Heat Vulnerability Index (2026) Methodology

The New York State (NYS) Department of Health created the Heat Vulnerability Index (HVI) for NYS excluding New York City to help local and state public health officials, residents, and other stakeholders identify and map areas with larger populations of people who may be more vulnerable to heat.

In 2026, the Department revised the HVI based on the Intergovernmental Panel on Climate Change's climate vulnerability framework of exposure, sensitivity, and adaptability. Fourteen indicators were derived from downscaled Parameter-elevation Regressions on Independent Slopes Model (PRISM) gridded climate data, the US Census Bureau American Community Survey and NYS Statewide Planning and Research Cooperative System data. Indicators were then grouped based on three factors (heat exposure, sociodemographics, and health outcomes) known to increase vulnerability to heat. Indicators were used to calculate scores for the three factors of vulnerability. An overall HVI score was calculated from the three factor scores for each area.

Heat Vulnerability Index Framework		
Heat Exposure	**Sociodemographics**	**Health Outcomes**
Average Maximum Heat Index (°F), May-September (2012 – 2021)	Black or African American	Asthma Emergency Department Visits
	Population With a Disability	COPD Emergency Department Visits
Trend in Number of Days Each Year Above Heat Index 85°F Since 2000	Ages 65 Years and Over and Living Alone	Heart Attack Hospitalizations
	Living Below 200% of Poverty Level	Diabetes Hospitalizations
	Ages 5 Years and Over with Limited English	Acute Kidney Failure Emergency Department Visits
	Employed in Outdoor Industries	
	Population Without Health Insurance	

Heat Exposure Factor Score

Daily maximum heat index derived from 4km PRISM gridded maximum temperature and maximum vapor pressure deficits for 2020 census tracts were analyzed for all tracts containing landmass outside of New York City (n = 3,069). Two indicators were calculated: the average maximum daily heat index between May and September from 2012-2021, and the trend in the number of days with a maximum heat index above 85°F each year since 2000. While related, these indicators represent the magnitude of exposure current summer temperatures in a tract and how quickly temperatures have

warmed in the past two decades. The 85°F benchmark is based in part on research showing elevated risk of adverse health impacts for New Yorkers at this temperature.

The Heat Exposure Factor Score was created by individually ranking each indicator variable and calculating its percentile rank. Then, the percentile rank values were added together. Finally, the resulting summed percentiles were ranked, and a final percentile was calculated. The Heat Exposure Factor Score ranges from 0 to 100; higher scores indicate greater risks of experiencing high summer temperatures and an expected additional day above 85°F each year, while lower scores indicate lower summer temperatures and an additional day above 85°F every 10 years or more.

Sociodemographics Factor Score

To measure the ability of the population to adapt to instances of high temperatures, seven sociodemographic indicators from the American Community Survey 5-Year Data for 2018-2022 capturing individual and community features were identified for inclusion in a Sociodemographics Factor Score. To arrive at these indicators, a list of possible indicators was drawn up based on the previous NYS HVI, other national and state-level indexes for social vulnerability or heat vulnerability, and research on heat vulnerability. Statistical and geospatial analyses were performed to minimize statistical and spatial correlations between indicators.

The seven sociodemographic indicators from the American Community Survey included in the HVI are: Percent of Population that is Black or African American (B02009), Percent of Population 65 Years and Over Living Alone (B09020), Percent of Population With Income Below 200% of the Poverty Level (C17002), Percent of Population Ages 5 and Older Which Speaks English “Less than Well” (DP02), Percent of Civilian Workforce Employed in Outdoor Sectors (S2403), Percent of Civilian Noninstitutionalized Population Without Health Insurance (S2701), and Percent of Population With a Disability (B18101).

Census tracts with a total population below the 1st percentile of populated census tracts (population = 854) were excluded from calculations to prevent areas with small population numbers from having an oversized impact on the final score. Census tracts with more than 50% of the population living in group quarters were also excluded as these areas typically contain universities, correctional facilities, nursing homes, and military barracks with populations excluded from certain demographic variables and facing vulnerabilities different from the general population.

The Sociodemographic Factor Score was created by individually ranking each indicator variable and calculating its percentile rank. Then, the percentile rank values were added together. Finally, the resulting summed percentiles were ranked, and a final percentile was calculated. Sociodemographic Factor Score values range from 0 to 100. A higher Sociodemographics Factor Score indicates a lower ability to adapt to high temperatures and higher vulnerability.

Health Outcomes Factor Score

NYS Department of Health uses aggregated sub-county areas based on census tracts to calculate rates of certain health outcomes. Aggregating tracts within a county to present this data protects the privacy of those living in areas with small populations and ensures the calculated rates are more stable. To arrive at an estimate of the portion of

the population with higher physiological vulnerability to heat, five health outcome indicators known to be exacerbated by high temperatures were included: asthma, COPD, heart attacks, diabetes, and acute kidney failure. Rates of emergency department visits or hospitalizations for 2018-2022 were calculated for populated sub-county areas outside of New York City not considered an area of special interest and with less than 50% of the population living in group quarters for a total of 1,012 areas.

The Health Outcomes Factor Score was created by individually ranking sub-county area rates and calculating their percentile rank. Then, the percentile rank values were added together. Finally, the resulting summed percentiles were ranked, and a final percentile was calculated. Most sub-county areas are comprised of multiple census tracts. To align with indicators for the other two Factors, each census tract was assigned the Health Outcomes Factor Score for the sub-county area in which it is located. The Health Outcomes Factor Score ranges from 0 to 100. A higher Health Outcomes Factor Score value corresponds to an estimated greater portion of the population with increased health sensitivity to heat. Group quarter, zero population, and special interest tracts do not receive a health outcomes factor score.

