



# Norway Climate Vulnerability Assessment

November 29, 2023



Prepared by Center for an Ecology-Based Economy

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# Executive Summary

## Climate Change in Norway

The town of Norway is experiencing changes in temperature, precipitation, and other local characteristics as a result of human-caused global warming. Since 1895 in Oxford County:

- Annual average temperatures have increased by 3.56°F.
- Average annual precipitation has increased by 5.8 inches due to more rainfall.

These changes are expected to continue over the next century.

- Statewide climate models project another 1°F to 4°F of warming by 2050 and up to 10°F by 2100.
- Annual precipitation in Norway is projected to increase from 2004 levels by 3.15 inches around 2050 and 6.67 inches by 2100.

Climate change leaves Norway more susceptible to challenges such as heat waves, flooding and storm damage, invasive species and other pests, insect-borne disease, and degrading lake water quality. For impacts like drought, wildfires, and ice storms, it is difficult to say whether climate change will increase their likelihood in Norway.

## Climate Vulnerability

When comparing common population-level indicators of climate vulnerability to statewide averages, Norway's community is more vulnerable than the average town in Maine.

- Norway has a higher percentage of children, people over 65, people with disabilities, people without a high school diploma or GED, poverty, unemployment, households without internet, and people living alone (particularly those who are 65 and older).

People who are isolated— either physically and socially— and people who are unhoused or in unstable housing conditions are generally most vulnerable to climate impacts.

Climate change impacts public health, financial stability, and overall wellness in Norway.

- Primary public health challenges include heat-related illness, vector-borne disease and pest impacts, water-borne illness, inability to meet essential health needs, and mental health and wellness decline.
- Financial impacts include increased medical costs, property damage, lost work shifts, burdensome energy costs from increased prices and usage, and food loss from power outages and lower garden productivity.

## Current Policies and Positive Assets

Norway does not have any formal policies explicitly related to climate change, but there are several informal or indirectly related town policies of note, including:

- Participation in Oxford County EMA's hazard mitigation planning process
- Town funding for General Assistance and social service providers
- Town coordination with and funding of Lakes Association of Norway (LAON) to monitor water quality of lakes
- Consistent upsizing of culverts when making road repairs
- MOU with Norway Armory for use as a shelter in emergency scenarios
- Mutual aid agreements with fire departments in the region
- Norway Fire Department strategizing for recruitment of more firefighters
- "Sand bucket" wellness checks on vulnerable households by Norway Police Department
- Plans to use the new police building as a warming and cooling center

There are also several community resources and assets that increase Norway's adaptive capacity, including Stephens Memorial Hospital; social service providers; social, cultural, and religious institutions; environmental organizations; and a "neighbors helping neighbors" culture.

## Recommended Strategies

We provide recommendations across six strategy areas. We encourage you to read the full list on page 18. We recommend that Norway implements policies and programs that:

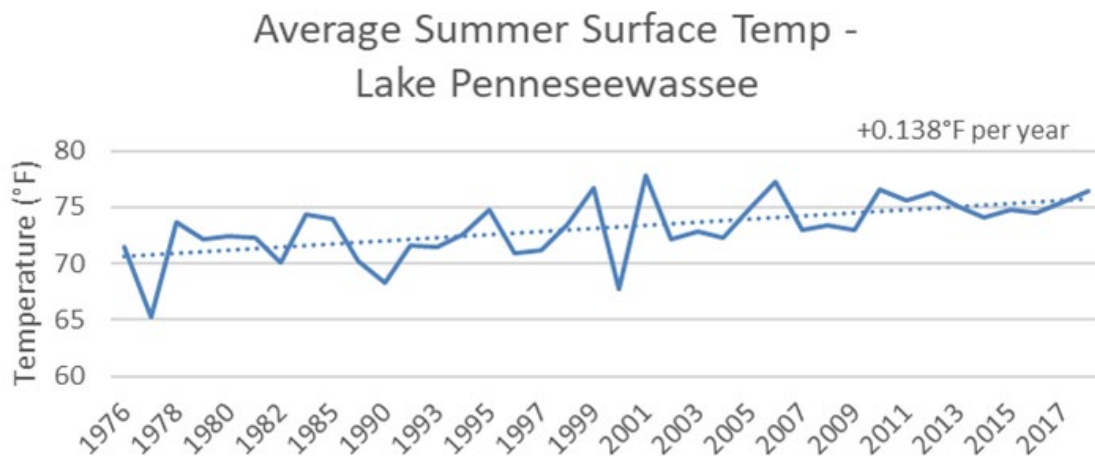
- Formalize the emergency response to climate hazards
- Improve communication and outreach year-round
- Reduce social isolation and disconnection for vulnerable populations
- Engage the community in climate education and preparedness
- Improve local energy independence and resilience
- Update codes and ordinances for resilience

# Climate Change in Norway

## Extreme Temperatures

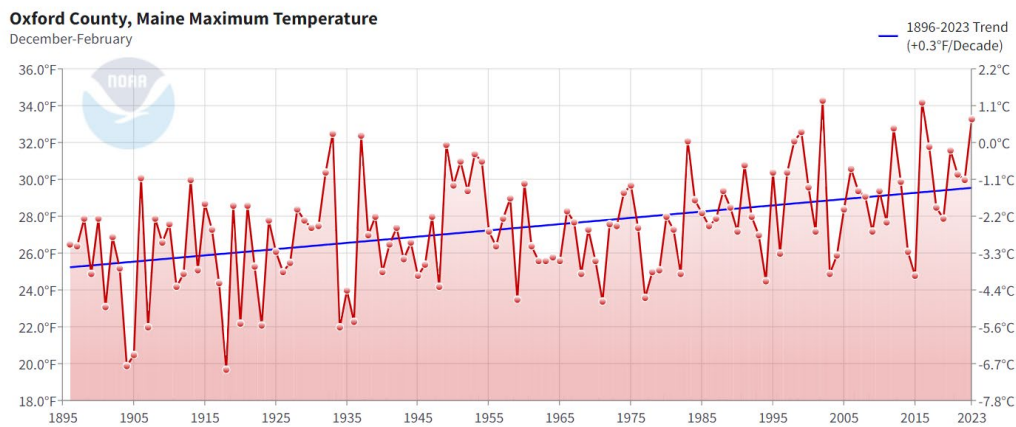
### Temperature Observations

The world is warming, and so is Norway. While local weather data is limited, county and state-wide average observations show significant increases in annual temperatures across Maine. In Oxford County, annual average temperatures have increased by 3.56°F since 1895 (NOAA, 2023). Our lakes are warming as well. In Norway, Lake Pennesseewassee’s summer surface temperature has warmed by 5.8°F since 1976 (Bacon, 2019).



Source: Maine Department of Environmental Protection & Volunteer Lake Monitoring Program

As in the rest of Maine, our county’s nights and winters are warming fastest. Annual night time temperatures have risen 4.57°F. Oxford County winters have warmed a startling 6.02°F– nearly a degree more than the statewide average. In the period from 2016 to 2023, our average peak daytime temperature in winter rose to 31°F (NOAA, 2023).



Source: NOAA U.S. Climate Divisional Database



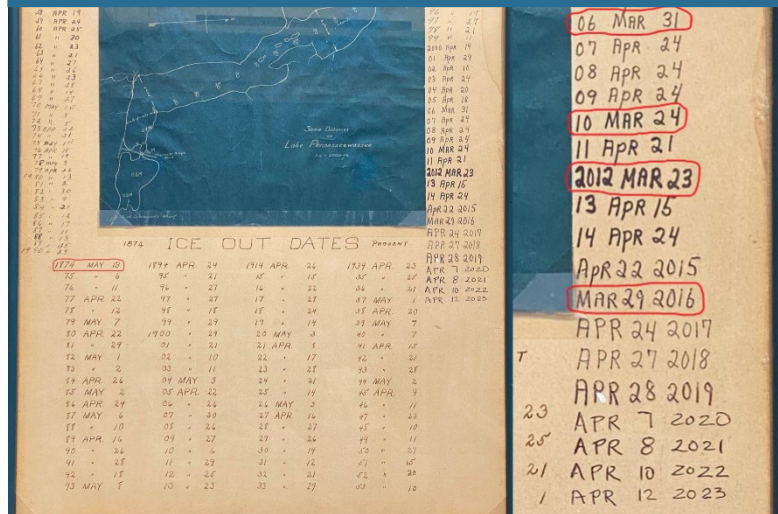
### Oxford County Winters, 10-Year Average Daily Maximum Temperatures

1896-1905	1906-1915	1916-1925	1926-1935	1936-1945	1946-1955	1956-1965	1966-1975	1976-1985	1986-1995	1996-2005	2006-2015	2016-2023
24.9°F	26.7°F	25.2°F	27.1°F	26.6°F	28.9°F	26.6°F	27.1°F	27.1°F	28.1°F	29.1°F	28.7°F	31°F

Source: NOAA U.S. Climate Division Database

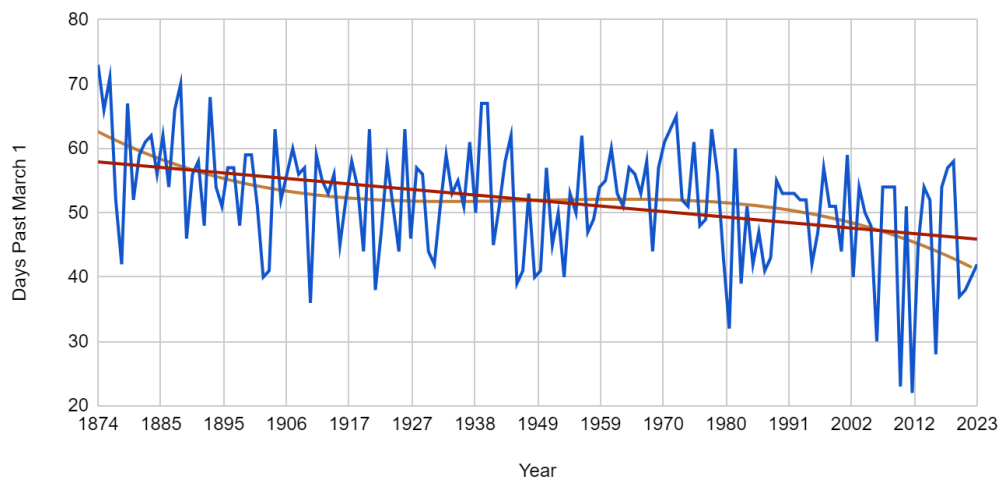
As our winters inch towards daytime averages above freezing, we are experiencing more “winter whiplash” of rapid freeze-thaw cycles, unseasonable heat, and changing winter conditions. Over the past century, the Northeast has seen increased days of mud, bare ground, insect pest survival, and thaw, while experiencing fewer days of frost, snow on the ground, snowmaking conditions, and ice (Fernandez et al., 2020).

### Lake Pennesseewassee Ice Out Records, Norway Weary Club



Lake Pennesseewassee has clearly been impacted by these shifts. The Weary Club’s ice-out data, dating back to 1874, shows a significant shift towards earlier ice-outs, with four March ice-outs all occurring since 2006.

