Sea Level Rise and Coastal Flooding

Sea level is rising at an increasing rate. In Southwest Harbor, just a few more inches of water can result in impacts to roads, homes and critical services.

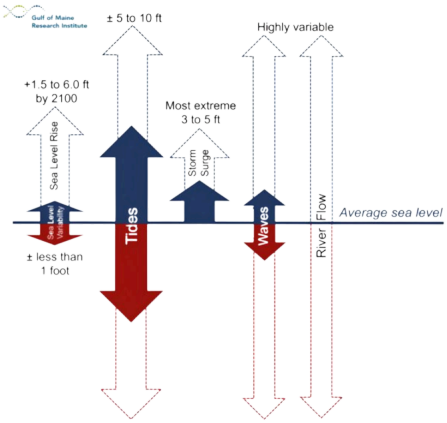
What Causes Coastal Flooding?

Sea Level Rise
Long term increase in ocean height from atmospheric warming and melting ice.

Tides
Particularly high tides can even cause "sunny-day" flooding.

Storm Surge
Wind-driven water during storms increases tidal height, resulting in a storm tide.

Waves
Can be especially damaging along open coastlines like Seawall Road.



Local Impact: Roads at Risk

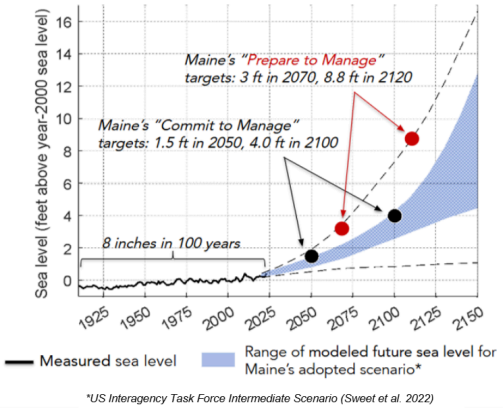
When roads are flooded or damaged some residents may be cut off from, or need to allow for increased driving time to, emergency and essential services.

Several roads in Southwest Harbor already experience flooding during high tides and storms:

- **Route 102A (Seawall Road):** Highly exposed to wave damage.
- **Shore Road & Meadow Lane:** Low-lying and likely to flood more often.
- **Bass Harbor Road:** Expected to flood regularly by 2050.

What's Changing?

Sea level has risen approximately **8 inches along Maine's coast in the last 100 years.** The rate of that rise has nearly doubled in the past two decades, and is expected to increase. Sea level is projected to rise between **0.9 – 1.2ft** in Southwest Harbor between 2025 and 2050, and between **3.3 – 5.5 ft** by 2100. Even just a few inches of sea level rise can result in increased and more widespread coastal flooding.



*US Interagency Task Force Intermediate Scenario (Sweet et al. 2022)

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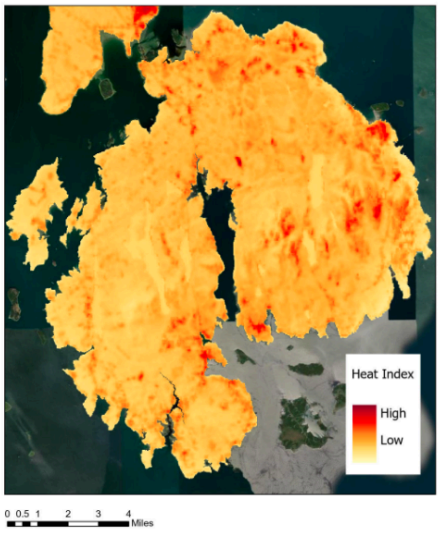
Temperature

Temperature influences all aspects of life in Southwest Harbor: from human health to ecosystem vitality to tourism. Rising temperatures are already altering seasonal rhythms, growing seasons, and energy usage throughout the town.

