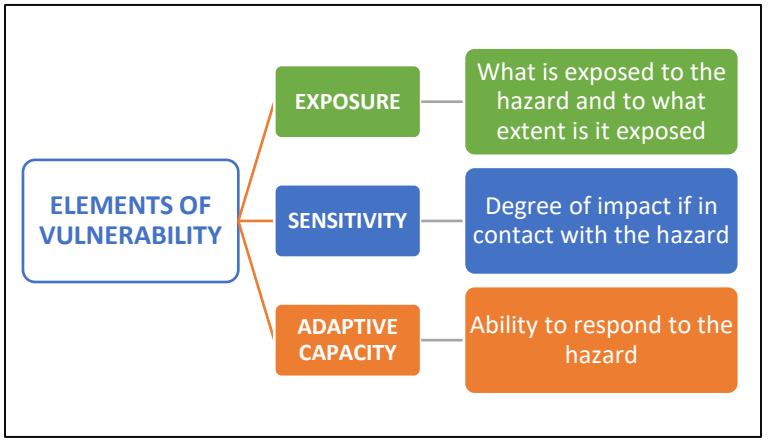
Southern Maine CAP Cohort: Climate Change Vulnerability Assessment Framework

Introduction to Climate Change Vulnerability Assessment

One of the first steps to understanding how communities can plan for and address climate change impacts is to assess climate hazards that are projected to impact an area as well as the things, people, and places that are vulnerable to those hazards. **Climate vulnerability is commonly defined** as the product of **exposure** to climate hazards, **sensitivity** of the built, social, and natural systems to those hazards, and the **adaptive capacity** of those systems for responding to change and stressors. Evaluating vulnerabilities, including what will be impacted by climate hazards, and to what extent those impacts will occur, provides a baseline for developing targeted strategies, measures, and solutions for reducing vulnerabilities.



The Climate Action Planning (CAP) Cohort project team will conduct a vulnerability assessment for each Cohort community to assess the impacts of climate hazards to the community. The team proposes to use a mix of quantitative and qualitative information and a combination of historical data, trends, and future projections to assess impacts of the following hazards:

- Flooding from sea level rise and storm surge
- Precipitation and extreme storms
- Extreme temperatures
- Drought
- Changing marine conditions

The assessment will evaluate impacts of those hazards to the built, social, and natural environment; public health; and the economy. Proposed assessment outputs, or end products, include maps of the locations of hazards and impacted assets, tabular data summarizing impacts, and narrative descriptions of impacts and vulnerabilities. The scope of the assessment will largely be dictated by the needs of the Cohort communities and the availability of locally relevant, accurate data. The 'desktop' vulnerability assessment will generate quantitative-based information about climate hazard exposure within each Cohort community. **Information about adaptive capacity and sensitivity, which is usually more qualitative in nature and not always readily captured by state or national datasets or numeric data, will be provided by each community Task Force and the broader community through engagement activities.**

Climate Scenarios and Planning Horizons

The project team proposes to use the years 2030 and 2050 as planning horizons for this vulnerability assessment. In other words, the assessment will consider the climate impacts and conditions that are projected to occur in the years 2030 and 2050. The assessment will also consider projected climate conditions for the year 2100 when it makes sense. These planning horizons are consistent with those used for the CAP Cohort greenhouse gas inventories as well as the State's Climate Action Plan, *Maine Won't Wait*. Additionally, the scenarios have been used by SMPDC in recent regional coastal resilience planning projects and assessments, from which the project team will draw for the CAP Cohort assessments.

The assessment will utilize climate projections that are based on Representative Concentration Pathways (RCPs), or greenhouse gas concentration trajectories, adopted by the Intergovernmental Panel on Climate Change (IPCC) in its climate assessments and reports. The project team proposes to use the range of climate projections associated with RCP 4.5, which represents a future where the Paris Agreement target of 1.5C of additional warming has been met, and RCP 8.5, which represents a "business as usual" future. Currently, the global community is not on track to meet the Paris Agreement target, so RCP 4.5 is looking more unlikely and future conditions in Maine will likely fall somewhere between the two RCPs.