### Lake Pennesseewassee Iceout, 1874-2023

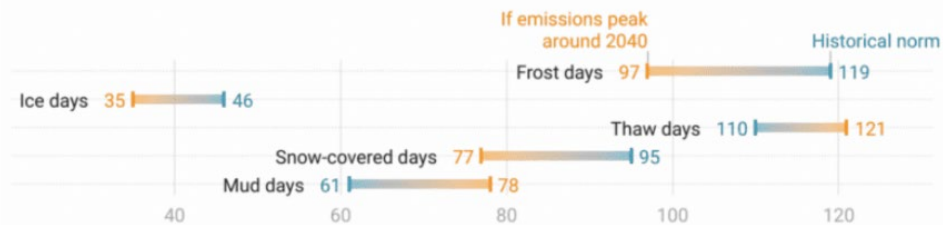


### Temperature Projections

Statewide, climate models project that annual temperatures will increase another 1°F to 4°F by 2050 and up to 10°F by the end of the century (MCC STS, 2020). Locally, assuming that global greenhouse gas emissions peak by 2040, models project an increase of 5.04°F from 1995-2004 baseline temperatures by 2050, and a total increase of 7.08°F by 2100 (Argonne National Laboratory, n.d.).

### Projected Northeast winter changes by mid-century in a moderate climate scenario

Compare how often different indicators of winter in the Northeast have happened historically (on average, each year from November to May, 1980-2005) with how often UNH researchers project these indicators could happen by mid-century (2040-2069) under a moderate climate change scenario, where global emissions peak around 2040.



The moderate emissions scenario used here is the U.N.'s Representative Concentration Pathway (RCP) 4.5.  
Chart: Annie Ropeik • Source: University of New Hampshire • Created with Datawrapper

Source: Annie Ropeik for *The Maine Monitor*, 2023

As temperatures rise through the next century, our winters and summers will continue to change. By mid-century, the Northeast is projected to have 22 fewer frost days, 11 fewer ice days, and 18 fewer days of snow cover (Ropeik, 2023).

While winters will continue to shift more rapidly, hotter summers will also present challenges. Heat waves and high heat days are projected to become more common across the state. Nearby, Bethel is projected to experience 6.5 high heat days when the heat index is above or equal to 95°F, while Lewiston might observe 15 such days (Fernandez et al., 2015).

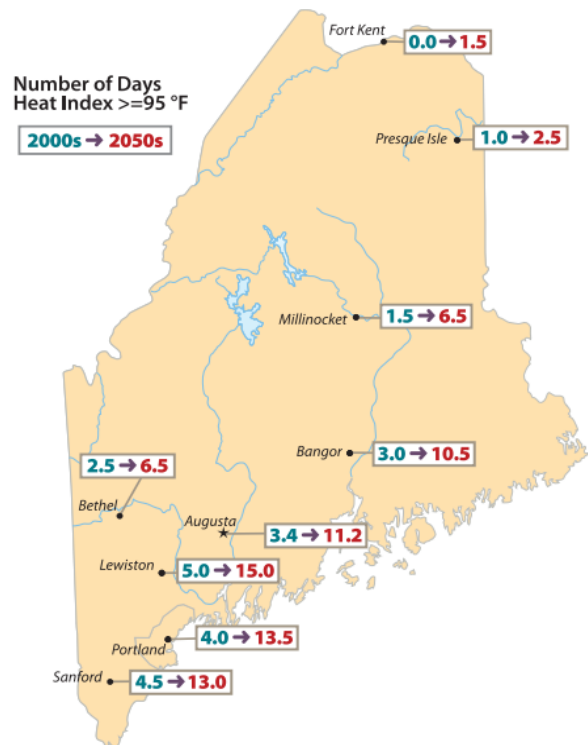


Figure 4. The average number of days when the heat index is greater than or equal to 95°F at selected sites for 2000–2004 and 2050–2054. Predicted values derived from a 48-km downscale simulation of one ensemble member of the CCSM3 model for the IPCC A2 emissions scenario.

Source: *Maine's Climate Future*, 2015 Update

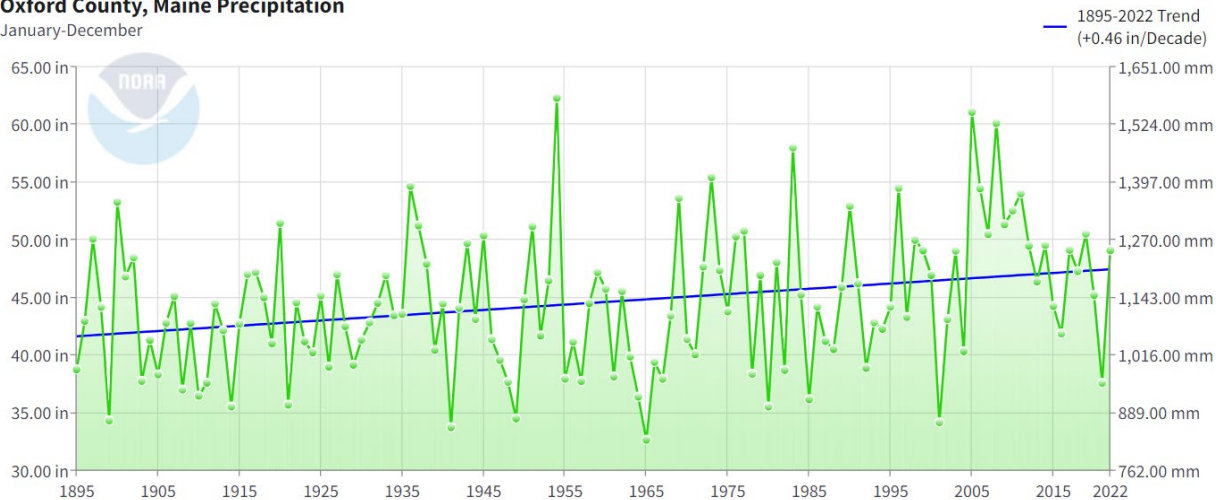
## Extreme Storms and Precipitation

### Precipitation Observations

Precipitation is on the rise across Maine and in Norway (Fernandez et al., 2020). In Oxford County, average annual precipitation has increased by 5.8 inches since 1895 (NOAA, 2023). This 14 percent change is largely driven by rainfall, as statewide snowfall has decreased by roughly 17 percent over the past decade (Fernandez et al., 2020).

#### Oxford County, Maine Precipitation

January-December

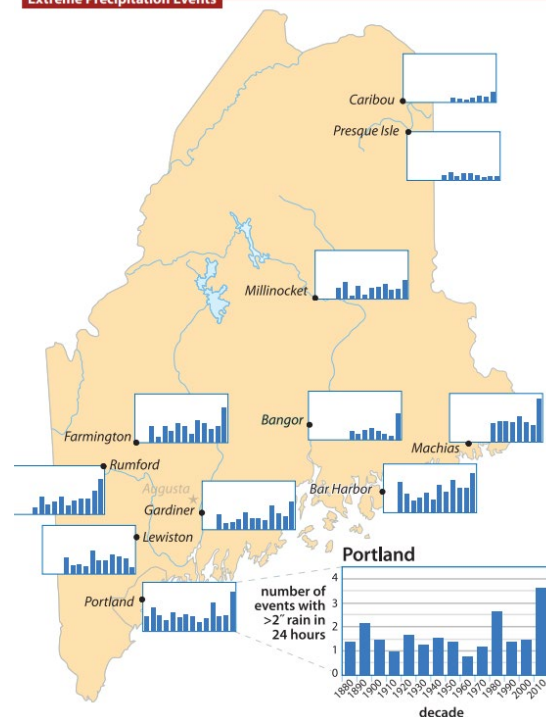


Source: NOAA U.S. Climate Divisional Database

Community members observe that local storms have grown more intense. Given that Norway is prone to hyper-local microbursts, caution must be taken when inferring changes in local precipitation patterns from regional data. That said, heavy precipitation has increased in Northeastern states at a faster rate than in any other region in the country (Fernandez et al., 2020). An analysis of precipitation in Farmington found that 2", 3", and 4" precipitation events are two to three times more common now than in the last century (Fernandez et al., 2020). Many long-term weather stations, including Rumford and Farmington, have recorded an increase in heavy precipitation events, but it is worth noting that Lewiston had not observed distinct increases as of 2015.

In addition to increased precipitation, we may be experiencing more intense winds during storms and day-to-day. Research on this topic is limited, but

#### Extreme Precipitation Events



Source: Maine's Climate Future, 2015 Update



anecdotal evidence suggests that parts of Maine are experiencing higher winds ([Schauffler, 2021](#)). Locally, First Street Foundation's Risk Factor suggests that average maximum wind speeds are higher in Norway than they were 30 years ago ([First Street Foundation, n.d.](#)). The tool also reports that Oxford County has recorded 126 notable wind events, though it is unclear how these events have changed over time. It has been suggested that nearby ski mountains have shut down lifts more frequently due to threatening gusts.

#### *Precipitation Projections*

Annual precipitation is expected to continue increasing through the next century ([MCC STS, 2020](#)). Assuming that global greenhouse gas emissions peak by 2040, annual precipitation in Norway is projected to increase from 2004 levels by 3.15 inches around 2050 and 6.67 inches by 2100 ([Argonne National Laboratory, n.d.](#)). Ice storms and severe wind storms are more complex and harder to predict, but may become more frequent or intense in Maine ([MCC STS, 2020](#)).

#### *What about droughts and wildfires?*

In other parts of the country, rising temperatures correlate with more severe droughts and worsening wildfires. In the western U.S., wildfires bigger than 1,000 acres in federal forests have become five times more common and are burning much greater areas than in the 1970s ([MCC STS, 2020](#)). However, there has been no observed increase in drought or wildfire occurrence in Maine to date, in part due to the upward trend in statewide precipitation ([MCC STS, 2020](#)).

That said, droughts and wildfires are still hazards of concern in Norway. Maine has experienced 35 statewide droughts since 1900 (Fernandez et al., 2020). One of the most severe droughts in the past century contributed to the wildfires of 1947, which burned over 220,000 acres and 1,000 homes ([Maine Forest Service, n.d.](#)). Closest to Norway, Brownfield lost its school, two churches, two post offices, businesses, and 250 homes ([Oxford County EMA, 2023](#)). Overall, the Maine Forest Service considers Oxford County one of the counties most vulnerable to forest fires and Norway is rated as being at moderate risk ([Oxford County EMA, 2023](#)). There is a 10 percent chance of a major wildfire occurring in any given year in Oxford County ([Oxford County EMA, 2023](#)).

Given the lack of observed changes and complexity of factors that drive droughts and wildfires, it is difficult to say whether climate change will increase the likelihood of droughts and wildfires ([MCC STS, 2020](#)). Overall, current trends suggest that Maine will face higher fire risk, though we do not know to what extent ([MCC STS, 2020](#)). And while climate change's effect on drought conditions in Maine remains uncertain, scientists suggest that the same forces driving more intense precipitation may exacerbate drought conditions when they do occur ([MCC STS, 2020](#)). Looking beyond Maine's borders, we can expect wildfires in the West and in Canada to worsen, which may result in increased frequency of poor air quality days in Norway as smoke blows into the northeastern U.S.

