

Maryland Department of the Environment: MDEnviroScreen Documentation

Version 3

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1. Introduction

The Maryland Department of the Environment (MDE) is dedicated to protecting and restoring the environment to ensure the health and well-being of all Maryland residents. Recognizing the disproportionate environmental burdens experienced by communities with environmental justice (EJ) concerns, MDE strives to reduce inequities while preventing the creation of new disparities.

MDEnviroScreen is a tool used to help identify communities disproportionately burdened by multiple sources of pollution and with population characteristics that make them more sensitive to pollution. MDEnviroScreen houses the EJ Score, Climate Vulnerability Score, Child Poverty Map, and Overburdened and Underserved Maps. Unlike national EJ screening tools, MDEnviroScreen is specifically tailored to the state's needs, relying on census tract-level data to provide localized insights. This document outlines the methodology and application of MDEnviroScreen, enabling users to understand its functionality and purpose.

The MDEnviroScreen EJ score represents a combined measure of pollution and the potential vulnerability of a population to the effects of pollution. The EJ score in MDEnviroScreen does not include indicators of race/ethnicity, language proficiency, or age. However, MDE recognizes the relationship between racial demographics and pollution burden. Collecting this data and analyzing this relationship can be used to better understand issues related to environmental justice and racial equity in Maryland.

The Climate Vulnerability Score (CVS) identifies communities disproportionately affected by climate impacts at the census tract level using the EJ Score and four additional climate variables. Together, these datasets define climate vulnerability as a function of climate exposure and community impact to classify percentile scores as baseline, low, moderate, or high vulnerability.

Understanding Environmental Justice

What is Environmental Justice?

Environmental justice is the principle that all Maryland residents—regardless of race, color, national origin, or income—should have equal opportunities to enjoy a healthy environment and quality of life. Assessing whether equal protection is applied remains a challenge, particularly in communities disproportionately affected by polluting facilities.

Research shows that health disparities exist between demographic groups in the U.S., with differences in mortality and morbidity tied to race/ethnicity, income, and education levels. These disparities underscore the importance of ensuring that affected residents can participate meaningfully in decisions that impact their environment, including the permitting process for sources of pollution.

To further this goal, Maryland enacted House Bill 1200, enhancing MDE's commitment to addressing environmental inequities through diversity, equity, and inclusion.

Overview of House Bill 1200 (Md. Code, Envir. § 1–601(a))

What does Md. Code, Envir. § 1–601(a) require?

Effective October 1, 2022, House Bill 1200 mandates:

- Permit applicants must include an EJ Score for the census tract where a project is proposed as part of the application.
- MDE must review the EJ Score during the permitting process.
- Public notices must include information about EJ Scores to promote transparency and community engagement.

MDEnviroScreen’s EJ Score is a specialized application developed in accordance with House Bill 1200 to identify and prioritize communities with EJ concerns. Using a percentile-based scoring system, the EJ Score analyzes three primary categories of environmental and demographic data:

- Pollution burden exposure
- Pollution burden environmental effects
- Sensitive populations (including socioeconomic data)

Overview of Climate Solutions Now Act (Md. Code, Envir. § 1-702)

What does Md. Code, Envir. § 1-702 require?

The Climate Solutions Now Act, mandates the creation of “a methodology for identifying communities disproportionately affected by climate impacts.” The law specifies the inclusion of:

- Underserved communities
- Overburdened communities
- Areas that are vulnerable to climate impacts, such as flooding, storm surges, and urban heat island effects

The Climate Vulnerability Score meets these requirements and includes additional drought and tree canopy cover data not named in the legislation. MDE added this additional data following consultation with the Commission on Environmental Justice and Sustainable Communities (CEJSC) and the University of Maryland Department of Community Engagement, Environmental Justice, and Health (CEEJH). These layers address Maryland’s unique geographical impact concerns to better support equity and resilience in communities disproportionately affected by climate impacts.

The Climate Solutions Now Act also defines “overburdened” and “underserved” to support the development of a map layer that utilizes equity and geographical impact remedies as key principles. The Climate Vulnerability Score incorporates the EJ Score as a proxy for overburdened and underserved status and analyzes two primary categories of data:

- Climate Exposure (Urban Heat Island, Flooding and Storm Surge, Drought)
- Community Impact (Tree Canopy Cover and EJ Score)

2. Purpose and Application

The Maryland EJ Screen Tool serves as a critical resource for:

- **Policymakers:** Identifying areas with high environmental burdens and informing equitable decision-making processes.
- **Community Members:** Understanding local environmental conditions and advocating for improvements.
- **Regulatory Agencies:** Integrating EJ Scores into permitting and policy development to enhance transparency and inclusivity.

The tool's primary objectives are to:

1. Identify and address EJ concerns in decision-making processes.
2. Foster transparency and public engagement by incorporating EJ Scores into environmental permit applications.
3. Support climate resilience efforts by integrating vulnerability data to address emerging challenges.

State agencies should not use the "Underserved" map layer to decide who gets disadvantages (like facing more pollution, having fewer resources, or bearing more costs) or who receives advantages (like getting funding, better services, or fewer restrictions) when making decisions about permits, funding, or other rules.

3. How to Use MDEnviroScreen

Accessing the Tool

1. Visit the MDE website and navigate to the Environmental Justice page under the Quick Links menu on the left side of the Home page.
2. On the Environmental Justice page, navigate to the [MDEnviroScreen](#) Tool.
3. Click on "Launch MDEnviroScreen Tool" at the top of the page.
4. Enter the project's address in the search bar to generate an EJ Score report.
5. To view the Climate Vulnerability Score or the Child Poverty Map, click the buttons for each at the top right of the page to open a new tab.

Generating and Submitting Reports

- The census tract-level MDEnviroScreen Report includes a detailed EJ Score and additional contextual layers for understanding local environmental and demographic conditions.
- Permit applicants must include the Report in their submissions as mandated by House Bill 1200. This ensures compliance and highlights areas of concern.
- Applications lacking the MDEnviroScreen Report are deemed incomplete.

Community Engagement

Applicants are encouraged to:

- Provide context on environmental exposures and health impacts within the community.
- Engage proactively with local residents, especially in areas with high EJ Scores.

The underserved designation is for reference only and should not be used for assigning benefit or burden to a population.