Temperature Trends

	Historical Average (1961 – 1990)	Mid-Century	End of Century
Annual Average Maximum Daily Temperature	53.6°F	58.4 – 59.8°F	59.8 – 64.6°F
Days Per Year Above 90°F	1.5 days	8.4 – 13 days	12.8 – 38.2 days

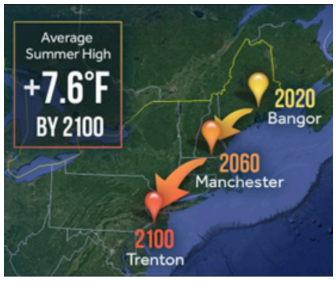
- **Winters are becoming shorter and milder**, with more freeze-thaw cycles and precipitation falling more as rain rather than snow.
- Increasing frequency and duration of heat waves.
- More developed areas with limited tree cover experience greater temperature fluctuations. In Southwest Harbor, this includes the downtown area, especially along Main Street and Clark Point Road.



Variations from the mean land surface temperature throughout Mount Desert Island.

Consequences of Warming

- Tourism, fishing, and agriculture industries as well as wintertime recreation may experience disruptions due to **extreme heat and overall warming trends.**
- National Parks, including Acadia, may see higher annual visitation, benefiting the local economy but putting pressure on housing, transportation, and park services.
- **Longer and warmer growing seasons may increase negative impacts to crops** through heat stress, drought risk, and exposure to pests and disease.



Graphic from Climate Central's "Shifting U.S. Cities" analysis, illustrating that summertime temperatures in Bangor will feel like Manchester, NH in 2060 and Trenton, NJ in 2100 under a high emissions scenario.

Local Impact: Heat Stress

Extreme heat poses significant risks to sensitive populations, including adults over 65, children under 5, and people with preexisting health conditions. In 2019, Hancock County had the highest percentage of adults living in homes without air conditioning in Maine, increasing vulnerability to heat exposure.

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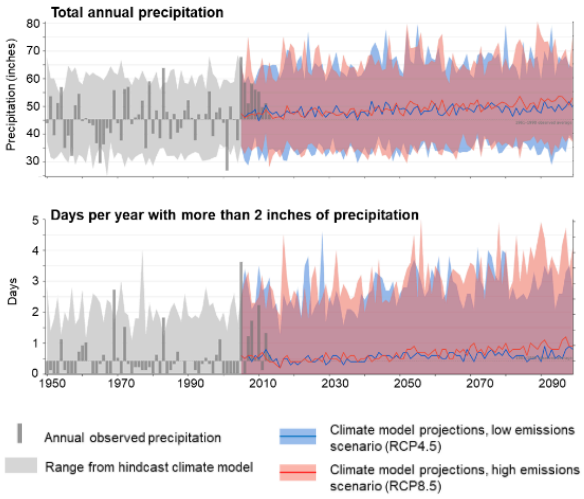
Precipitation

Southwest Harbor is experiencing heavier and more frequent precipitation events, which place residents at risk of degraded drinking water and exposure to extreme storms.

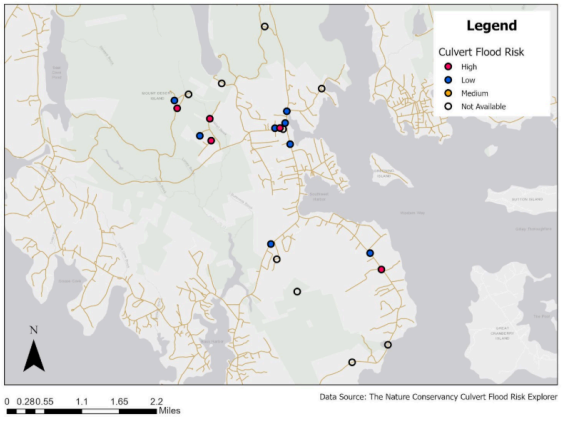
What's Changing?