# Community Vulnerability Profile

The observed and projected changes in Norway’s climate will impact our community members and economy in myriad ways. These changes leave Norway more susceptible to challenges such as heat waves, flooding and storm damage, invasive species and other pests, insect-borne disease, and degrading lake water quality. Some of these issues, like flooding, decline of lake water quality, and an increase in Lyme disease, have impacted Norway already. Norway should plan for all of these climate impacts to increase in severity.

However, some people are more vulnerable to these impacts than others. In general, people that are considered to be more vulnerable to climate hazards include children, older adults, and individuals with disabilities. Other indicators that are often analyzed to understand a community’s vulnerability include poverty rate, unemployment, educational attainment, level of English proficiency, and access to transportation. Prevalence of those and several other indicators are summarized in Table 1.

Table 1. Social Vulnerability Indicators for Norway				
Indicator	Population Norway	Population Maine	Household Norway	Household Maine
Total, 2020 Decennial Census	5,077	1,362,359	2,210	582,437
People under 18*	1,038 (20.4%)	18.4%	538 (24.3%)	24.3%
People 65 years and over*	1,299 (25.6%)	21.8%	897 (40.6%)	34.8%
Limited English proficiency**	-	-	0 (0%)	0.9%
No High School Diploma**	582 (11.7%)	4.8%	-	-
People with a disability**	1,195 (24%)	15.5%	-	-
Below poverty level**	923 (18.5%)	11.5%	273 (14.2%)	11.7%
Unemployed**	119 (5.5% unemployment)	3.9%	-	-
No internet subscription**	-	-	321 (16.8%)	9.9%
No vehicle**	-	-	93 (4.9%)	6.7%
Single parent households*	-	-	140 (6.3%)	5%
Living alone*	689 (13.6%)	12.9%	689 (31.2%)	29.7%
Over 65 living alone*	334 (25.7%, people 65+)	17.7%, people 65+	334 (15.1%)	13.7%
<p>* 2020 Decennial Census                      ** American Community Survey, 2021 5-Year Estimates</p> <p>ACS results are presented as a percentage of the ACS population estimates. ACS 2021 estimated the population to be 4,988 and number of households to be 1,915. Indicator list is adapted from information presented by Southern Maine Planning and Development Commission’s community vulnerability assessments.</p>				

Red blocks indicate where Norway has a higher percentage of vulnerable populations and households than Maine. This is the case in every group except for those with limited English proficiency, households with no vehicle access, and households with children under 18. People with a disability and those over 65 each represent over a quarter of Norway’s population. Out of those who are over the age of 65, a quarter live alone, leaving them particularly vulnerable to extreme weather events.

There are also housing characteristics that may leave occupants more vulnerable to climate hazards. Those indicators are summarized in Table 2.

Table 2. Housing Vulnerability Indicators for Norway	
Indicator	Estimates
Renter Occupied Units	628 (32.8%)
Multi-unit Buildings	948 (36.2%)
Mobile Homes	406 (15.5%)
Structures Built Before 1970	962 (35.4%)
American Community Survey, 2021 5-Year Estimates Indicator list is adapted from information presented by Southern Maine Planning and Development Commission’s community vulnerability assessments.	

Renters and residents of multi-unit buildings generally have less power to make home improvements, like weatherization or installation of air conditioning, that can reduce their vulnerability to climate impacts. Older homes and mobile homes are also considered more vulnerable to extreme weather and temperatures.

While Tables 1 and 2 provide useful contextual information about our community, they do not tell the full story about who is most vulnerable to climate change and how they will be impacted. Informed by stakeholder conversations, community survey responses, and a public forum, the following sections flesh out a more nuanced understanding of Norway’s community vulnerability.

# Population Vulnerability to Climate Hazards

Everyone who lives, works, and plays in Norway will be impacted by climate change. Hazards such as extreme heat, flooding and storm damage, drought, wildfires and poor air quality, pests and insect-borne disease, and poor lake water quality can negatively impact public health and economic well-being if adequate adaptive measures are not in place. According to a community survey of 40 Norway community members conducted by CEBE for this assessment, a number of negative impacts are already occurring: 90 percent of respondents reported impacts related to one or more of the hazards listed above.

## Public Health and Wellness

Climate hazards that may impact Norway present a number of challenges for public health and overall wellness. The primary challenges are:

- Heat-related illness
- Vector-borne disease and pest impacts
- Water-borne illness
- Inability to meet essential health needs
- Mental health and wellness decline

### *Heat-related illness*

Days when the heat index exceeds 90°F are still relatively uncommon in Norway but continue to grow in frequency. Extreme heat poses a range of challenges for our health. Commonly known impacts include heat stroke, heat exhaustion, and dehydration. Extreme heat can also cause renal failure and other kidney-related issues; worsen existing health conditions; impact fetal health and result in preterm births; and contribute to poor mental health conditions ([MCC STS, 2020](#)). In 2022 and 2023, there have been 40 heat-related emergency department visits in Oxford County ([Maine Tracking Network, 2023](#)). Locally, four survey participants reported that they have already experienced worsening health conditions (one specified heat stroke) due to high temperatures, and two shared that they have needed to seek medical attention for heat-related illness.

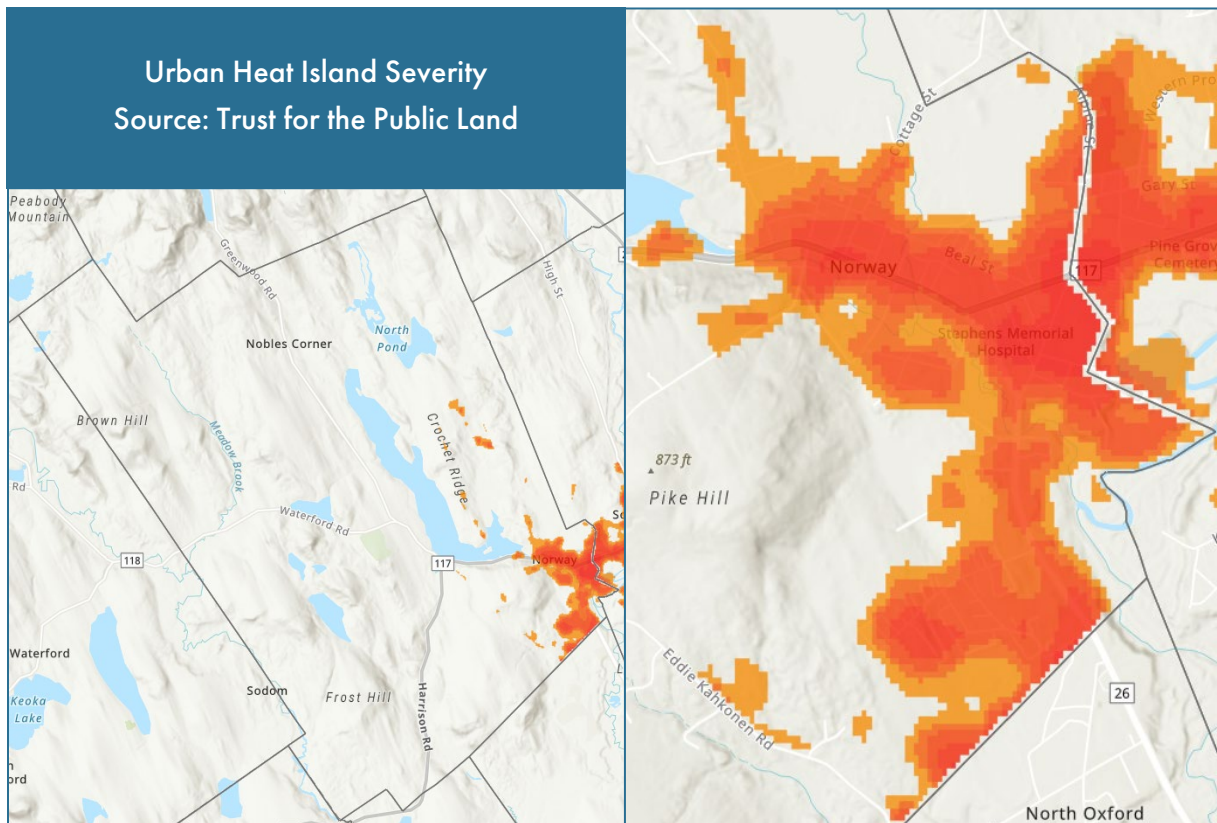
On the whole, Maine residents are particularly vulnerable to high temperatures since we are less adapted to high temperatures ([MCC STS, 2020](#)). But there are also people in our community who are particularly vulnerable to extreme heat due to increased sensitivity and exposure. Those who are more sensitive to the way heat impacts their body include older adults and young children, people with chronic disease and mental illness, and those who are pregnant.

There are also a number of community members who face greater exposure to high temperatures. People who work outdoors are also particularly exposed to extreme heat. In Norway, an estimated

478 people work in an outdoor job like construction ([Census Bureau, 2021](#)). Another group that is particularly exposed are those without air conditioning. Though data is not available for Norway, county-wide data suggests 47 percent of adults live without air conditioning in Oxford County ([Maine Tracking Network, 2019](#)). In our stakeholder conversations, several people expressed concern for the many people who live in small, aging apartments in town. Poor insulation, especially for second- or third-floor apartments, can lead to unbearably hot indoor conditions if occupants lack air-conditioning.

The former police chief observed that escaping to the front stoop is a common strategy for when apartments become too hot. However, it is worth noting that the streets also present concerns. One public forum participant pointed out that lack of shade from street trees can make some stretches of town feel too hot to walk through.

Spatial data assessing surface temperatures affirms this observation; as shown here, downtown Norway experiences a severe heat island effect compared to more remote parts of town ([Trust for Public Land, 2019](#)).





### *Vector-borne disease and pest impacts*

Warmer winters, higher relative humidity, and more days over 65°F are associated with increases in deer tick populations in Maine ([MCC STS, 2020](#)). As these conditions become more common, we may see more cases of Lyme disease and other deer tick-borne illnesses such as anaplasmosis, babesiosis, deer tick virus, encephalitis, and tick-borne relapsing fever. The lone star tick, known for its cause of red-meat allergy among other diseases, is also extending its territory northward as temperatures increase and is expected to establish throughout Maine by 2040 ([MCC STS, 2020](#)). From 2016 to 2020, Norway had 44 reported cases of Lyme ([Maine Tracking Network, 2023](#)). Those living outside of the downtown area have greater tick exposure.