4. Overview of Data in MDEnviroScreen

Categories of Analysis and Indicator Descriptions

Underserved

Socioeconomic/Demographic Indicators

- **Low-Income, Minority, and Limited English Proficiency Indicators:** Identify vulnerable populations facing compounded risks, according to the following criteria:
 - At least 25% of the residents qualify as low-income.
 - At least 50% of the residents identify as nonwhite.
 - At least 15% of the residents have limited English proficiency.

State agencies should not use the "Underserved" map layer to decide who gets disadvantages (like facing more pollution, having fewer resources, or bearing more costs) or who receives advantages (like getting funding, better services, or fewer restrictions) when making decisions about permits, funding, or other rules.

Overburdened

Pollution Burden Exposure

This category assesses potential exposure to pollutants using indicators above the 75th percentile statewide, including:

- **Particulate Matter (PM) 2.5:** Measures the concentration of fine inhalable particles. Prolonged exposure is linked to respiratory and cardiovascular health issues.
- **Ozone:** Tracks ground-level ozone levels, associated with respiratory conditions.
- **Diesel PM (AirToxScreen):** Highlights diesel particulate matter emissions and their health impacts.
- **Cancer Risk:** Quantifies long-term exposure risks to cancerous materials.
- **Respiratory Hazard Indices:** Quantifies long-term exposure risks to air toxins.
- **Traffic Proximity:** Assesses proximity to high-traffic areas and pollution sources.

- **Proximity to TRI Facilities and Hazardous Waste Sites:** Tracks exposure to pollutants from industrial and hazardous sites.

Pollution Burden Environmental Effects

This category evaluates environmental degradation and its effects, using indicators such as:

- **Lead Paint Presence:** Identifies houses build before 1960. This acts as a proxy for the total amount of lead paint one might be exposed to.
- **Proximity to RMP Facilities:** Highlights proximity to sites with chemical accident risks and contaminated redevelopment areas.
- **Proximity to Brownfields:** Highlights proximity to sites with chemical accident risks and contaminated redevelopment areas.
- **Wastewater Discharge:** Measures relative risk of a population being exposed to pollutants from wastewater that flows into rivers or other water bodies.
- **Emitting Power Plants and Mining Operations:** Evaluates exposure risks from significant pollutant sources.
- **CAFO:** Highlights proximity to concentrated animal feeding operations.

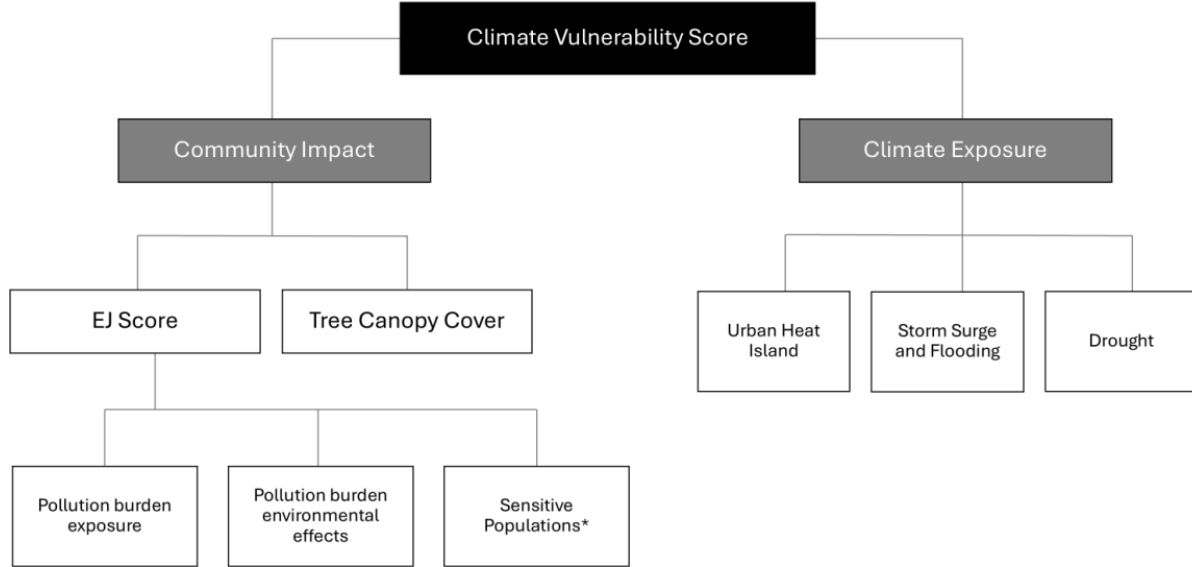
Sensitive Populations (including Socioeconomic Data)*

Sensitive populations and populations lacking access are identified based on health and infrastructure vulnerabilities, including:

- **Rates of Low-Birth-Weight Infants:** Reflects broader community health disparities.
- **Asthma and Heart Attack Discharges:** Tracks respiratory and cardiovascular health impacts.
- **Broadband Gaps:** Highlights areas with limited digital infrastructure.

*Low Income Percentile is grouped with sensitive populations for the EJ Score calculations.

Climate Vulnerability Score Indicators



*Low Income Percentile is grouped with sensitive populations for the EJ Score calculations.

Figure 1. Diagram representing the workflow of the Climate Vulnerability Score. Gray boxes represent a subindex. Note that EJ Score is used as a proxy for overburdened and underserved communities, does not include indicators of race, ethnicity, language proficiency, or age.

Climate Exposure Sub-index

This category assesses the degree of exposure to climate hazards using indicators such as:

- **Urban Heat Island:** Identifies certain areas of cities that are hotter than the average temperature for that same city based on heat severity.
- **Drought:** Maps the percent area and intensity of drought conditions over time from abnormal to exceptional.
- **Storm Surge and Flooding:** Identifies watersheds with significant existing and future flood impacts (coastal, riverine, pluvial) based on potential for run-off, risk to infrastructure, and historical and future flood risk.

Community Impact Sub-index

This category assesses the existing sensitivity and degree at which the affected community could mitigate the potential for harm using indicators such as:

- **Tree Canopy Cover:** The proportion (%) of each census tract covered by tree canopy, including over impervious structures, roads, and other impervious surfaces.
- **EJ Score:** Score is calculated using three indicators as a proxy for evaluating overburdened and underserved communities (Pollution Burden Exposure, Pollution Burden Environmental Effects, and Sensitive Populations).