- Rainfall is expected to become more variable, with increased risk of both droughts and episodes of prolonged or extreme precipitation. The overall trend, though, points toward **warmer and wetter conditions.**
- By mid-century, Mount Desert Island's annual precipitation is projected to grow from the historical average of 45 in/yr to 48.5 – 50 in/yr and by the end of the century, to 50 – 52.5 in/yr.
- Extreme precipitation is often defined as days with over 2" of rain. Historically on MDI, this has occurred about once every two years, but by century's end it could increase up to 3–4 days per year under a low-emissions scenario.
- With fewer days below freezing, **more precipitation will fall in forms other than snow**, such as sleet, freezing rain, or rain.



Variation in historical precipitation (1950-2013) and projected precipitation from climate models (2006-2100) for Hancock County.

Local Impact: Culverts and Flooding



Location of culverts in Southwest Harbor, colored by flood risk.

- **Heavy rainfall can trigger flash flooding** along streams, creeks and critical roadways, complicate wastewater treatment, and perpetuate erosion.
- To perform effectively, culverts must be appropriately sized and maintained. **Several culverts throughout Southwest Harbor are at high risk of flooding (see left).**

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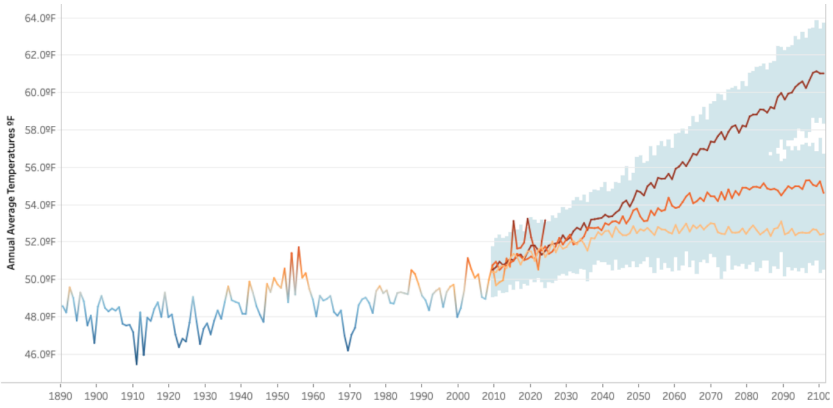
Marine Conditions in the Gulf of Maine

The Gulf of Maine is vital to Southwest Harbor's identity, economy, and environment. Warming waters, acidification, and shifting species present both challenges and opportunities for fisheries, tourism, and coastal ecosystems.

Ocean Temperature

- The Gulf of Maine is warming at a rate nearly **3.5 times faster** than the global ocean average.
- Historically, annual average surface ocean temperatures in the midcoast hovered around 46°F, but over the past decade they have remained closer to 49°F.
- By the end of the century, Gulf of Maine surface temperatures are projected to reach 52.5 – 61°F, depending on the level of greenhouse gas emissions released over the coming decades.



Observed (1890-2021) and projected (2010-2100) annual average sea surface temperature for the Gulf of Maine. Source: Maine Climate Impact Dashboard.

Local Impact: Marine Species

- Globally averaged surface ocean pH has **declined by 30%** since the late 19th century, increasing ocean acidity. Ocean acidification inhibits the growth and development of shellfish, corals, and plankton, with implications for the wider food web.
- Marine temperature increases have already begun causing the traditionally sub-arctic ecosystem to adopt more temperate characteristics, favoring a **new distribution of marine species.**
- About half of the Northeast's commercial finfish and shellfish species (including cod and American lobster) are **highly sensitive to climate change;** future warming may push them into new regions and reduce their availability to local fisheries.
- **Reductions in herring, cod, and *Calanus finmarchicus*** (a large zooplankton species at the heart of North Atlantic food webs) have been observed in recent years.
- Warmer water species, such as longfin squid, silver hake, black sea bass, and blue crab, have been more frequently observed in the region and **could represent new commercially valuable fisheries** depending upon future fishing regulations and market demands.