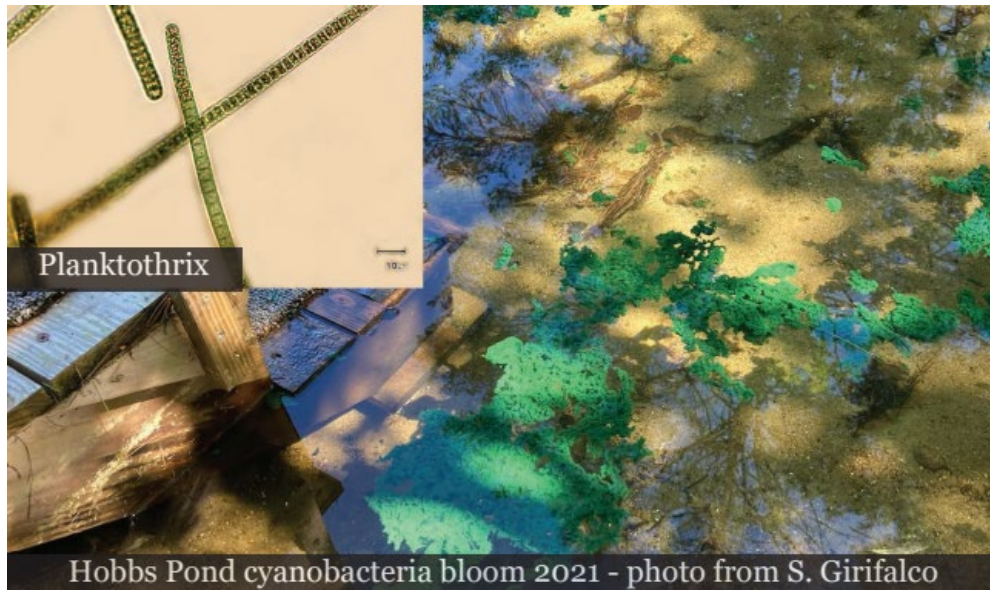
Ticks currently pose a greater public health threat than other pests. Mosquitos have, for the most part, remained more of a nuisance than a health hazard as Norway has not experienced reported cases of mosquito-transmitted diseases like West Nile virus, Eastern Equine Encephalitis, and Jamestown Canyon virus that are present in Maine. However, factors like earlier and warmer springs, increased summer precipitation, and warmer falls are expected to exacerbate transmission of these diseases.

Another emerging threat is browntail moth caterpillars, an invasive pest that damages deciduous trees and can cause skin and lung irritation. While browntail moths are not new to Maine, their territory has expanded over the past decade. Researchers suggest that this expansion and proliferation may be related to climate change because the fungal pathogen that had kept the moths at bay requires cooler spring temperatures which are becoming less common ([UMaine, 2022](#)). This past year, browntail moths established in Norway, with a number of survey respondents and forum participants identifying them as a concern. The caterpillars were most prevalent in Longley Square, where they decimated trees and threatened the health of many community members who pass through that area. As Norway continues to warm, we expect that browntail moths and other invasive pests will remain a threat.

Overall, nine survey participants reported that they have experienced disease or illness from ticks or other pests.

### *Water-borne illness*

Norway's four lakes— Sand Pond, Hobbs Pond, North Pond, and Lake Pennessewassee— are invaluable resources for our community. But rising lake temperatures and increased runoff from heavy rainfall threatens the health of our lakes and community. These climate impacts encourage the growth of harmful algal blooms, which can cause rashes, nausea, diarrhea, or even death in people and animals ([MCC STS, 2020](#)). Anyone who swims or boats near a harmful algal bloom is at risk of becoming ill. People who are immunocompromised and pets are especially vulnerable ([CDC, 2022](#)).



Source: Lakes Environmental Association, *LEA Lake News*, 2022

Hobbs Pond was affected by harmful cyanobacteria blooms during the summers of 2021 and 2022. These blooms, which lasted three weeks in 2021 and nine weeks in 2022, limited access to the popular swimming hole and sent at least one swimmer to the hospital with “nausea, hives and tingling of extremities” (Sherlock, 2023; p. 4, Peierls, 2022). Lake water quality also came up through the community engagement process, where one survey respondent noted that some of their swimming spots have not been swimmable and attendees of the public forum brought up the Hobbs Pond blooms as a key vulnerability to address. Even in cases where harmful algal blooms are not present, higher bacterial levels can lead to infections and other health issues.

#### *Inability to meet essential medical needs*

Climate change will increase the likelihood of severe weather events that impact our community’s ability to meet essential health needs like functioning ventilators or hospital access. For example, extended power outages can result from severe storms or a widespread heat wave that taxes the power grid. Power outages can be inconvenient for some in Norway; for others, they can be deadly. As of June 2023, there are 61 Medicare beneficiaries in Norway who rely on electricity-dependent medical equipment like ventilators (U.S. Department of Health & Human Services, 2023). While data is unavailable, it is likely that some of these community members live in one of the two subsidized housing facilities in Norway for people over 62 and those with disabilities. One stakeholder expressed concern that these facilities may lack backup generators despite housing some of the most vulnerable in our community.

Those with pressing medical needs are also vulnerable to roads made impassable by flooding, washouts, or debris. For example, impassable roads could prevent someone from reaching the

hospital during a medical emergency. But if these conditions last for an extended period, they also threaten individuals who are reliant on meal or medication deliveries. Impassable roads not only strand medically vulnerable individuals, but health providers as well. In one stakeholder conversation, a mental health clinician shared a story about experiencing a road washout that left her with no way out of her house, causing her to call off from work. Critical care providers across all fields could be similarly impacted during a severe storm, reducing Norway's capacity to respond to medical needs during and in the aftermath of these events.

In general, those living in more remote parts of Norway are most vulnerable to these impacts. Homes further outside of town are more likely to lose power due to the higher number of trees, and they are anecdotally believed to go longer without power since downtown Norway's grid is prioritized for Stephens Memorial Hospital. Out of 30 survey respondents who live outside of downtown, 53.3 percent reported that they have been experiencing more power outages due to storms. This is not surprising as Central Maine Power, the utility servicing the town, is rated among the least reliable public utilities in the U.S. ([Citizens Utility Board, 2021](#)). People living outside of downtown are also more likely to encounter road washouts, flooding, and downed trees that result from a severe storm. Only two out of ten survey respondents who reported inability to travel or commute due to storm damage lived in downtown Norway. Those living on private roads with no outlets are particularly vulnerable.

#### *Mental health and wellness decline*

The mental health and overall wellness impacts of climate change are not as tangible as the previously discussed issues. However, climate change can take a toll on multiple levels. Most immediately, extreme heat has been shown to increase aggression, violence, and suicide rates, while moderate heat can disturb sleep and reduce cognitive function ([MCC STS, 2020](#)). Exposure to extreme weather events can also lead to long-term mental health issues like anxiety, depression, and PTSD ([MCC STS, 2020](#)). Recurring impacts, such as property damage from storms, may produce chronic stress and anxiety about future events. More generally, concern about climate change can develop into climate anxiety and psychological distress. Climate change is already taking a toll on mental health in Norway. Seven survey respondents reported that they have experienced mental health challenges as a result of climate anxiety or extreme weather impacts. A conversation with Oxford County Mental Health Services also revealed that flooding and other extreme weather impacts are a source of anxiety for clients.

Climate change can also impact more general wellness by preventing exercise and recreational activities. In the summer, wildfire smoke and high heat may get in the way of outdoor exercise and recreation. 24 survey respondents shared that they have been increasingly unable to enjoy outdoor activities because it is too hot. Harmful algal blooms can also limit access to recreation on Norway's

lakes. That said, winter recreation is particularly vulnerable due to quickly rising winter temperatures. 14 survey respondents reported that they have been increasingly unable to enjoy winter activities due to melting snow and ice. Loss of recreation opportunities is not as serious as other public health issues described here, but it is an added stressor that can contribute to a decline in mental health and overall wellbeing.

### **Financial Stability**

In addition to health impacts, climate change threatens the financial stability of community members. All of the public health concerns listed above can result in increased medical costs, with one national study attributing over \$800 billion annually in American health costs to climate change ([Natural Resources Defense Council, 2021](#)). Storms can also result in substantial property damage. One stakeholder noted that the damage from just one storm can be financially overwhelming for residents with lower incomes. Back-to-back storms can be devastating. Some survey respondents noted financial impacts related to property. Nine respondents reported that their property has been damaged in an extreme weather event; four reported that their home or business has become more prone to flooding; and one respondent was displaced due to flooding or storm damage. Other financial impacts include lost work shifts, burdensome energy costs from increased prices and usage, and food loss from power outages and lower garden productivity.

With all of these impacts, it is important to consider that low-income households are particularly vulnerable to accumulating impacts that increase overall vulnerability. For example, if a household is suffering financially due to repairs that were needed following flood damage on their property, this leaves them even more financially vulnerable to future damage and other climate-related financial impacts.

### **Community-Wide Adaptive Capacity**

In the previous pages, we outlined a number of climate impacts of concern. The degree to which the town of Norway is vulnerable to these impacts depends on the town's adaptive capacity, or ability to cope with the hazards presented. In this section we highlight a few overarching themes, as well as positive assets, that may influence community-wide adaptive capacity.

#### *Isolation and Disconnection*

A recurring theme from stakeholder conversations and the public meeting is isolation. One element of this is physical isolation. When asked who they are most concerned about during an extreme weather event, every stakeholder mentioned people who live in more remote parts of Norway, and particularly those with fewer financial resources.

Social isolation is also a key indicator of sensitivity to climate hazards. In western Maine, Healthy Oxford Hills and the Oxford County Wellness Collaborative have spent significant time analyzing and addressing social isolation in our community, which is considered one of the primary drivers of poor health outcomes. It is also a driver of high vulnerability to climate hazards, as observed in other parts of the country. A stark example can be found in Chicago's 1995 heat wave, which resulted in over 700 deaths. Sociologist Eric Klinenberg found that social isolation was the driving factor in these deaths. His research showed that two neighborhoods, both identified as vulnerable based on racial and economic characteristics, had wildly different outcomes based on the degree of social contact, collective life, and public engagement facilitated by vibrant public spaces ([University of Chicago Press, 2002](#)).

Disconnection from support and available resources is another major concern that was presented by stakeholders, survey respondents, and forum participants. Specifically, there was much interest in the topic of how to communicate about available resources and how to reach those who may need them most. Five survey respondents suggested ideas for improving community resilience that related to better outreach and education about climate hazards. A number of recommendations emerged from the public forum related to this topic as well.

While connecting vulnerable people to resources is a start, stakeholders noted that there are often complex barriers to accessing help, including stigma around how these resources are framed and a culture of rugged individualism. In one heartbreaking example, the former police chief shared that an older woman died in Norway during the ice storm of 1998 when she refused to leave her house after she lost power, even as she was offered help. Additionally, stakeholders who routinely work with vulnerable populations acknowledge that part of the challenge with community-wide communication is that there is no longer one source that everyone looks to for information.

### *Housing Instability*

The group that is most vulnerable to nearly every hazard and impact mentioned in this assessment are those who are unhoused or living in unstable housing situations. To an extent, homelessness in Norway is an invisible problem. While there are some people who are camping outdoors, there are far more who are "couch surfing." There are also many people who come to Norway for the services available but can't find a place to live, leading them to live in their car or in sheds and campers in someone's yard. Homelessness in Norway is a complex issue that cannot be solved through town policy alone, but the climate vulnerability dimension of this issue cannot be overstated. Fortunately, more work will be done to understand the challenges of serving the unhoused in Norway in the coming year, starting with a forum hosted by the Oxford Hills Area Clergy Association in September 2023.



### *Positive Assets for Adaptive Capacity*

There are several community resources and assets that help build Norway's adaptive capacity. The presence of Stephens Memorial Hospital is one of those assets. The placement of the hospital within walking distance of downtown has a twofold benefit of offering nearby medical treatment and ensuring that Norway's downtown power grid is prioritized for restoration during power outages. This greatly reduces the risk of extended outages for the roughly 2,696 residents who live in the downtown area. The hospital is also home to Healthy Oxford Hills and the Western Maine Community Engaged Research group, which could both serve as valuable partners on future projects that address climate impacts to public health. Additionally, the hospital's large conference room could act as an overnight cooling or warming center if needed. That said, our current understanding is that the hospital does not have a plan in place for climate emergencies, so more work is needed to ensure that they are prepared to help Norway's community in the case of an extreme weather event.