Child Poverty Indicator

- **Children Under Poverty Line:** Percentage of children in the census tract living below the federal poverty level according to the 2023 ACS data.

Geographic Framework

MDEnviroScreen utilizes 2021 Census TIGER/Line data released on October 7, 2021 and the U.S. Census Bureau's American Community Survey (ACS) 2019-2023 estimates. Key features include:

- Analysis of 1,463 census tracts (excluding areas covered by water).
- Population and distance weighted geospatial analysis.
- Use of WGS 1984 Web Mercator (Auxiliary Sphere) spatial reference for mapping.
- The following geographic transformation was applied to the data layer before including in the application: NAD_1983_To_WGS_1984_1.

This geographic framework ensures accurate representation of Maryland's regions while incorporating updated boundaries and data.

5. Methodology

Primary Data Sources

- **U.S. Census Bureau:** Provides socioeconomic and demographic data essential for understanding community characteristics via the American Community Survey (ACS).
- **Environmental Protection Agency (EPA):** Supplies environmental burden indicators, including air quality, proximity to pollution sources, and environmental effects.
- **Maryland-specific datasets:** Tailored to address local issues, such as sensitive populations, climate vulnerability, and state-specific environmental concerns.
 - Water and Science Administration (WSA) part of Maryland Department of the Environment (MDE)
 - Maryland Department of Health (MDH)
 - Vital Statistics Administration (VSA) part of MDH
- **Chesapeake Bay Program (CBP):** Provides land use and land cover data to calculate tree canopy coverage.
- **The Trust for Public Land (TPL):** Supplies urban heat island severity data for U.S. cities.
- **National Drought Mitigation Center (NDMC), U.S. Department of Agriculture (USDA)** and the **National Oceanic and Atmospheric Administration (NOAA):** Supplies US drought impact data to inform percent area and intensity of drought conditions over time via the US Drought Monitor program (USDM).

Calculation Methodology

EJ Score Calculation

Pollution Burden Exposure

- **Summary:** Derived from EPA datasets, this indicator includes metrics such as particulate matter levels, ozone concentrations, and traffic proximity. Percentiles are calculated to identify areas exceeding the 75th percentile statewide.
- **Calculation:** $((\text{Particulate Matter (PM) 2.5 Percentile}) + (\text{Ozone Percentile}) + (\text{AirToxScreen Diesel PM Percentile}) + (\text{AirToxScreen Cancer Risk Percentile}) + (\text{AirToxScreen Respiratory Hazard Index Percentile}) + (\text{Traffic Proximity Percentile}) + (\text{Proximity to TRI Facility Percentile}) + (\text{Hazardous Waste Landfill Proximity Percentile})) / 8$

Pollution Burden Environmental Effects

- **Summary:** Data on lead paint presence, proximity to hazardous sites, and wastewater discharge is integrated from EPA and state databases, recalibrated to Maryland's geography.
- **Calculation:** $((\text{Lead Paint Indicator Percentile}) + (\text{Proximity to Risk Management Plan Facility Percentile}) + (\text{Proximity to Hazardous Waste Facility Percentile}) + (\text{Proximity to National Priorities List Percentile}) + (\text{Wastewater Discharge Indicator Percentile}) + (\text{Proximity to Brownfield Site Percentile}) + (\text{Proximity to Emitting Power Plant Percentile}) + (\text{Proximity to Mining Operation Percentile}) + (\text{Proximity to Concentrated Animal Feeding Operation (CAFO) Percentile})) / 9$
- **Sensitive Populations (including Socioeconomic Data)* Summary:** Health data, including asthma-related emergency visits and low-birth-weight rates, are sourced from state health agencies and cross-referenced with ACS. Connectivity and income data are sourced from ACS.
- **Calculation:** $((\text{Asthma Emergency Room Discharges Percentile}) + (\text{Myocardial Infarction Discharges Percentile}) + (\text{Low Birth Weight Infants Percentile}) + (\text{Population Lacking Broadband Connectivity Percentile}) + (\text{Low Income Percentile})) / 5.$

*Low Income Percentile is grouped with sensitive populations for the EJ Score calculations.

Score Calculation

- **Calculation:** $((\text{Pollution Burden Exposure Percentile}) + (\text{Pollution Burden Environmental Effects Percentile}) + (\text{Sensitive Population Percentile})) / 3$

Climate Vulnerability Score Calculation

Climate Exposure

- **Summary:** Data on drought risk, flooding and storm surge risk, and urban heat island effect, sourced from federal, state, and nonprofit organizations.
- **Calculation:** $((\text{Urban Heat Island}^*) + (\text{Drought}^*) + (\text{Storm Surge and Flooding}^*))/3$ *Values are normalized using minimum-maximum scaling

Community Impact

- **Summary:** Data on cumulative environmental and societal impacts, and tree cover percentage are integrated from federal and state sources and recalibrated to Maryland's geography.
- **Calculation:** $((1 - \text{Tree Canopy Cover Percent}^*) + (\text{EJ Score Percentile}))/2$

* Tree Canopy Cover values are reversed as low values indicate high overburdened/underserved status

Climate Vulnerability Score*

- **Calculation:** $((\text{Climate Exposure Raw Values}) + (\text{Community Impact Raw Values}))/2$

*Final score is converted to percentile

Geospatial Analysis

In Version 3 of MDEnviroScreen, a detailed geospatial analysis was conducted to identify and prioritize communities with environmental justice concerns in Maryland. The analysis involved integrating various environmental and demographic datasets to assess the cumulative impact of environmental burdens on vulnerable populations.

Data Aggregation

- **Primary Data Sources:** Data from the U.S. Census Bureau's American Community Survey (ACS) 2019-2023 estimates, 2021 Census TIGER/Line shapefiles, and Maryland Department of Health (MDH) data were used.
- **Secondary Data Sources:** Data from CBP's 2022 1-meter Land Use and Land Cover dataset, TPL's 2019 UHI Severity 30-meter raster, USDM 2019 Drought Impacts shapefile, and MDE's Stormwater, Dam Safety, and Flood Management Program's Watershed Prioritization Map.
- **Geospatial Data:** The datasets included geographic boundaries, population data, environmental indicators, and socioeconomic variables. All information was at the census tract level.

Data Processing

- **Data Integration:** Data from multiple sources were combined to create a comprehensive dataset. This involved aligning different datasets to a common geographic framework.
- **Data Cleaning:** Data accuracy was ensured by removing duplicates, correcting errors, and standardizing formats.