Climate Change Vulnerability Assessment Framework

Climate Hazard	Impacts / Assets	Assessment Output	Data Source*
			**Task Force knowledge and community input are key data sources that will supplement all of the data sources listed*
Flooding from Sea Level Rise & Storm Surge	Flooding	• Maps of sea level rise and storm surge inundation boundaries • Maps of flood depths projected with sea level rise and storm surge • Maps of the 1% annual chance (*i.e.* 100-year) storm event	• Maine Geological Survey (MGS) *(Assessment will focus on sea level rise scenarios that are consistent with ME Climate Council 'commit to manage' scenarios with the addition of storm surge (i.e. 1.5 ft and 3.9 ft plus storm surge from the 1% annual chance storm event))* • Maine Climate Council reports • FEMA • First Street Foundation Flood Factor • Maine Climate Council Scientific and Technical Subcommittee • SMPDC coastal resilience assessments (*Climate Ready Coast – Southern Maine, Economic Resilience Assessment & Plan, Tides, Taxes, & New Tactics study)*

	Property	• # of parcels impacted
		• "use" of impacted parcels *(e.g.,* commercial, residential, conserved, *etc.)*
		• Ownership type *(e.g.,* municipal, state, private, *etc.)* of impacted parcels
		• Assessed value of impacted property
		  ○ Assessed value as % of municipal budget
			• Municipal data
			  ○ Parcels/land use
			  ○ Assessor's tables
			  ○ Infrastructure
			  ○ Septic

Climate Hazard	Impacts / Assets	Assessment Output	Data Source*
		• Historic structures and sites	

	Infrastructure
	• Roads
	• Evacuation routes
	• Critical facilities
		• Name and # of roads impacted
		• Classification of roads
		• Miles of roads impacted
		• Culverts that are existing and/or future tidal barriers
		• Location of coastal engineering structures
		• Evacuation routes impacted
		• Critical infrastructure and facilities exposed to flooding
		  ○ Water infrastructure
		  ○ Wastewater infrastructure
		  ○ Emergency service centers and shelters
		  ○ Energy infrastructure
		• Transit routes and stops impacted
		• General information about saltwater intrusion, groundwater rise, and impacts to subsurface infrastructure (findings from NH assessment)
			• Maine Dept. of Transportation
			• US Dept. of Homeland Security power grid infrastructure
			• ISO New England maps of energy infrastructure
			• Local transit providers (YCCAC, KACTS, PACTS)
			• Maine & York County Emergency Management Agencies
			• MGS Coastal Structure and Dune Crest Overtopping Potential
			• Maine Coastal Program Tidal Restriction Atlas
			• Maine Historic Preservation Commission
			• National Register of Historic Places
			• New Hampshire groundwater rise modeling (J. Knott)

	Social	• Populations with elevated social vulnerability • Social service locations *(overlapping info with infrastructure category)* • Linkages to housing – affordability, quantity, condition, etc.	• US Census • The Nature Conservancy Coastal Resilience Tool – Maine Social Vulnerability Index (E. Johnson)

	Natural environment	• Current tidal marshes and future marsh migration areas
		• Significant habitats (vegetation and wildlife)
		• Conserved lands
		• Areas and rates of erosion and shoreline change
		• Environmentally sensitive areas impacted
			• Maine Natural Areas Program
			  ○ current tidal marshes
			  ○ potential marsh migration
			  ○ Conserved lands
			• NOAA Environmental Sensitivity Index
			• Maine Dept. of Inland Fisheries and Wildlife Beginning with Habitat
			• Maine Geological Survey shoreline change data – State of Maine's Beaches Report