Norway is also home to a number of organizations that may provide valuable support for those who are most vulnerable in our community. Those include social service providers like Community Concepts, Androscoggin Home Healthcare and Hospice, The Progress Center, Oxford County Mental Health Services, The Hills Addiction Center, and SeniorsPlus. It also includes social, cultural, and religious institutions like our churches, Norway Memorial Library, Norway Grange, Heywood Club, Weary Club, American Legion, and Alan Day Community Garden. Center for an Ecology-Based Economy will also remain an asset for future collaboration on local climate resilience.

Finally, there is a level of informal neighborhood-based support that is difficult to quantify but is certainly beneficial for Norway's overall resilience. During the public forum, it was suggested that the town ask our community, "What is your neighborhood already doing to support and lean on each other?" While some have expressed doubt about how far "neighbors helping neighbors" goes these days, there is also a strong sense that Norway residents do look out for each other.

# Recommendations

## What policies and programs are in place?

There are few relevant policies and programs pertaining to climate resilience in Norway. That said, there are several informal or indirectly related town policies that contribute to our community's adaptive capacity. Those policies include:

- Participation in Oxford County EMA's hazard mitigation planning process
- Town funding for General Assistance and social service providers
- Town coordination with and funding of Lakes Association of Norway (LAON) to monitor water quality of lakes
- Consistent upsizing of culverts when making road repairs
- MOU with Norway Armory for use as a shelter in emergency scenarios
- Mutual aid agreements with fire departments in the region
- Fire Department strategizing for recruitment of more firefighters
- "Sand bucket" wellness checks on vulnerable households by Norway Police Department
- Plans to use the new police building as a warming and cooling center

## Preliminary Recommendations

Based on the community feedback and our assessment of Norway's vulnerability, we propose the following recommendations:

- A. Formalize emergency response to climate hazards
  - a. Conduct climate change scenario planning exercises with first responders
  - b. Adopt a warming and cooling center policy that defines when the centers open, what space(s) will be used, what resources will be made available, how on-site supervision will be provided, and where and how information about the center(s) will be communicated
    - i. Ensure that overnight heating and cooling facilities are available if needed
  - c. Develop an emergency communication plan
  - d. Develop a "community outreach information network" of community organizations and volunteers to contact and support vulnerable populations during climate emergencies
    - i. Explore the option of a "Bike Brigade" to make deliveries of essential food and medicine in the case of closed roads
- B. Improve communication and outreach year-round
  - a. Create a town mailing list for Norway residents
  - b. Install permanent town-owned signage on Main Street to communicate important town announcements and health advisories

- C. Reduce social isolation and disconnection for vulnerable populations
  - a. Create a neighborhood-based support program (such as ReadyMarin or Washington State's Map Your Neighborhood) that encourages neighborhood-level wellness checks and mutual aid
  - b. Maintain a voluntary list of people who would like to be checked on occasionally or during emergencies
  - c. Collaborate with local organizations to run a public awareness campaign about social isolation and disconnection as it pertains to extreme weather
- D. Engage the community in climate education and preparedness
  - a. Develop PSAs, flyers, and other materials that provide information about climate emergency preparedness and available resources in our community
  - b. Distribute informational materials to residents via tax bill or other mailers
  - c. Create and distribute emergency kits to vulnerable and remote populations
  - d. Host additional public forums on climate resilience, especially as part of Norway's Climate Action Plan development
- E. Improve local energy independence and resilience
  - a. Continue to install solar on municipally-owned properties
  - b. Replace generators with solar and battery storage systems
  - c. Plan for long-term transition to distributed energy generation and storage
- F. Update codes and ordinances for resilience
  - a. Conduct a climate resilience-framed review of existing codes and ordinances to determine where updates are needed
  - b. Coordinate with the Lake's Association of Norway to determine if new or updated ordinances are needed to protect lake health
- G. Develop a system for tracking local climate data
  - a. Maintain records on known infrastructure and community impacts from climate events
  - b. Invest more in continued lake monitoring and assessment of strategies for maintaining lake health

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# Appendix A. Community Recommendations

## Community Recommendations

Throughout the engagement process, we sought ideas about how Norway can improve community-wide resilience. We received 78 recommendations from 36 people through our stakeholder conversations, community survey, and public forum. Those ideas are summarized below.

### *Emergency response and services*

- Plan for emergency by assessing generator conditions and capacity around town (armory, hospital, town office). Consider switching to solar battery storage
- Warming and cooling center
  - Formalize warming and cooling center policy (x2)
  - Plan, ensure capacity for on-site supervision, and keep supplies on hand
  - Hospital has a conference room in the basement that could be a natural location if needed
  - Reframe warming/cooling centers and other climate resources as a community space rather than charity (“I’m here for the coffee and to chat, but while I’m here I might as well stay a bit...”)
- Make services and places available to people during severe weather events
- Build a list - ask people to sign up if they want to be checked on in an emergency
  - Could involve local students
- Distribute emergency kits to remote and vulnerable populations (possibly in conjunction with sand bucket drop-offs)
- More fire ponds in remote areas
- Have good equipment

### *Education, outreach, and awareness*

- Improve emergency communication
  - Consider restarting town-wide newsletter for Norway residents
  - Formalize an emergency communication process (e.g. call tree)
  - Install more public signage (e.g. a digital sign on Main Street)
  - Improve outreach and communication about warming and cooling centers
- Improve emergency preparedness through education
  - Provide climate hazard preparedness materials (what individuals can do, available resources and support, etc.) in spaces like the OCMHS waiting room
  - Encourage and educate for improved personal preparedness in remote parts of town

- Send out information about emergency preparedness and available resources with tax bill or other materials that residents receive
- PSAs and handouts
- Be a leader in educating people about climate challenges
- Climate education for children
- Community education through frequent forums, info in newspaper and on social media
- Continue to advocate, answer concerns...
- Provide a list of micro actions! What are small things someone can do daily? Provides some sense of control

### *Community building*

- Brainstorm solutions as a community
- Create program that encourages formation of neighborhood groups for support/mutual aid during emergencies
- Ask our community: what is your neighborhood already doing to support and lean on each other?
- For future climate readiness, engage:
  - Local state officials
  - Hospital
  - Lakes Association

### *Data collection*

- Improve record-keeping to make emergency planning process easier
- Invest more in Lakes Association for lake monitoring, health measures
- Develop and track local climate metrics
  - Partner with the school district to launch a citizen science program where kids can collect data, take pictures, etc.

### *Built environment*

- Roads
  - Repairs
    - Repair and build flood-resilient roads (x2)
    - Plan for increased road repair budget
    - Regularly inspect and repair roads
  - Encourage EVs
  - Complete streets x3
- Codes, Ordinances, Zoning
  - Update building codes to require energy efficiency standards in new builds (x2)

- Forward thinking zoning
- Adjust antiquated ordinances that prevent resilient development (e.g. remove parking minimums for housing)
- Flood mitigation

#### *Natural environment*

- Lake quality protection
  - Boat wake rules to prevent erosion
  - Invasive species prevention
  - Invasive species control
  - Lake quality monitoring
  - Address runoff (x2)
  - Ban phosphorus fertilizers
  - Limit water drawing from lakes for private use (pools)
- No Mow May
- Promote local, sustainable food production
- Street trees, heat island mitigation (x2)

#### *Energy*

- Renewable energy for town buildings
- More solar opportunities
- Lower energy costs
- Energy conservation
- More distributed energy generation and storage
- Support electrification for community members
- Sponsor low/no interest heat pump loans

#### *Other*

- Provide public drinking water and restroom access
- Limit growth and population
- Naysayers - Don't spend money on climate adaptation
  - Don't waste money on problems that don't exist
  - Reduce taxes, stay out of "it"
  - Don't support energy like solar
- Very general
  - Be proactive (x2)
  - Reduce emissions
- This pre-planning process is exactly what's needed now!

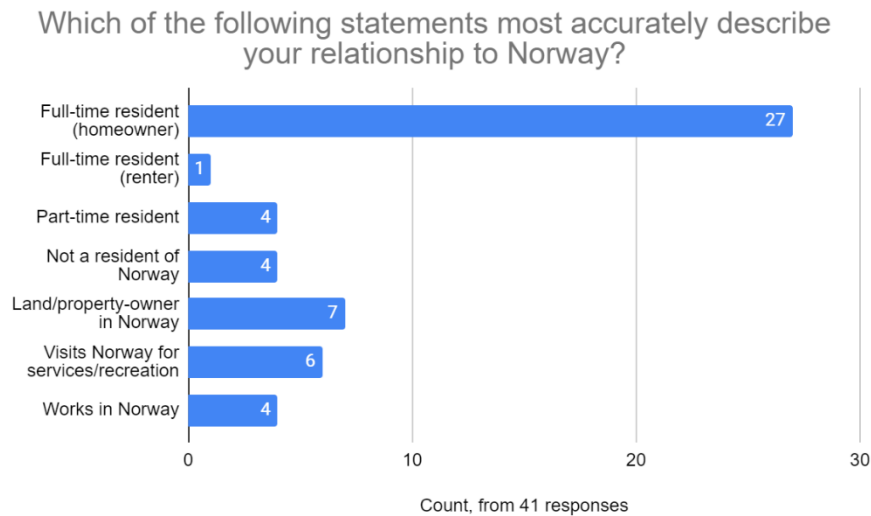
# Appendix B. Survey Responses

## About the Survey

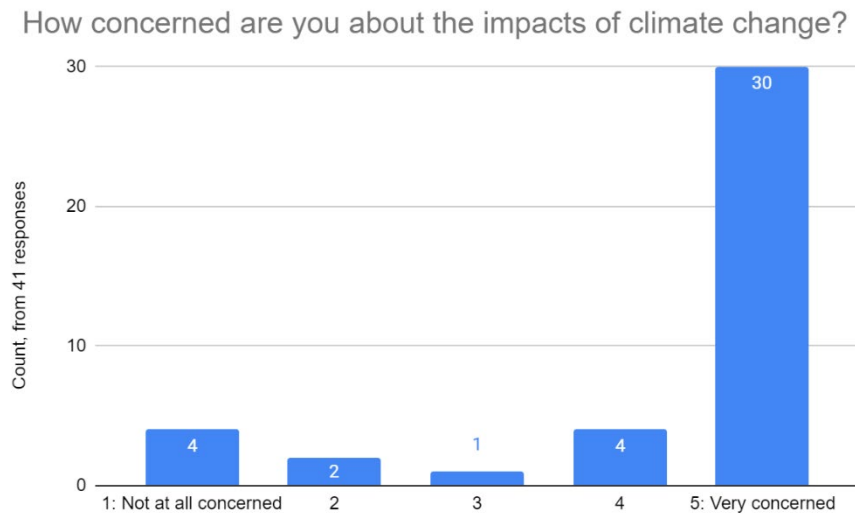
On August 2, 2023, a community survey was published on Norway’s website and paper copies were made available in the town office, library, and the Center for an Ecology-Based Economy’s office on Main Street. We also shared the survey at several community events. We received a total of 41 survey responses, the results of which are summarized below. The survey remains open and will be used to capture additional input as Norway develops its Climate Action Plan.