- **Tabular Data:** The data was initially in tabular format and was brought into a geodatabase using a key field, the GEOID, which is unique to each tract.
- **Reclassification:** Data was reclassified using a binary classification system to identify data points of interest (e.g., pixels with and without tree canopy)

Spatial Analysis Techniques

- **Overlay Analysis:** Multiple layers of data were combined to identify areas where different environmental and demographic factors intersect. For example, pollution exposure data were overlaid with socioeconomic indicators to identify overburdened communities.
- **Weighted Proximity Analysis:** The distance between specific features and census tracts was measured, and a proximity score was calculated for each census tract by summing $1/\text{distance (km)}$ for all features within 5 kilometers.
- **Buffer Analysis:** Buffer zones were created around specific features (e.g., industrial sites) to assess the impact on surrounding areas.
- **Hotspot Analysis:** Areas with high concentrations of specific indicators, such as pollution levels or health disparities, were identified.
- **Cluster Analysis:** Similar data points were grouped to identify patterns and trends within the data.

Geospatial Modeling

An ArcGIS model was developed in ModelBuilder to consolidate all the functions and create a repeatable process. This process can be tailored for different data sources or datasets, such as using ACS 5-year estimates for different years. The detailed model is available in Appendix C.

Weighted Analysis

- **Methodology:** Data were adjusted to account for population density, ensuring that areas with higher populations were appropriately represented in the analysis.
- **Application:** This helped to identify communities that may be disproportionately affected by environmental burdens due to higher population densities.

Spatial Reference and Projection

WGS 1984 Web Mercator Auxiliary Sphere: This spatial reference system was used for mapping, ensuring consistency with national standards and compatibility with web-based mapping applications.

- **Projection:** Geographic coordinates were transformed to a flat map while maintaining spatial relationships and minimizing distortion.
- **Transformation:** NAD_1983_To_WGS_1984_1

Transparency and Updates

- **Regular Reviews:** Data sources and methodologies are regularly reviewed and updated to reflect the latest available datasets.
- **Documentation:** Changes and updates are documented in MDE’s annual reports to ensure transparency and maintain methodological clarity.

Web Viewer and Visualization

MDEnviroScreen includes a web viewer that provides interactive mapping capabilities, enabling users to visualize environmental and demographic disparities across Maryland. This tool integrates various mapping and visualization techniques to present data in an accessible, user-friendly manner

Mapping and Visualization Techniques

- **Thematic Mapping:** The web viewer features thematic maps that highlight specific themes or indicators, such as pollution burden or socioeconomic status. These maps help users quickly identify areas of concern.
- **Choropleth Maps:** Color gradients are used to represent data values across different geographic areas, making it easy to visualize disparities. Users can see at a glance which areas are most affected by environmental burdens.
- **Interactive Maps:** The web viewer allows users to explore data layers interactively. Users can zoom in and out, pan across the map, and click on specific areas to get detailed information about the indicators and scores for that location.
- **Customizable Layers:** Users can add or remove contextual layers to tailor their analyses. This feature supports community-specific or policy-driven inquiries, allowing users to focus on the data most relevant to their needs

User Engagement

MDEnviroScreen is designed to engage users by providing a comprehensive view of environmental justice concerns. The interactive features and customizable layers make it a powerful tool for policymakers, community members, and regulatory agencies to understand and address local environmental conditions.

Transparency and Updates

- Data sources and methodologies are regularly reviewed and updated to reflect the latest available datasets. Changes are documented in MDE’s annual reports to ensure transparency.
- Historical data and recalibrations, such as cross-walking census tracts between decennial censuses, are explicitly detailed to maintain methodological clarity.

Interactive Features

- MDEnviroScreen includes interactive mapping capabilities, enabling users to visualize environmental and demographic disparities.

- Contextual layers can be added to tailor analyses, supporting community-specific or policy-driven inquiries.

Appendix

Appendix A: Health Data Metadata

Last updated December 23, 2024

Asthma Emergency Department (ED) Visits 2017-2019

File name: Asthma ED Visits_CT1719.csv

Variable	Variable Description
censustract	Maryland census tract from 2015-2019; 1406 tracts total
county	Maryland jurisdiction; 24 jurisdictions total
state	Maryland
crude_rate	Crude rate ¹ of asthma-related ² ED visits per 10,000 population -777 = the value is suppressed (the total number of ED visits is less than 11)

1. Calculated from (total asthma-related ED visits from 2017-2019/total estimated census tract population)*10,000, rounded to nearest tenth; Census tract population estimates derived from U.S. Census Bureau 2015-2019 estimates.
2. Asthma-related ED visits were obtained from Maryland Health Services Cost Review Commission (MD HSCRC) 2017-2020 data and are based on ED admission year. An ED visit was determined as asthma-related if the primary diagnosis had any of the following ICD10 codes (includes all sub-variation codes):

J45.* : Asthma

J45.2* Mild intermittent asthma

J45.20 Mild intermittent asthma, uncomplicated

J45.21 Mild intermit. Asthma, acute exacerbation

J45.22 Mild intermit. asthma, status asthmaticus

J45.3* Mild persistent asthma

J45.30 Mild persistent asthma, uncomplicated

J45.31 Mild persistent asthma, (acute) exacerbation

J45.32 Mild persistent asthma, status asthmaticus

J45.4* Moderate persistent asthma

J45.40 Moderate persistent asthma, uncomplicated

J45.41 Mod. persistent asthma, (acute) exacerbation

J45.42 Mod. persistent asthma, status asthmaticus

J45.5* Severe persistent asthma

J45.50 Severe persistent asthma, uncomplicated

J45.51 Severe persistent asthma, (acute) exacerbation

J45.52 Severe persistent asthma, status asthmaticus

J45.9* Other and unspecified asthma

J45.90 Unspecified asthma

J45.901 Unspecified asthma, (acute) exacerbation

J45.902 Unspecified asthma, status asthmaticus

J45.909 Unspecified asthma, uncomplicated

J45.99* Other asthma

J45.990 Exercise-induced bronchospasm
 J45.991 Cough variant asthma
 J45.998 Other asthma