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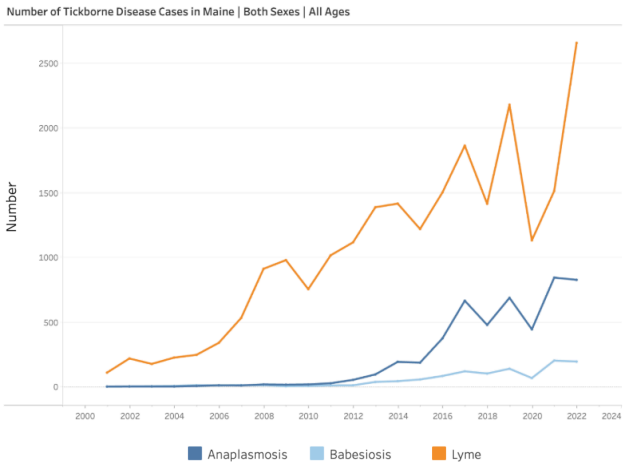
Tick-Borne Diseases

Since 2001, Maine has witnessed a steady increase in the incidence of tick-borne diseases, with Lyme disease being the most prevalent. In communities like Southwest Harbor, prevention, education, and adaptation strategies are essential for community safety.

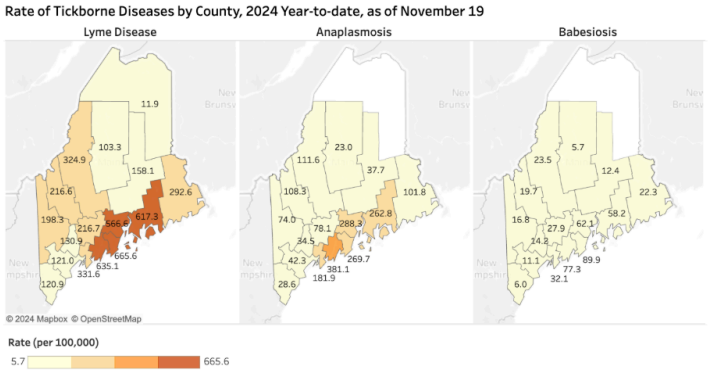
What's Changing?

- Maine consistently ranks among the top five U.S. states for Lyme disease incidence, which is increasing due to climate change.
- **Rising temperatures, with longer growing seasons and warmer winters, extend tick activity**, increasing opportunities for human-tick encounters and allowing more ticks to complete their life cycle, which boosts populations.



Changes in the number of tickborne diseases recorded in Maine over the last 20 years. Source: The Maine Environmental Public Health Tracking Program.

Local Impact: Lyme Disease and Other Illnesses



Rate of tickborne diseases in Maine, summarized by county and disease type. Source: The Maine Environmental Public Health Tracking Program.

- In 2024, **Hancock County stood out as a hotspot for tickborne diseases in Maine**, with an average Lyme disease incidence rate of 617 per 100,000 people.
- In recent years, Lyme disease in Maine has risen disproportionately among the elderly (65+) and children aged 5-14.
- The rising prevalence of tick-borne illnesses places **added pressure on healthcare providers**.
- There is a heightened need for awareness and education, especially among tourists who may be unfamiliar with tick-prevention strategies.

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Drinking Water Supply

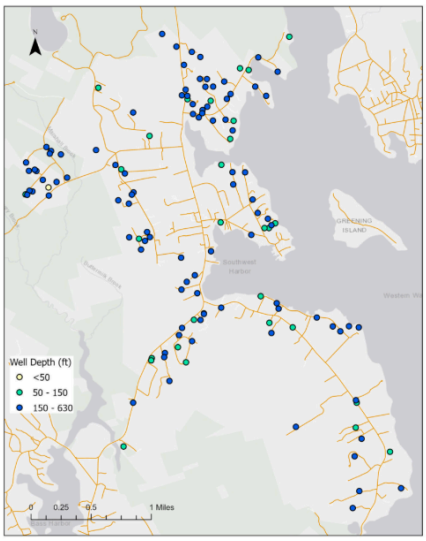
Sea level rise and changing precipitation threaten Southwest Harbor's drinking water, with risks varying depending on whether households rely on wells or surface sources.