## Survey Questions and Responses

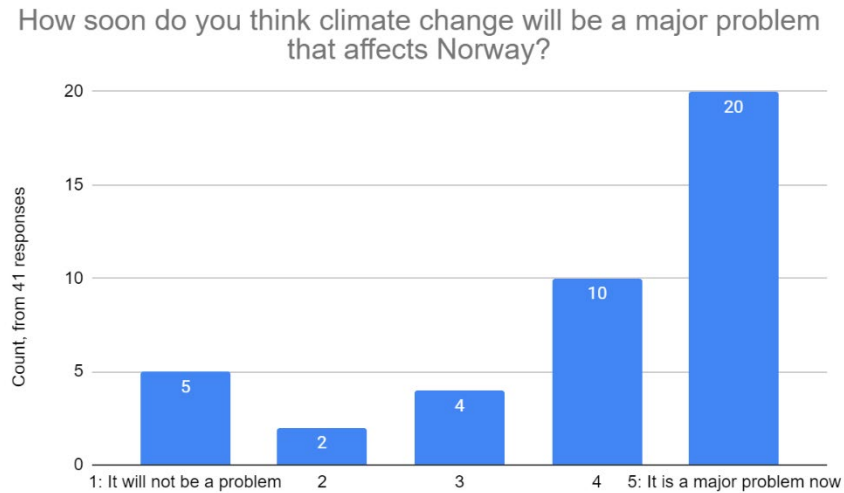
1. Which of the following statements most accurately describe your relationship to Norway?



2. How concerned are you about the impacts of climate change?



3. How soon do you think climate change will be a major problem that affects Norway?



4. Have you experienced any of the following heat-related disruptions in Norway?

Have you experienced any of the following heat-related disruptions in Norway?		
	Count, from 40 responses	Percentage, out of 40
I am sometimes unable to sleep, study, work, or normally function because it's too hot	18	45.0%
I am sometimes unable to commute/travel because it's too hot	2	5.0%
I have experienced new or worsening heart, breathing or other ailments during heat waves	3	7.5%
I have sought medical attention due to heat-related illness	2	5.0%
I have used a cooling center or other air-conditioned space (please specify below) because my home is too hot	2	5.0%
I can't afford or struggle to afford air conditioning during the summer	2	5.0%
I am sometimes unable to enjoy outdoor and recreational activities because it's too hot	24	60.0%
I am sometimes unable to enjoy outdoor spaces because of drought	6	15.0%
I am sometimes unable to enjoy the outdoors, work or normally function due to air quality concerns	6	15.0%
No, I have not experienced these heat-related disruptions	11	27.5%
Other: . .Snow and ice ? . The climate has changed , permanently <a href="https://climate.nasa.gov/">https://climate.nasa.gov/</a> . .		
Other: Re: cooling center, "Would if I had one!"		

5. Have you experienced any of the following cold-related disruptions in Norway?

Have you experienced any of the following cold-related disruptions in Norway?		
	Count, from 41 responses	Percentage, out of 41
I am sometimes unable to sleep, study, work, or normally function because my home is too cold	2	4.9%
I have been increasingly unable to commute/travel because it's too cold or the roads are too icy	8	19.5%
I have been increasingly unable to enjoy outdoor and recreational activities due to melting snow or ice	14	34.1%
My home has flooded due to burst pipes	0	0.0%
I am sometimes unable to remove snow or hire someone else to remove snow after a snowstorm	6	14.6%
I struggle to afford my heating or utility bills in the winter due to increased heating costs	10	24.4%
I have used a warming center or other heated space (please specify below) because my home is too cold	1	2.4%
No, I have not experienced these cold-related disruptions	18	43.9%
Other: Receives state assistance for heating		
Other: NA - not here in winter		

6. Have you experienced any of the following storm-related disruptions in Norway?

Have you experienced any of the following storm-related disruptions in Norway?		
	Count, from 39 responses	Percentage, out of 39
My home or business has been more prone to flooding or storm damage	4	10.6%
I have been displaced from my home or business due to flooding or storm damage	1	2.6%
I am sometimes unable to enjoy outdoor or recreational spaces due to flooding or storm damage	10	25.6%
My ability to commute/travel has been disrupted by flooding or storm damage	10	25.6%
My property or private road has eroded or a sinkhole has formed	11	28.2%
I have had to call emergency services during a storm	0	0.0%
I have more frequently lost power due to severe storms	20	51.8%
No, I have not experienced these storm-related disruptions	6	15.4%

Other: Heavy rain this summer have sometimes kept me home
Other: My public street is decaying due to storms and damage from the town plowing, and sweeping methods.
Other: The work CMP has done has improved service
Other: Re: Roads, "High Street washed out"
Other: I installed a generator to avoid disruption from power outages
Other: The town has had significant washouts over the last year from excessive rain that are impacting the roads, lakes and town budget.

7. Have you experienced any of the following public health-related disruptions in Norway?

Have you experienced any of the following public health-related disruptions in Norway?		
	Count, from 39 responses	Percentage, out of 39
I have experienced new or worsening seasonal outdoor allergies	12	30.8%
I have experienced new or worsening heart, breathing or other ailments due to poor air quality	3	7.7%
I have experienced mental health challenges due to extreme weather impacts or climate anxiety	7	17.9%
I have experienced disease and/or illness from insects such as tick, mosquito and/or others	9	23.1%
Trees/vegetation on my property or neighborhood have died or are stressed from invasive pests	15	38.5%
Myself or my pets have been unable to swim or were made ill by poor water quality	0	0.0%
No, I have not experienced these public health-related disruptions	12	30.8%
Other: Heat stroke		
Other: I am a swimmer and some of my spots are not swimmable		

8. Have you experienced any of the following climate-related financial disruptions in Norway?

Have you experienced any of the following climate-related financial disruptions in Norway?		
	Count, from 38 responses	Percentage, out of 38
I have lost shifts or missed work due to one of the hazards described above (e.g. extreme temperatures, flooding, insect-borne illness, etc.)	1	2.6%
I have increased medical bills due to one of the hazards described above (e.g. extreme temperatures, flooding, insect-borne illness, etc.)	0	0.0%

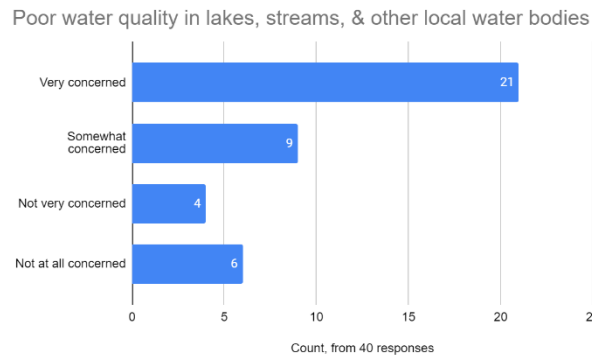
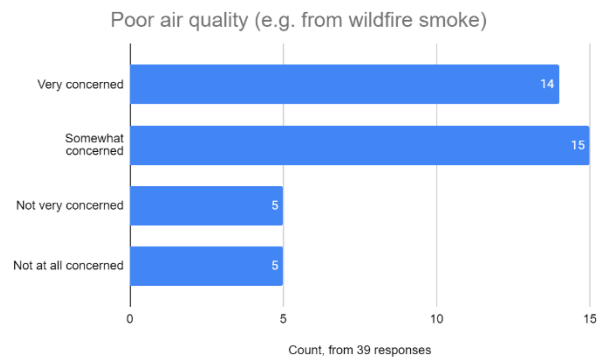
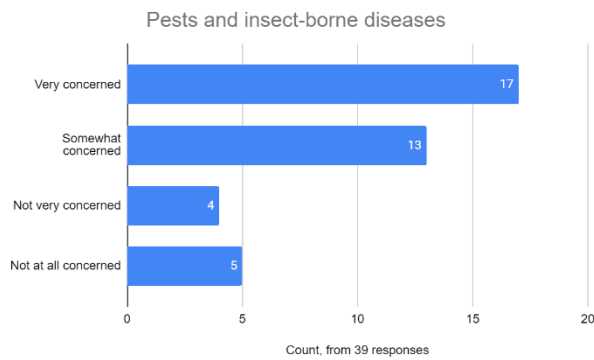
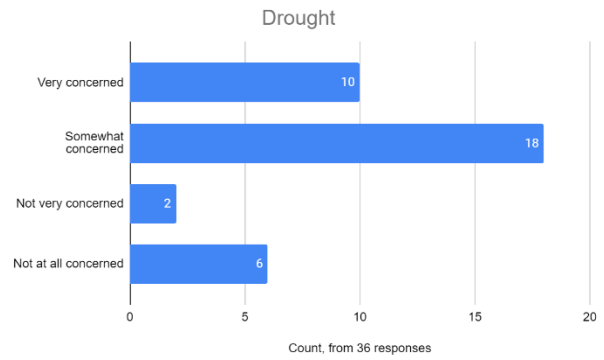
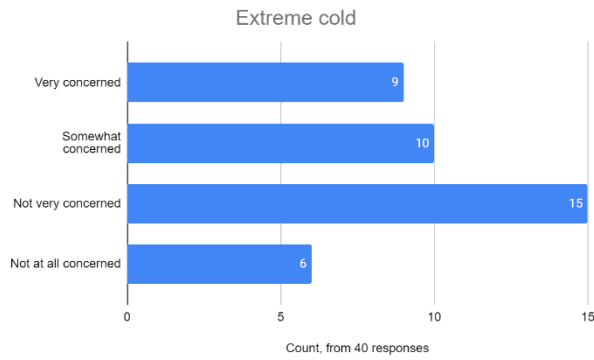
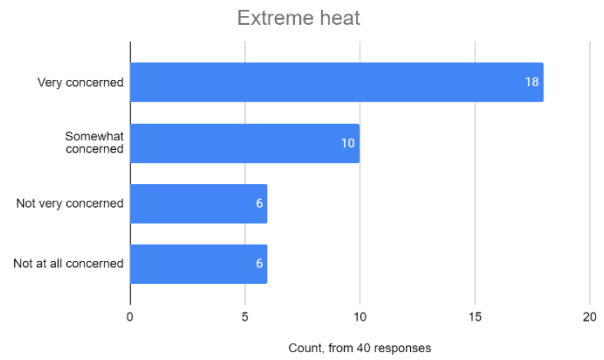
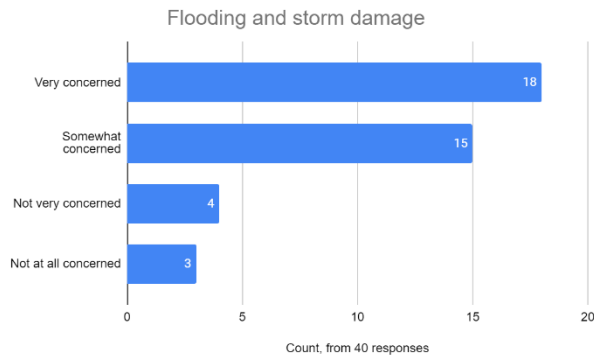


My home, car, belongings, land, or other property has been damaged by an extreme weather event	9	23.7%
My business has closed for more than one day, had reduced foot traffic, or experienced other losses (please describe below) due to climate-related impacts	0	0.0%
My crops or other agricultural activity has been damaged by extreme or erratic weather events or drought	9	23.7%
No, I have not experienced these climate-related financial disruptions	22	57.9%
Other: Higher property taxes due to increases in town costs to manage storms and road repair.		