Heart Attack/Myocardial Infarction (MI) Hospitalization 2017-2019

File name: MI Hospitalizations_CT1719.csv

Variable	Variable Description
censustract	Maryland census tract from 2015-2019; 1406 tracts total
county	Maryland jurisdiction; 24 jurisdictions total
state	Maryland
crude_rate	Crude rate ³ of MI-related ⁴ hospitalizations per 10,000 population -777 = the value is suppressed (the total number of hospitalizations is less than 11)

1. Calculated from (total MI-related hospitalizations from 2017-2019/total estimated census tract population) *10,000, rounded to nearest tenth; Census tract population estimates derived from U.S. Census Bureau 2015-2019 estimates
2. MI hospitalizations were obtained from Maryland Health Services Cost Review Commission (MD HSCRC) 2017-2020 data and are based on hospitalization admission year. A hospitalization was determined as MI-related if the primary diagnosis had any of the following ICD-10 codes (includes all sub-variation codes):

I21.*: Acute myocardial infarction
 I21.0* : ST elevation (STEMI) of anterior wall
 I21.01: ST elevation myocardial infarction (STEMI) involving left main coronary artery
 I21.02: STEMI involving left anterior descending coronary artery
 I21.09: STEMI involving other coronary artery of anterior wall
 I21.1: STEMI of inferior wall
 I21.11: STEMI involving right coronary artery
 I21.19: STEMI involving other coronary artery of inferior wall
 I21.2*: STEMI of other sites
 I21.21: STEMI involving left circumflex coronary artery
 I21.29: STEMI involving other sites
 I21.3*: STEMI of unspecified site
 I21.4*: Non-ST elevation myocardial infarction (NSTEMI)
 I21.9*: Acute myocardial infarction, unspecified
 I21.A*: Other type of myocardial infarction I21.
 A1: Myocardial infarction type 2 I21.
 A9: Other myocardial infarction type
 I22.*: Subsequent STEMI and non-STEMI
 I22.0: Subsequent STEMI of anterior wall
 I22.1: Subsequent STEMI of inferior wall
 I22.2: Subsequent NSTEMI
 I22.8: Subsequent STEMI of other sites
 I22.9: Subsequent STEMI of unspecified site

Appendix B: EPA Metadata

Note for Appendix B

This appendix provides a condensed version of the EPA's [EJScreen Technical Documentation for Version 2.3](#), highlighting key points relevant to the methodology and indicators. The original document contains extensive details on environmental and socioeconomic indicators, calculation methodologies, and application frameworks, which remain unchanged. The following sections have been streamlined for brevity while preserving essential content.

EJScreen Overview

EJScreen is the EPA's environmental justice screening and mapping tool, using standardized, nationally consistent data to identify areas with potential environmental burdens and vulnerable populations. It combines environmental and socioeconomic indicators at the Census block group level, offering detailed mapping and data reporting capabilities.

Geographic Framework

- Built on 2022 Census TIGER/Line data for all 50 states, D.C., and Puerto Rico.
 - Socioeconomic data sourced from the U.S. Census Bureau's ACS 2019-2023 5-Year Estimates.
 - Includes 242,336 block groups using WGS 1984 Web Mercator (Auxiliary Sphere) as the spatial reference.
 - Population data derived from the 2020 Decennial Census, weighted by block centroids.
-

Key Indicators in EJScreen

Socioeconomic Indicators

EJScreen includes seven socioeconomic and five health-related indicators to assess community susceptibility to environmental factors:

- **People of Color:** Percent of individuals not identifying as non-Hispanic White-alone.
- **Low Income:** Percent of households with income \leq 2x the federal poverty level.
- **Unemployment:** Percentage of the population actively seeking employment.
- **Limited English Proficiency:** Households where no member aged 14+ speaks English "very well."

- **Educational Attainment:** Percentage of population aged 25+ without a high school diploma.
- **Age Vulnerability:** Percent of population under age 5 or over age 64.
- **Persons with Disabilities:** Derived from ACS data on disability status.

Environmental Burden Indicators

EJScreen tracks 13 environmental burden indicators, including:

- **Particulate Matter (PM 2.5):** Annual average concentrations of fine particulate matter.
 - **Ozone:** Peak daily 8-hour average concentrations reflecting respiratory risks.
 - **Traffic Proximity:** Weighted AADT counts within 10 km, emphasizing closer traffic sources.
 - **Lead Paint:** Percent of housing units built before 1960, indicating potential lead exposure.
 - **Superfund Proximity:** Sites within 10 km, weighted by distance to block group population.
 - **Wastewater Discharge:** Toxicity-weighted concentrations of TRI chemicals in nearby water bodies.
 - **Drinking Water Non-Compliance:** Weighted scores based on Safe Drinking Water Act violations.
 - **RMP Facility Proximity:** Proximity to facilities handling regulated substances under the Risk Management Plan.
 - **Hazardous Waste Proximity:** Proximity to treatment, storage, and disposal facilities.
-

Indexes in EJScreen

EJScreen combines indicators into indexes to simplify analysis and interpretation:

- **Demographic Index:** Average of people of color and low-income percentages.
 - **EJ Indexes:** Combine environmental burden indicators with the demographic index to identify areas with higher potential burdens.
 - **Supplemental Indexes:** Include additional factors such as health disparities and climate vulnerabilities.
-

Data and Methodology

- **Data Sources:** Environmental indicators come from EPA, CDC, NASA, and other authoritative sources.
 - **Percentile Rankings:** Standardized to highlight relative burdens at national and state levels.
 - **Calculation Methods:** Each indicator’s methodology ensures consistent application across geographies.
 - **Spatial Analysis:** GIS frameworks integrate multiple data layers for block group-level resolution.
 - **Updates:** Regularly updated with the latest datasets and methodological improvements.
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Notes

This appendix provides a summarized version for reference purposes. For comprehensive details, including in-depth methodologies and data sources, consult the full [EJScreen Technical Documentation](#). Detailed tables, formulas, and specific examples have been omitted here for brevity but are available in the original document.

Explanation for Inclusion:

The "Detailed Descriptions of Environmental Burden Indicators" section has been included in its entirety in the index to provide comprehensive and unaltered information on the various environmental burden indicators used in the analysis. This section offers detailed explanations of each indicator, ensuring that the methodology, data sources, and significance of the indicators are clearly understood. By including this section as is, we maintain the accuracy and integrity of the information, which is crucial for the analysis and interpretation of the results.