Heat Vulnerability Index

The overall HVI sums together the scores for each vulnerability factor and scales this sum by percentile to produce the Heat Vulnerability Index with values ranging from 0 to 100 which designates the level of vulnerability in one area compared to the rest of the state. The overall HVI reflects how vulnerable a population is to heat based on their social and demographic attributes, the overall disease burden for select heat-sensitive health outcomes, and the exposure to higher temperatures. High values of heat vulnerability indicate the potential for increased vulnerability in those areas, while lower values of heat vulnerability represent the opposite, though lower vulnerability scores do not mean individuals are not vulnerable.

The inclusion of exposure vulnerability means areas which may have been considered at “High Risk” under the previous HVI due to their socio-demographic and land use features may now be classified much lower if they do not experience high summer temperatures or increasing number of days above 85°F or if they do not have relatively higher health burden, whereas some areas of the state which may have previously been classified as at lower risk may now be considered at higher risk due to their exposures to high summer temperatures or if they have relatively higher health burden.

Data Sources

- Oregon State University PRISM Group (2026). *PRISM Time Series Data* [Data set]. Northwest Alliance for Computational Science & Engineering. https://prism.oregonstate.edu/data/
- U.S. Census Bureau. (2023). *American Community Survey (ACS) 5-year estimates* (2018-2022) [Data set]. https://www.census.gov/programs-surveys/acs.html
- New York State Department of Health (2026). *Statewide Planning and Research Cooperative System (SPARCS)* (2018-2022) [Data set]. New York State Department of Health. https://www.health.ny.gov/statistics/sparcs

Resources

Heat Exposure

- Spangler, K. R., Weinberger, K. R., & Wellenius, G. A. (2019). Suitability of gridded climate datasets for use in environmental epidemiology. *Journal of exposure science & environmental epidemiology*, 29(6), 777-789. https://doi.org/10.1038/s41370-018-0105-2
- Bernard, T. E., & Iheanacho, I. (2015). Heat index and adjusted temperature as surrogates for wet bulb globe temperature to screen for occupational heat stress. *Journal of Occupational and Environmental Hygiene*, 12(5), 323–333. https://doi.org/10.1080/15459624.2014.989365
- Daly, C., Smith, J. I., & Olson, K. V. (2015). Mapping atmospheric moisture climatologies across the conterminous United States. *PLOS ONE*, 10(10), e0141140. https://doi.org/10.1371/journal.pone.0141140

Sociodemographics

- Nayak, S. G., Shrestha, S., Kinney, P. L., Ross, Z., Sheridan, S. C., Pantea, C. I., Hsu, W. H., Muscatiello, N., & Hwang, S. A. (2018). Development of a heat vulnerability index for New York State. *Public Health*, 161, 127–137. https://doi.org/10.1016/j.puhe.2017.09.006
- New York State Energy and Research Development Agency. (2023). *Disadvantaged Communities*. https://www.nyserda.ny.gov/ny/Disadvantaged-Communities
- Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. (2024, December 16) *CDC/ATSDR Social Vulnerability Index 2022 Database United States.* https://www.atsdr.cdc.gov/placeandhealth/svi/data_documentation_download.html
- Environmental Defense Fund & Texas A&M University. (2023). *The U.S. Climate Vulnerability Index*. https://climatevulnerabilityindex.org/
- California Environmental Protection Agency Office of Environmental Health Hazard Assessment. (2026, January 1). *CalHeatScore*. https://calheatscore.calepa.ca.gov/
- Intergovernmental Panel on Climate Change (IPCC). (2023). *Climate Change 2022 – Impacts, Adaptation and Vulnerability: Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press. 2023. https://dx.doi.org/10.1017/9781009325844

Health Outcomes

- Adeyeye, T. E., Insaf, T. Z., Al-Hamdan, M. Z., Nayak, S. G., Stuart, N., DiRienzo, S., & Crosson, W. L. (2019). Estimating policy-relevant health effects of ambient heat exposures using spatially contiguous reanalysis data. *Environmental Health*, *18*(1), 35. https://doi.org/10.1186/s12940-019-0467-5

- Fletcher, B. A., Lin, S., Fitzgerald, E. F., & Hwang, S. A. (2012). Association of summer temperatures with hospital admissions for renal diseases in New York State: a case-crossover study. *American journal of epidemiology*, *175*(9), 907–916. https://doi.org/10.1093/aje/kwr417
- Chu, L., Chen, K., Crowley, S., & Dubrow, R. (2023). Associations between short-term temperature exposure and kidney-related conditions in New York State: The influence of temperature metrics across four dimensions. *Environment international*, *173*, 107783. https://doi.org/10.1016/j.envint.2023.107783
- Li, M., Shaw, B. A., Zhang, W., Vásquez, E., & Lin, S. (2019). Impact of Extremely Hot Days on Emergency Department Visits for Cardiovascular Disease among Older Adults in New York State. *International journal of environmental research and public health*, *16*(12), 2119. https://doi.org/10.3390/ijerph16122119
- Centers for Disease Control and Prevention (2025, September 18). *Clinical Overview of Heat and Cardiovascular Disease*. https://www.cdc.gov/heat-health/hcp/clinical-overview/heat-and-people-with-cardiovascular-disease.html
- Aydin-Ghormoz, H., Adeyeye, T., Hsu, W., & Muscatiello, N. (2025). Assessing Heat-Health Vulnerability Through Temporal, Demographic, and Spatial Lenses: A Time-Stratified Case-Crossover Analysis in New York State. *International journal of environmental research and public health*, *22*(7), 1124. https://doi.org/10.3390/ijerph22071124