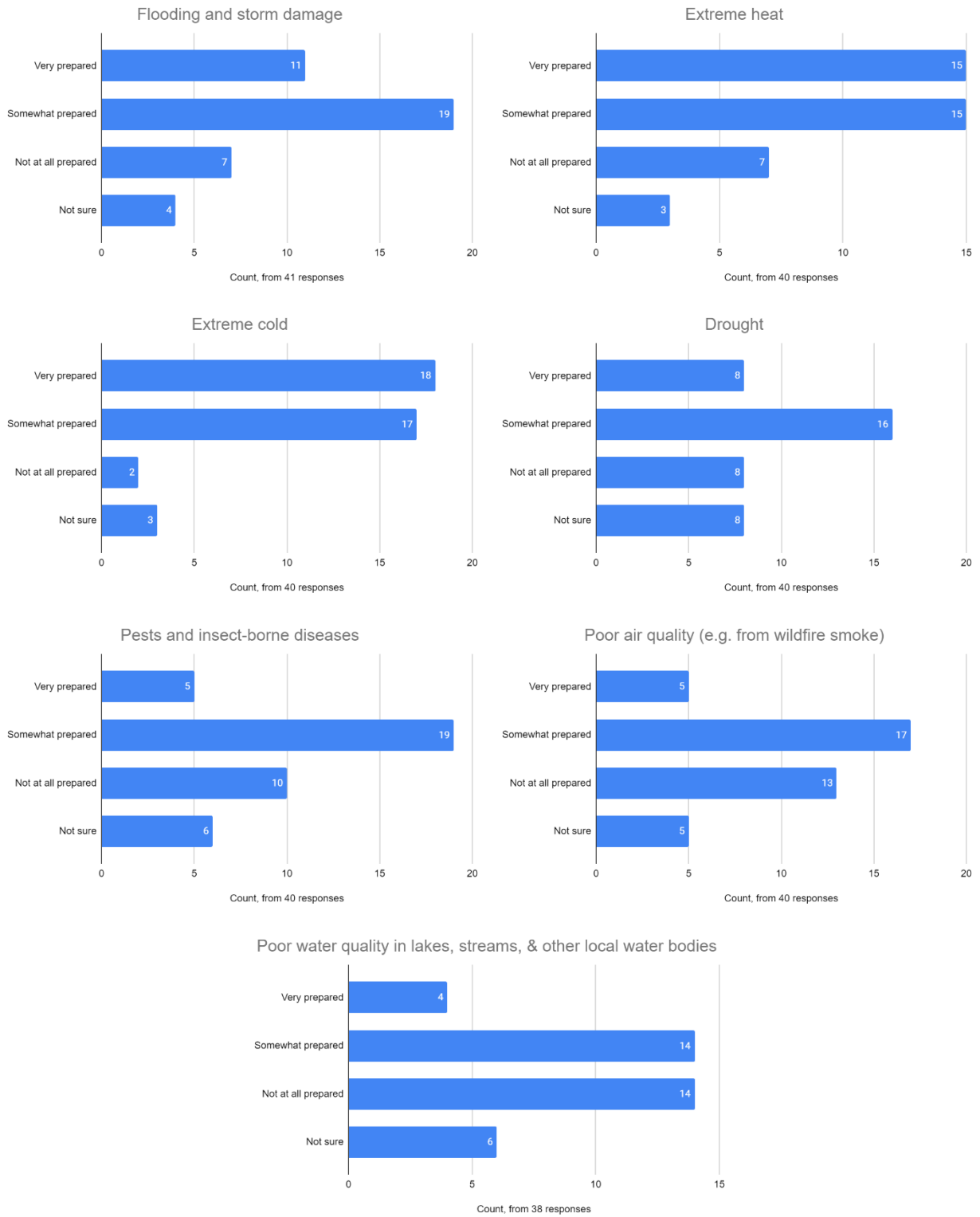
9. Are there any other details that you would like to share about climate-related disruptions you have been experiencing?

<b>Are there any other details that you would like to share about climate-related disruptions you have been experiencing?</b>
<a href="https://climate.nasa.gov/">https://climate.nasa.gov/</a>
Brown tail moths are in Norway.
I checked two too hot items, but I don't think it has been any hotter than other temps I've seen here in the past. But that is not the real issue.
I moved to Norway from Colorado due to climate change impacts there. Extreme heat, drought, poor air quality in summers due to western forest fires
It is a constant source of stress. We live in a low-lying area and have not flooded yet but expect we may and are looking to move to higher ground. This has a significant financial and mental health impact.
Recreational trails have had severe damage from heavy rain and wind
The severity and frequency of rain events has increased
These scares that you present are weather (underlined) related. Look at weather (UL) history. These events have occurred in the past and will again. Current policies causing extreme energy pricing is causing severe effects economically. People cannot (UL) afford food because of the price of gas. The price of gas is directly related to these incorrect "climate change" assumptions closing gas refineries. This will worsen greatly soon. Few (UL) can afford electric vehicles or charging stations.
In response to "how concerned are you about the following hazards...": All these issues can be handled as in the past.
When the power goes out because of severe storms -- this is dangerous

10. In general, how concerned are you about the following hazards in Norway?



# 11. In general, how prepared do you feel for the following hazards in Norway?



12. How could the town of Norway help the community be more resilient to climate hazards?

How could the town of Norway help the community be more resilient to climate hazards?
- Make services/places available to people affected by severe weather. I am concerned about health risks to vulnerable populations.
- Provide frequent educational forums and info in the newspaper and on social media
. .Be more pro active
Be forward thinking in zoning and in current road repair and future road building
Be proactive
By not supporting highly inefficient energy systems such as solar. My electric bill has tripled (UL) in the past 3 years due to the requirement to rely on "clean" energy. It is simply unaffordable and very unreliable especially in Maine.
By reducing our carbon footprint, teaching children about climate change and brainstorming as a community to help each other.
Continue to advocate, answer concerns, and have good equipment
Develop public transit to lessen vehicle emissions in public areas, support and promote pedestrian and bicycle travel/infrastructure
Do not allow large amounts of water to be taken from local lakes for swimming pools
Encourage energy conservation
Establish no wake rules when water levels are high, establish strict rules regarding use of wakeboard boats (they erode the shoreline), maintain strict standards for preventing the introduction of invasive species via boat, establish solid practices for invasive species control (beyond LAON volunteers), monitor and control water flows into lakes to identify erosion/silt/invasive species/bacteria and algae.
Establishing more Solar opportunities for power.
Get more folks going with an electric lifestyle
Keep out of it and reduce tax bills
Lower energy costs somehow, flood mitigation.
Public service announcements, maybe a handout.
Regular road inspections and repairs of small issues before they become large, expensive issues.
Review building codes to ensure that adequate energy efficiency standards are mandatory in new construction. Sponsor no/low interest loans for heat pumps. Ban phosphorus containing fertilizers. Continue efforts towards making our town more walkable/bikeable -wider sidewalks, more bike lanes. Community participation in No Mow May!
Stop wasting money on a problem that does not exist.
The more people, the more will be affected, the more problems. SEVERELY LIMIT GROWTH is the best answer to that question.

The town could shift all public buildings to renewable energy sources. It could rebuild roads to be better prepared for intensive storms and to encourage electric vehicles like Bikes. The town could be an educational leader to teach people about climate challenges and to promote local solutions like resilient agriculture both commercially and domestically.

The town has had to do a lot of road repairs due to heavy rain events and flooding. It needs to be prepared for higher than normal highway costs.

The town needs to expand shade trees on Main St. & downtown in general. Several large trees have been taken down on Main St. recently without replacements. Main St. risks becoming an urban heat island if shade is not expanded. Existing trees need to be cared for and new ones planted. No tree should be removed unless all alternatives to the removal have been exhausted and a replacement tree has been obtained. Shade is becoming a precious commodity! At the very (UL) least there should be no net loss of trees.

This pre-planning process is exactly what's needed now!

Watershed issues contributing to runoff into our lakes needs to be a priority with appropriate expertise and funding. Degradation of water quality in Norway's lakes will have a negative effect on their attractiveness for recreational activities and with therefore have a negative economic impact due to decreases in property value.

### 13. Is there anything else you would like to share related to the topic of climate vulnerability?

#### Is there anything else you would like to share related to the topic of climate vulnerability?

First, I would say answers to the survey might depend on age/health of the respondent. Specifically, I am 76 and have an incurable (but treatable) cancer. I'll be very surprised if I'm still here when things get permanently really bad. This year has been very unusual, but is it a sign of things to come or just a blip for now? Second, thinking (way?) ahead, if Norway manages to become an island of survivability when things do get really bad, and other places that haven't planned ahead hear about Norway, you will need an army to protect the town.

Our infrastructure comes to mind, specifically how this year I've seen road access be disabled due to erosion or active overflow of water. Focusing and prioritizing permeable surfaces and alternative modes of transportation (walking & cycling) would be beneficial for more than just the reliability of our transportation systems.

The only thing I am vulnerable for are the insane amount forests being cut for so called clean energy.

We all need to use less energy

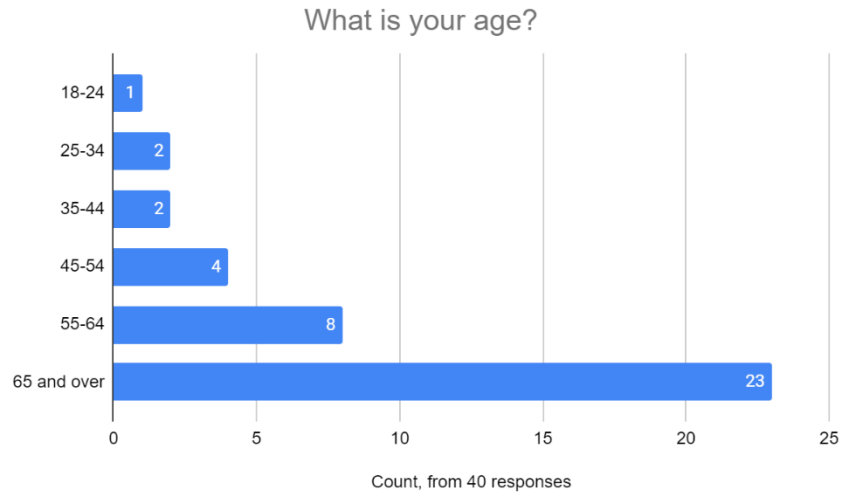
. . Get on it •

Please stop/slow the economic pain that is being inflicted on Mainers with these frightful and cruel and unsupported policies and laws. Don't make people choose between food and "climate change" (UL)

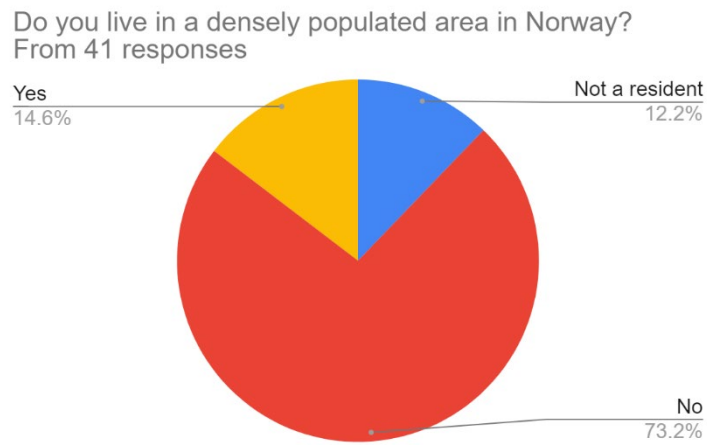
Not directly related to climate, but attention needs to continue to be paid to the prevention of invasive plants like milfoil in our lakes and the resources available to deal with it should they be identified.