PM2.5 (2024 EPA EJ)

The PM2.5 indicator is a measure of potential exposure to inhalable particles that are 2.5 micrometers or smaller. This is measured in terms of annual average concentration in air measured in micrograms per cubic meter. PM2.5 information included in EPA EJScreen highlights areas across the U.S. that have the highest PM2.5 levels when compared to the nation or state. It does not indicate whether a selected area is or is not meeting the national ambient air quality standard for PM2.5.

The PM2.5 indicator in EPA EJScreen is a measure of potential exposure but not a measure of risk. The raw PM2.5 data is compiled by 2020 Census tract, which is publicly available for use in the tool by EPA’s OAQPS.

Ozone (2024 EPA EJ)

The ozone indicator in EPA EJScreen v2.3 reflects the annual mean of the 10 highest MDA8 O3 concentrations (henceforth referred to as the “peak concentration metric”). EPA EJScreen is replacing the seasonal mean metric with the peak concentration metric so that it is more consistent with the form of the O3 NAAQS1. This better represents the NAAQS attainment status of areas across the nation and exposure to peak ozone concentrations tied to respiratory effects in controlled human exposure studies (U.S. EPA, 2020a; U.S. EPA, 2020b). The ozone indicator in EPA EJScreen is a measure of potential exposure but not a measure of risk.

Diesel PM (2024 EPA EJ)

The Diesel PM indicator is the estimated concentration of Diesel PM as provided by the 2020 AirToxScreen. The raw indicator is expressed in units of micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) and reported at the Census block group-level. 2020 block groups are remapped to 2022 block groups. EPA EJScreen converts Diesel PM concentrations into percentiles.

Toxic Releases to Air (2024 EPA EJ)

The Toxic Releases to Air indicator quantifies relative potential human health impacts of certain chemicals included on the list of toxic chemicals established under section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) based on the quantities released to air by facilities. The indicator is derived by considering the quantities of the chemical(s) released to air, modeling the fate of the chemical(s) in air based on an approximate point of release, determining chemical concentrations in air, and weighting the chemical concentrations by the relative toxicity(ities) of the chemical(s). Average annual toxicity-weighted concentration results from all modeled air releases are aggregated at the U.S. Census block group and other geographies in EPA EJScreen.

Traffic Proximity (2024 EPA EJ)

The traffic proximity indicator is based on AADT count divided by distance in meters from the Census block centroid. The proximity score is based on the traffic within a search radius of 10 km. This distance was selected to be large enough to capture the great majority of road segments (with traffic data) that could have a significant impact on the local residents, balanced against the need to limit the scope due to computational constraints. The closest traffic is given more weight, and the distant traffic is given less weight, through inverse distance weighting. For example, traffic 500 meters away is given only one tenth as much weight as traffic 50 meters away.

For Version 2.3, the 2020 version of the HPMS data contained overlapping and/or coincident line segments, which would have resulted in overcounting. The following steps were taken to ensure each AADT is used only once: created a new text column by concatenating Route_ID and AADT, then performed a spatial dissolve operation based on the concatenated string, which resulted in a final set of non-overlapping segments. The process was applied to all states.

Lead Paint Indicator (2024 EPA EJ)

The lead paint indicator is the percentage of occupied housing units built before 1960, calculated from the U.S. Census Bureau's ACS 5-year summary estimates on age of housing stock. EPA EJScreen uses age of housing stock as a surrogate for potential lead exposure as regulations banning

lead-based residential paint in 1978 led to the reduction and finally an end to the use of such paint in housing. The percentage of older housing units is a proxy for potential exposure to lead paint and lead-containing dust that accumulates indoors, in homes, or in other buildings where lead paint was used. EPA EJScreen uses housing units built before 1960.

Superfund Proximity (2024 EPA EJ)

The Superfund proximity indicator is reflective of the total count of sites proposed and listed (final or proposed) on the NPL as well as SAA sites in each block group within 10 km of the average resident in a block group, divided by distance, calculated as the population-weighted average of blocks in each block group.

RMP Facility Proximity (2024 EPA EJ)

The RMP facility proximity is reflective of the total count of active RMP facilities in each block group within 10 km of the average resident in a block group, divided by distance, calculated as the population-weighted average of blocks in each block group. For EPA EJScreen Version 2.3, only active facilities were counted.

Hazardous Waste Proximity (2024 EPA EJ)

The hazardous waste proximity indicator is reflective of the total count of hazardous waste facilities in each block group within 10 km of the average resident in a block group, divided by distance, calculated as the population-weighted average of blocks in each block group. Hazardous waste facilities are defined as Resource Conservation and Recovery Act (RCRA) handlers that are either operating TSDFs from RCRA or reporting LQGs from the 2021 BR.

Wastewater Discharge (2024 EPA EJ)

The wastewater discharge indicator quantifies relative potential human health impacts of certain chemicals included on the list of toxic chemicals established under section 313 of the EPCRA based on the quantities discharged to water by facilities and proximity measures. The indicator is derived by considering the quantities of the chemical(s) discharged to water, modeling the fate of the chemical(s) in water based on an approximate point of release, determining chemical concentrations in water, and weighting the chemical concentrations by the relative toxicity(ities) of the chemical(s). Average annual toxicity-weighted concentration results in downstream stream segments within 10 km of a block centroid, divided by distance in meters, are presented as the population-weighted average of blocks in each block group.

AirToxScreen Cancer (2022 EPA EJ)