Concerns for Surface Sources

- About **¾ of Southwest Harbor households** get their water from the Southwest Harbor Water and Sewer District, which primarily draws from Long Pond and processes water at a filtration plant. As of a 2023 Consumer Confidence report, all monitored contaminants in Southwest Harbor's drinking supply were **well within regulatory limits.**
- Climate-driven **flooding and freezing can damage infrastructure or overwhelm systems with contaminants**, while power outages and hazardous conditions can further disrupt water supply operations and maintenance.
- **Rising temperatures drive a higher water demand** for irrigation, cooling, and other uses, placing additional strain on supply systems, especially during the summer months when Mount Desert Island experiences a seasonal population surge.

Concerns for Well Water

- About **¼ of Southwest Harbor households** get their water from private wells or small community well systems.
- **Climate-driven heavy rain events increase stormwater runoff**, which can carry pollutants, bacteria, and septic effluent into water sources. This will impact both surface and well water, but private wells which may not undergo treatment are of primary concern.
- Wells are **vulnerable to droughts**, which can lower the water table and concentrate existing contaminants.
- **Saltwater intrusion** occurs when rising seas push saltwater into underground or surface freshwater supplies, reducing water quality. Deeper wells aren't automatically more vulnerable to saltwater intrusion; vulnerability depends on factors like aquifer type, proximity to saltwater, and pumping rates. Monitoring the deepest coastal wells, however, can provide an early warning of saltwater intrusion.



Location and depth of wells in Southwest Harbor.

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Wildfires

Though uncommon in coastal Maine, wildfires like the 2024 St. Sauveur fire near Southwest Harbor show how quickly they can spread and threaten people, property, and air quality.

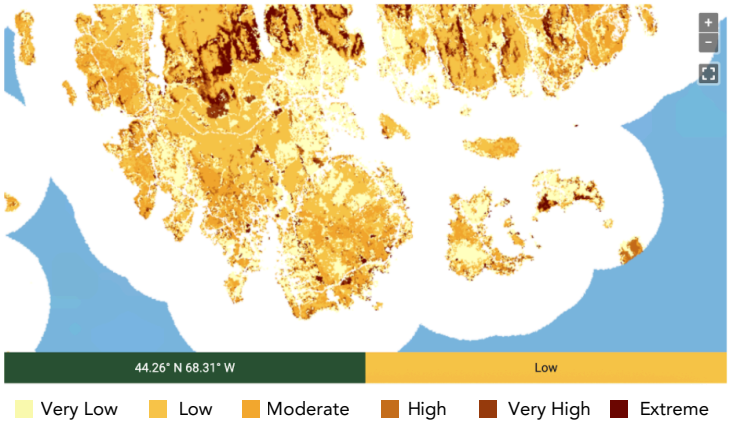
Causes and Consequences

Precipitation levels + Temperature + Dryness + Timing of these factors = Wildfire Risk

- Wildfires are relatively rare in coastal Maine due to the wet climate limiting available fuel. **Thus, the unpredictability of when wildfires may occur make them difficult to plan for**. Southwest Harbor's natural and built environment is not fire-adapted so, when wildfires do happen, they can have immense negative impacts on the community.
- Hancock County has a **low to moderate burn probability**, according to the Northeast-Midwest Wildfire Risk Assessment Portal, a pattern expected to persist in the coming decades, though increasing summer droughts may raise the risk.
- Wildfire risk only becomes a threat when there's an ignition source, such as lightning, downed power lines, or most commonly, human negligence. **Reducing risk requires proper outdoor stewardship** through signage, education, safe disposal of flammable materials, property management such as preventing overgrowth, and municipal ordinances or services like yard waste management.
- Wildfires threaten **human safety, infrastructure, and wildlife habitat,** and their smoke contains particulates that **reduce air quality** and increase outdoor health risks, especially for the elderly, young children, and those with respiratory conditions.

