South Bay and Delta). History suggests that people will resist relocation.

You can join in actions that will protect us:

- ***Reduce your carbon footprint – the amount of greenhouse-gas emissions you cause.*** You can estimate your household’s greenhouse-gas emissions and get ideas on reducing them with carbon-footprint calculators like those listed under Resources, below. Many actions can help – including what you eat, how you garden, what and how much you buy, and how you deal with waste. For most households, the biggest effects are likely to come from housing and transportation. Possibilities include dense housing; good insulation and energy-efficient appliances; switching to electricity, green energy providers and/or solar power or heat pumps; and traveling by electric vehicle, transit, cycling, and walking. Changes by individuals add up – but they will not solve the problem.
- ***Support candidates, laws, policies, plans, and funding that deal realistically with global warming.*** Most of the burden of dealing with sea-level rise is being left to local jurisdictions. Effective action will almost certainly require unprecedented regional cooperation, difficult tradeoffs, and large new funding sources. Cities’ required climate plans and your city’s Sustainability Committee/Commission can offer ways to get involved locally. You can support city and county actions such as increasing housing density, adopting energy-saving building codes, reducing waste, and using green energy. You can learn about, support, or seek to influence decisions on how federal, state, and local infrastructure dollars are raised and spent, as well as state laws and programs such as cap-and-trade.
- ***Support and volunteer with nonprofits.*** Nonprofit organizations many ways to contribute to joint action. Work ranges from public education and hands-on efforts like planting trees, through research and political and legal action. Berkeley’s Ecology Center maintains a list of volunteer opportunities.

Recent resources, upcoming events:

- Maps that let you explore likely effects of sea-level rise are [here](#), [here](#), or [here](#).
- Two of many carbon-footprint calculators come from [Nature Conservancy](#) or [UC Berkeley](#). Many other apps are available, like this one on [how to store more carbon and reduce emissions in landscaping](#).
- [Adapting to Rising Tides](#) is a regional planning effort led by the Bay Conservation and Development Commission. [Their 2020 report is here.](#) [Bridging the Gap](#) is their fall 2021 estimates of likely costs of sea-level rise and possible funding sources. Their strategy for dealing with effects of sea-level rise, [Bay Adapt](#), is expected to be adopted in 2022.
- Greenbelt Alliance, Save the Bay, and Richmond Land have produced a [Resilience Playbook](#) listing actions, possible policies, and a “toolkit” for carrying them out.