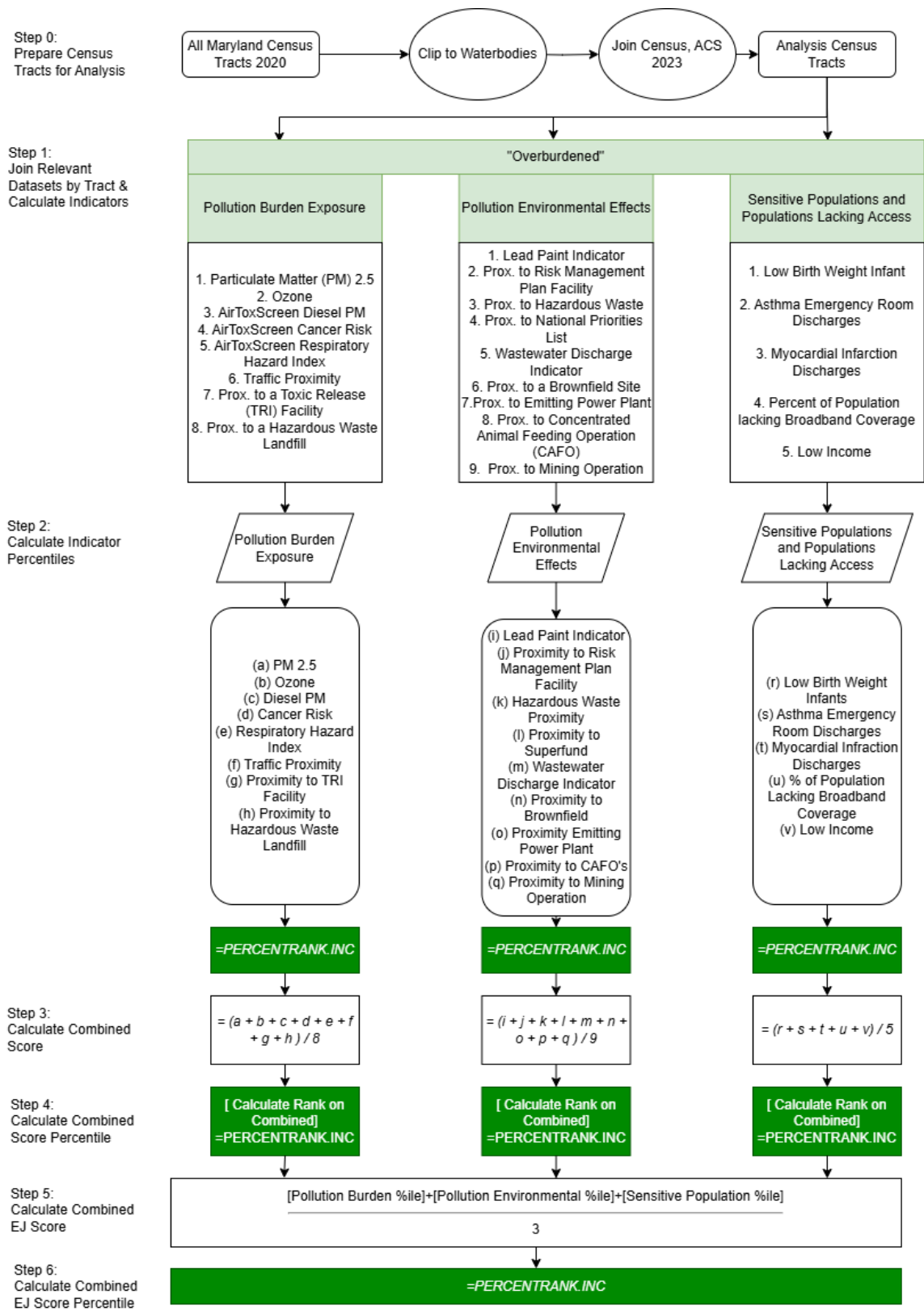
The air toxics cancer risk data is the estimated lifetime inhalation cancer risk from the analyzed carcinogens in ambient outdoor air, as provided by EPA's AirToxScreen. The value of the indicator is persons per million over a 70-year lifetime. The data is reported at the Census block level.

AirToxScreen Respiratory Hazard Index (2022 EPA EJ)

The air toxics respiratory hazard index is the ratio of exposure concentration to health-based reference concentration, as provided by EPA's AirToxScreen. This data is reported at Census block level.



Appendix C: GIS Model Summary



Appendix D: Definitions

- **Broadband Gaps:** Areas lacking adequate digital infrastructure, limiting access to online resources and services.
- **Climate Solutions Now Act:** Legislation mandating a methodology for identifying communities disproportionately affected by climate impacts that must at minimum include “underserved communities, overburdened communities, and areas that are vulnerable to climate impacts such as flooding, storm surge, and urban heat island” (UHI).
- **Climate Exposure:** a sub-index of the Climate Vulnerability Score that evaluates aggregated climate impacts from flooding, storm surges, urban heat island effect, and drought.
- **Climate Vulnerability Score (CVS):** a percentile-based metric used for identifying communities disproportionately affected by climate impacts, building off the minimum requirements outlined in the Climate Solutions Now Act.
- **Community Impact:** a sub-index of the Climate Vulnerability Score that evaluates the adaptive capacity and sensitivity of a census tract using EJ Score and tree canopy cover.
- **Environmental Effects:** The impact of environmental factors, such as pollution or degradation, on communities.
- **Environmental Justice Score (EJ Score):** A percentile-based metric used to evaluate the combined impact of environmental, health, and socioeconomic indicators in a census tract.
- **Geospatial Analysis:** The process of using geographic data and mapping to analyze spatial relationships and patterns.
- **House Bill 1200:** Legislation mandating the inclusion of EJ Scores in permitting processes and requiring public transparency and community engagement.
- **Interactive Features:** Functionalities in tools or software that allow users to engage actively, such as visualizing data layers.
- **Lead Paint Indicator:** An environmental measure reflecting the percentage of housing units built before 1960, indicating potential exposure to lead-based paint.
- **Low Birth Weight Infants:** Infants born weighing less than 5 pounds, 8 ounces. Often used as an indicator of community health.
- **Low Income:** Low income is defined as the percent of the tract whose household income is below two times the poverty level.
- **Myocardial Infarction Discharges:** Hospital discharges related to heart attacks, indicating cardiovascular health trends in a community.
- **Ozone:** A gas in the Earth's atmosphere that, at ground level, is a harmful pollutant contributing to respiratory issues.

- **Overburdened Community:** Areas with elevated levels of pollution burden exposure, environmental effects, as well as sensitive populations and populations lacking access.
- **Percentile-Based Scoring System:** A method of ranking data where values are expressed relative to others in a dataset.
- **Pollution Burden:** The cumulative impact of environmental exposures and effects, such as air pollutants, proximity to hazardous sites, and wastewater discharges, on a community.
- **Proximity Indicators:** Metrics that assess closeness to environmental hazards, such as traffic, industrial sites, or waste facilities.
- **Sensitive Populations:** Groups more likely to experience adverse health effects due to preexisting vulnerabilities, individuals with limited communication access, individuals with limited financial resources, or individuals with chronic illnesses.
- **Traffic Proximity Indicator:** A metric assessing the potential exposure to vehicular emissions based on proximity to major roadways and traffic volumes.
- **Transparency:** The principle of making data, processes, and decision-making accessible and understandable to the public.
- **Underserved Community:** Areas with socioeconomic challenges, as determined by indicators such as low income, high nonwhite population percentages, or limited English proficiency. This layer is for reference only and not to be used to assign benefit or burden.
- **WGS 1984 Web Mercator Auxiliary Sphere:** A spatial reference system commonly used for web-based mapping applications.