It's real!

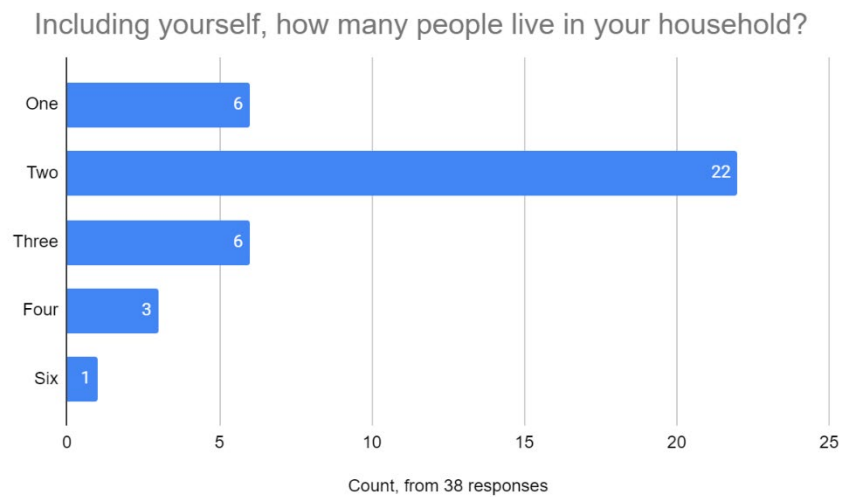
14. What is your age?



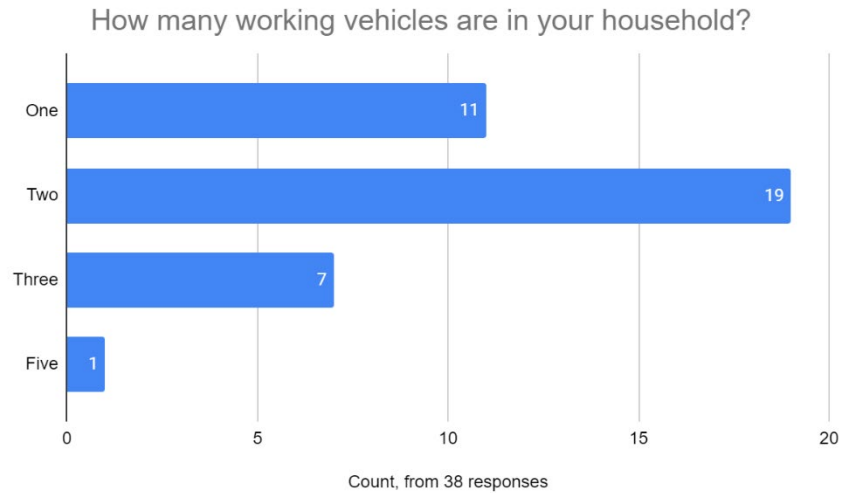
15. Do you live in a densely populated area in Norway?



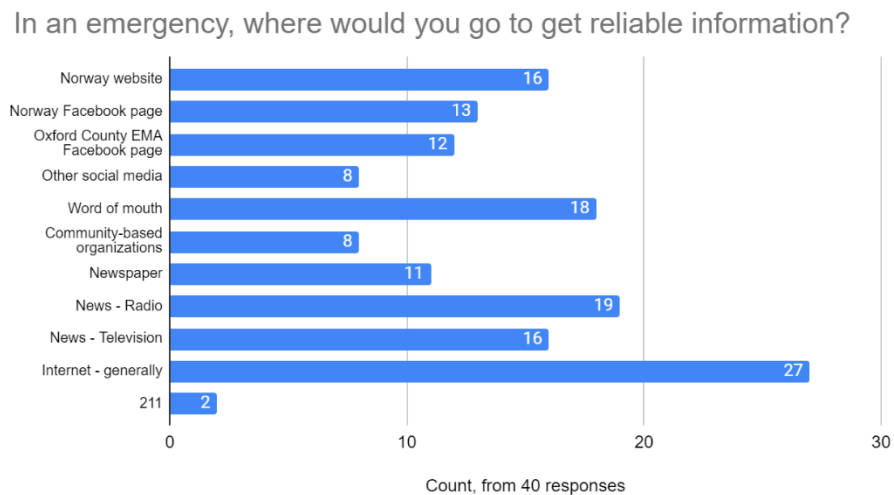
16. Including yourself, how many people currently live in your household?



17. How many working vehicles are in your household?



18. In an emergency, where would you go to get reliable information? Select all that apply.



19. Would you like to name your source for reliable information? (E.g. a specific church, Facebook group, website, etc.).

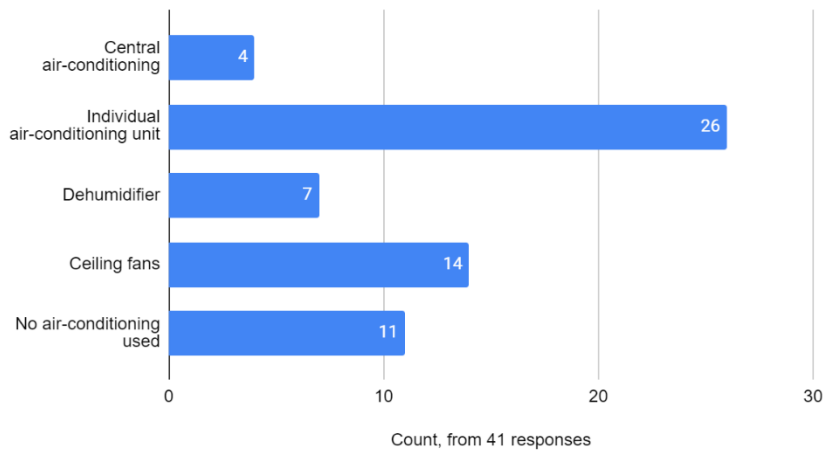
Would you like to name your source for reliable information?
<a href="https://hwp-viz.gsd.esrl.noaa.gov/smoke/index.html">https://hwp-viz.gsd.esrl.noaa.gov/smoke/index.html</a>
I use all -- + discern. Internet--
Local friend group
Maine news center, Maine DOT, Oxford county site or their Facebook page
Maine public broadcasting
Maine Public Radio
None reliable in my opinion



Norway Police, town Facebook, ox county emergency
NPR
Self
Sun Journal, msn website and NPR radio
Town Fb page
WGME 13 Website, NPR
Norway Memorial Library
Town of Paris website

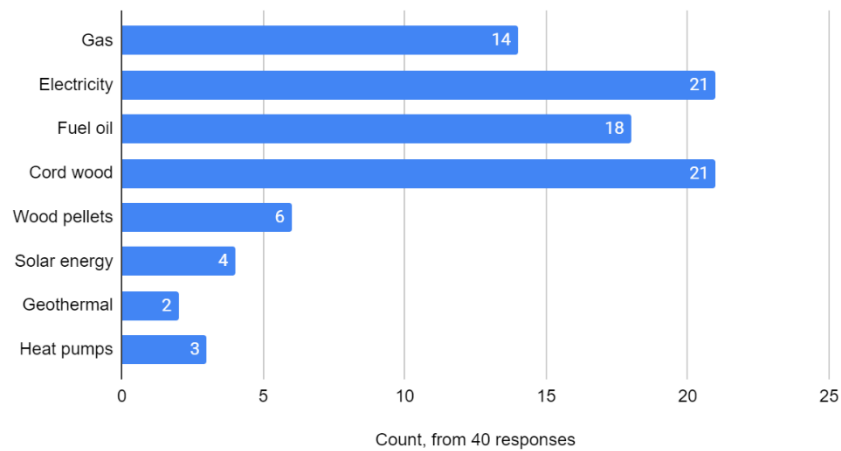
20. Which air-conditioning equipment do you use to cool your home?

Which air-conditioning equipment do you use to cool your home?



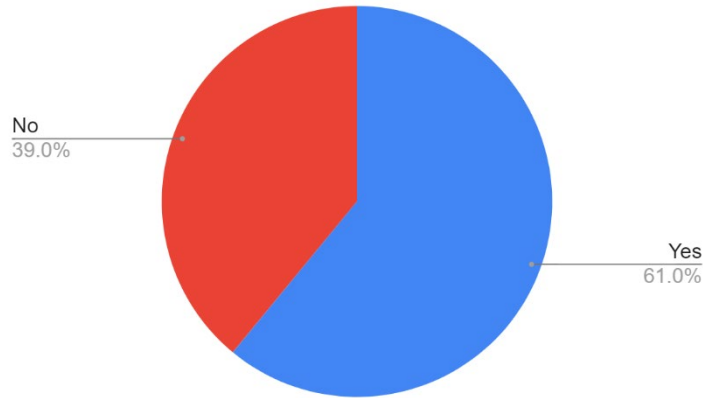
21. Which fuel(s) do you use to heat your home? Select all that apply.

Which fuel(s) do you use to heat your home?



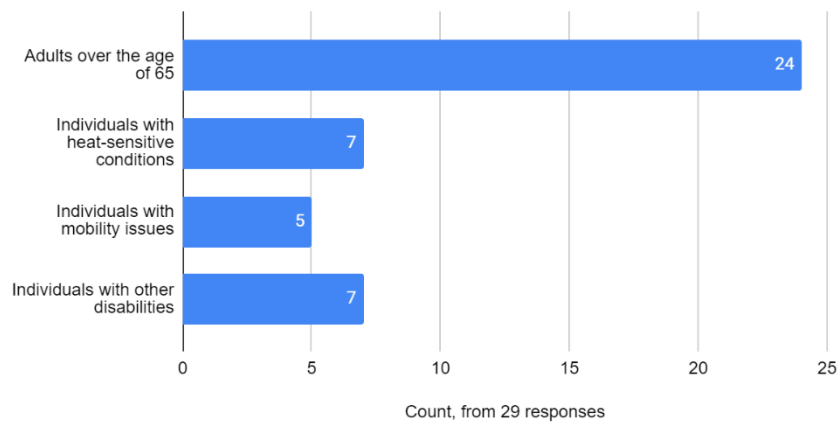
22. Do you own a generator for your home?

Do you own a generator for your home? From 41 responses



23. Including yourself, does your household include any of the following individuals?

Including yourself, does your household include any of the following individuals?



24. What is your annual household income?

What is your annual household income?