Reducing Risk

- Acadia National Park poses the highest wildfire risk to nearby communities due to dense forests and dry vegetation buildup. As such, its **Fire Management Program** proactively addresses this risk through prescribed burns, mechanical clearing, and coordination with local fire departments.
- In 2023, Maine Forest Rangers conducted **wildfire home risk assessments** in Southwest Harbor.
- When needed, Southwest Harbor's **volunteer fire department** collaborates with other island fire services, including Tremont, Mount Desert, and Bar Harbor through mutual aid agreements.



Wildfire Risk in Southwest Harbor. Source: Northeast-Midwest Wildfire Risk Explorer.

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Vulnerable Populations

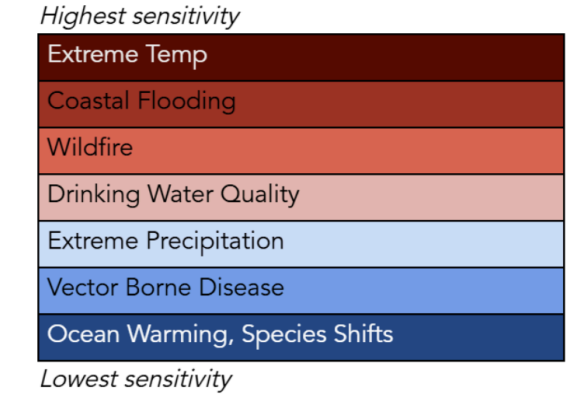
Climate change impacts will not be felt equally. In Southwest Harbor, social, economic, and demographic factors can heighten some people's exposure and sensitivity to climate hazards and their impacts.

Some populations such as children under five, adults over 65, and people with disabilities are physiologically sensitive to climate-related stressors. These sensitivities can be compounded by systemic factors like income inequality, housing instability, and limited access to healthcare or transportation, which together create heightened vulnerability by making it harder for people to prepare for, respond to, and recover from climate impacts.

	Extreme Temperature (Percent)	Vector Borne Disease (Percent)	Drinking Water Quality (Percent)	Wildfire (Percent)	Coastal Flooding (Percent)	Extreme Precipitation (Percent)	Ocean Warming (Percent)	Species Shifts (Percent)
Disability	229 (14.2%)		229 (14.2%)	229 (14.2%)	229 (14.2%)			
Over 65	500 (31.0%)		500 (31.0%)	500 (31.0%)	500 (31.0%)			
Individuals doing poorly or struggling	425 (26.3%)		425 (26.3%)	425 (26.3%)	425 (26.3%)	425 (26.3%)		
Natural Resources Sector	35 (2.2%)	35 (2.2%)		35 (2.2%)	35 (2.2%)	35 (2.2%)	35 (2.2%)	35 (2.2%)
Children under 5	66 (4.1%)	66 (4.1%)	66 (4.1%)	66 (4.1%)				
Renters	286 (17.7%)			286 (17.7%)	286 (17.7%)	286 (17.7%)		
No Vehicle Access	73 (4.5%)				73 (4.5%)			
Total count of instances of vulnerability	*1,614 (100%)*	*101 (6.3%)*	*1,220 (75.6%)*	*1,541 (95.4%)*	*1,548 (95.9%)*	*746 (46.2%)*	*35 (2.2%)*	*35 (2.2%)*

Socio-demographic sensitivity matrix, showing the number of individuals in Southwest Harbor that are sensitive to climate hazards by count and, in parentheses, as a percentage of the total instances of vulnerability. Instances of vulnerability are counted as total identified vulnerabilities in a population. For example, one person who may be over the age of 65 and also has a disability would be counted as two instances of vulnerability.

- In 2022, the total population of adults over 65 in Southwest Harbor was **500, comprising 33.4%** of the town's population. During times of distress or disaster, elderly residents are at risk of becoming isolated from in-home support systems, increasing their reliance on emergency services.
- In 2022, **28.7% of Southwest Harbor's population** had an income-to-poverty ratio under 2.00, categorized as "poor or struggling." Weather-related disasters can have the greatest impact on these households, as they may not be able to afford weather-proofing safeguards and can incur costs from storm damage.



Climate hazards ranked by sensitivity of Southwest Harbor's vulnerable population to those hazards and their impacts.

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