Climate Hazard	Impacts / Assets	Assessment Output	Data Source*
			• Maine Dept. of Environmental Protection Environmental and Geographic Analysis Database • NOAA land cover carbon sinks
	Economic	• Location and # of coastal public access points • Impacts of inundation to working waterfronts • Description of economic hubs/downtown areas impacted by inundation	• Maine Dept. of Marine Resources • Maine Bureau of Parks and Lands boating facilities data
Precipitation & Extreme Storms	Water quality and quantity • Stormwater • Flooding • Public health	• Precipitation trends and projections ○ Rain and snow • Storm frequency data • Impaired waterbodies	• Maine Climate Council reports • NOAA National Weather Service • Maine Dept. of Environmental Protection • Maine Dept. of Inland Fisheries and Wildlife impervious cover data • U Maine - Maine's Climate Future
	Power outages	• Outage data from past storm events • General economic impacts of power outages • Social/public health impacts of outages	• Central Maine Power • Kennebunk Light and Power
	Economic	• Local and general economic impacts of storms	• Maine Climate Council Reports • SMPDC Economic Resilience Plan and Assessment for Coastal York County
Extreme Temperatures	Air temperatures	• Temperature trends and projections • # of high-heat days • Location and severity of heat islands • Seasonal shifts	• Trust for Public Land heat island model & data • NLCD and Maine Office of GIS tree cover data
	Public health	• Impacts to public health and socially vulnerable populations (*e.g.,* heat stress, *etc.*) • Air quality and associated impacts to public health (*e.g.,* air pollution, allergens – historical data, trends, #days of standard exceedances, *etc.*)	• Maine Climate Council Scientific reports • Maine Center for Disease Control tracking network data portal • US Census • The Nature Conservancy Coastal Resilience Tool – Maine Social Vulnerability Index (E. Johnson) • Maine Dept. of Environmental Protection

Climate Hazard	Impacts / Assets	Assessment Output	Data Source*
		• General information about vector-borne diseases	
	Natural environment	• General information about shifting species ranges and impacts to biodiversity • General information about invasive species	• Maine Climate Council Scientific reports • Northeast Regional Invasive Species and Climate Change Network
Drought	Public water supplies and private wells	• # of drought days and severity of drought • Relation to wildfires and general information about wildfire risk • General information about public health impacts • Impacts to socially vulnerable populations	• US Drought Monitor • Maine Climate Council Scientific reports • Maine Drought Task Force • Maine Farmland Trust • Maine Organic Farmers and Gardeners • UMaine Cooperative Extension
	Impacts to water quality and quantity		
	Public health		
	Agriculture	• Growing season trends and projections • Food security	
Changing Marine Conditions	Ocean acidification	• Trends and projections for the Gulf of Maine • Impacts to commercial and recreational fishing industry and aquaculture industry ○ Current # of commercial and recreational licenses • Shifting marine species • Current areas of shellfish harvesting • Harmful algal blooms • General information about the local marine economy	• Maine Climate Council reports • NASA Earth Observatory • UMaine - Maine's Climate Future • Maine Department of Marine Resources • NOAA
	Ocean temperature		
	Economic		

Assessing Social Vulnerability to Climate Change

The vulnerability assessment will use a combination of quantitative and qualitative data to examine aspects of social vulnerability across all climate hazards. The Maine Social Vulnerability Index (SVI) (a percentile ranking of vulnerability calculated by census block group and based on 17 socioeconomic and demographic factors including household income, educational attainment, race, ethnicity, age, no vehicle, employment status, etc.), US census data, and indicators of social vulnerability will be utilized to better understand the demographic makeup of each Cohort community and assess where socially vulnerable populations are located in relation to climate hazards. Additional resources that the project team will consult include the EPA EJScreen Tool, CDC Social Vulnerability Index, and the Council on Environmental Quality Climate and Economic Justice Screening Tool.

The following demographic information and vulnerability indicators will be utilized to quantitatively assess social vulnerability and adaptive capacity. This information will likely be presented at the community level and block group level. Some demographic categories and indicators will be presented in concert to better understand geographic location and distribution of compounding vulnerabilities (e.g., population over the age of 65 without a vehicle). Information about social adaptive capacity and sensitivity will be gleaned from the quantitative data and assessment and will be supplemented and contextualized with information gathered from the Task Force and community members through engagement approaches.

- Age
  - Population under 18 and 65+
- Household income
  - Below national poverty level
  - Below US EPA (2021) climate change and social vulnerability threshold of $51,500 for household income
  - Below state, county, and community median income
- Employment status
  - Unemployment rate
- Vehicle ownership
- Housing tenure and characteristics
  - Owner and renter occupied
  - Mobile home
  - Multi-unit
  - Year built
- Household size and type
  - Single-parent household
  - Living alone
- Educational attainment
- Poverty
- Language
- Race & ethnicity
- Disability status
- Access to internet