Appendix E: Layer and Sources Table

	Indicator	Source	Details	Link to Dataset	Data Year
EJ Score	Particulate matter (PM) 2.5	EPA EJ 2024	Annual average PM2.5 levels in air, µg/m3	EPA, OAR (fusion of model and monitor data). For methods, see EPA Report EPA-454/S-15-001	2020
	Ozone	EPA EJ 2024	Ozone annual mean top 10 of daily maximum 8-hour concentration in air	EPA, OAR (fusion of model and monitor data). For methods, see EPA Report EPA-454/S-15-001	2020
	AirToxScreen Diesel PM	EPA EJ 2024	Diesel particulate matter level in air, µg/m3	EPA Air toxics data, retrieved 2024	2020
	AirToxScreen Cancer Risk	EPA EJ 2022	The air toxics cancer risk data is the estimated lifetime inhalation cancer risk from the analyzed carcinogens in ambient outdoor air, as provided by EPA's AirToxScreen. The value of the indicator is persons per million over a 70-year lifetime. The data is reported at the Census block level.	EPA Air toxics data, retrieved 2022	2019
	AirToxScreen respiratory hazard index	EPA EJ 2022	Air toxics respiratory hazard index (ratio of exposure concentration to health-based reference concentration)	EPA Air toxics data, retrieved 2022	2019
	Traffic Proximity	EPA EJ 2024	Count of vehicles (AADT, avg. annual daily traffic) at major roads within 500 meters, divided by distance in meters (not km)	Calculated from 2020 U.S. DOT traffic data, retrieved 1/9/2023	2020

	Lead Paint Indicator	EPA EJ 2024	Percent of housing units built pre-1960, as indicator of potential lead paint exposure	Calculated based on Census/American Community Survey (ACS) data, retrieved 12/16/2023	2018-2022
	National Priorities List Superfund site proximity	EPA EJ 2024	Count of proposed or listed NPL - also known as superfund - sites within 5 km (or nearest one within 10 km), each divided by distance in kilometers	Calculated from EPA Superfund NPL boundaries and site (Final and Proposed) plus Superfund Alternative Approach (SAA) boundaries and sites, retrieved 2/26/2024	2024
	Risk Management Plan facility proximity	EPA EJ 2024	Count of RMP (potential chemical accident management plan) facilities within 5 km (or nearest one within 10 km), each divided by distance in kilometers	Calculated from EPA RMP database, retrieved 2/26/2024	2024
	Hazardous waste proximity	EPA EJ 2024	Count of hazardous waste facilities (TSDFs and LQGs) within 5 km (or nearest within 10 km), each divided by distance in kilometers	TSDF data calculated from EPA RCRA Info database, retrieved 1/31/2024	2024
	Wastewater discharge indicator	EPA EJ 2024	RSEI modeled toxic concentrations at stream segments within 500 meters, divided by distance in kilometers (km)	Calculated from RSEI modeled toxic concentrations to stream reach segments, created 12/27/2023	2021
	Proximity to a Concentrated Animal Feeding Operation (CAFO)	MDE AFO	Count of Concentrated Animal Feeding Operation (CAFO) facilities within 5 km, each divided by distance in kilometers		2023
	Asthma emergency	MDH	2017-2019 Asthma Emergency Department		2017-2019

	room discharges		Visit rates per 10,000 by census tract.		
	Myocardial infarction discharges	MDH	2017-2019 Myocardial Infarction Hospitalization rates per 10,000 by census tract.		2017-2019
	Low-birth-weight infants	VSA (MDH)	Infants born weighing less than 5 pounds, 8 ounces (2500 Grams)		2017-2019
	Proximity to emitting power plants	EPA	Count of emitting powerplant facilities within 5 km, each divided by distance in kilometers	Emissions & Generation Resource Integrated Database (eGRID)	2022
	Proximity to a Toxic Release Inventory (TRI) facility	EPA	Count of Toxic Release Inventory (TRI) facilities within 5 km, each divided by distance in kilometers	Rest Service	2024
	Proximity to a brownfields site	MDE LRP	Count of brownfield facilities within 5 km, each divided by distance in kilometers		2024
	Proximity to mining operations	MDE	Count of mining facilities within 5 km, each divided by distance in kilometers		2018/2019
	Proximity to a hazardous waste landfill	EPA	Count of hazardous waste sites (RCRA) Treater, Storer, and Disposer (TSD) facilities within 5 km, each divided by distance in kilometers	Rest Service	2024
	Percent of population qualify as low-income	US Census ACS 2023	Estimated total of population with income in the past 12 months below poverty level		2023
	Percent of the population lacking broadband coverage	US Census ACS 2023, S2801	TYPE OF INTERNET SUBSCRIPTIONS: Without a Broadband Internet subscription		2023
	EJ Score Percentile	MDE	Score is calculated using indicators to	Rest Service	

Climate Vulnerability Score			screen locations and communities based on census and health data, including: <ul style="list-style-type: none"> • pollution burden; • pollution burden environmental effects; • sensitive populations, including socioeconomic data 		
	Tree canopy cover (TCC)	CBP	The proportion of a census tract with TCC and TCC over 'Impervious Structures', over 'Other impervious Surfaces', and over 'Impervious Roads.'	Chesapeake Bay Land Use and Land Cover (LULC) Database 2022 Edition	2018-2022
	Urban Heat Island	TPL	Identifies certain areas of cities that are hotter than the average temperature for that same city based on heat severity (1-5).	Urban Heat Island Severity for U.S. Cities	2019
	Drought	NDMC, USDA, NOAA	Maps the percent area and intensity of drought conditions over time from abnormal (D0) to exceptional (D4).	US Drought Monitor	2019
	Storm Surge and Flooding-Coastal, Riverine, Pluvial, Infrastructure	US Census ACS 2023	Identifies watersheds with significant existing and future flooding impacts (1-4) based on potential for run-off, risk to infrastructure, and historical and future flood risk.		2023
Child Poverty	Children Under Poverty Line		Percentage of children in the census tract living below the federal poverty level according to the 2023 ACS data.		2023