

# Environmental Justice in a Changing Climate: Pollution and Resilience in Illinois

Samuel N Nimaful, Joel Holison , Augustine Hanyabui, Gloria O Darkoh, Laureta Tatenda Nyamutswa,  
Faith Esther Holison  
Eastern Illinois University

**Abstract**— Environmental justice (EJ) in Illinois is shaped by the long arc of industrialization, suburbanization, infrastructure siting, and land-use decisions that have unevenly distributed environmental burdens across communities. Illinois’ pollution landscape spans legacy industrial corridors in and near Chicago[1], heavy manufacturing and petrochemical activity in the Metro-East, extensive agricultural nutrient and pesticide pressures across rural watersheds, major transportation and freight emissions, and persistent contamination from historical dumping and hazardous waste sites. These burdens interact with—and are increasingly amplified by—climate change impacts such as more intense precipitation and flooding, extreme heat, and air-quality-relevant meteorological shifts (e.g., conditions that favor ozone formation). Together, these factors create a cumulative exposure environment that can deepen existing health inequities and economic vulnerabilities for low-income communities and communities of color. [2] This report synthesizes official and peer-reviewed evidence through 2024 to analyze (a) the major historical and current pollution sources in Illinois; (b) how pollution burdens are distributed spatially by race, income, and related social vulnerability factors; (c) climate hazards that exacerbate exposure and risk; (d) documented and plausible public health outcomes linked to pollution and climate stressors; (e) Illinois and local policy frameworks and resilience programs; (f) community-led EJ initiatives and illustrative case studies; and (g) recommended strategies and metrics for monitoring progress. Where possible, the analysis uses official screening and monitoring frameworks such as EPA’s EJSCREEN and CDC/ATSDR’s Environmental Justice Index (EJI), alongside Illinois EPA air and water program documentation and Illinois Department of Public Health (IDPH) surveillance. [3]

**Keywords**— First, Illinois’ pollution sources are multi-sector and often co-located. Industrial point sources include petroleum refining, metal processing/recycling, legacy heavy industry, and associated hazardous air pollutants (HAPs) and criteria pollutants. Transportation emissions are a core exposure pathway in urban and logistics corridors, especially diesel particulate matter and near-road pollution; these often align with industrial zoning and land-use legacies highlighted by recent cumulative-impact efforts in Chicago. [4] . Second, official EJ frameworks in Illinois recognize disproportionate burdens and operationalize enhanced outreach to communities identified as “areas of EJ concern.” Illinois EPA’s EJ Policy defines an “area of EJ concern” as a census block group where low-income and/or minority population is greater than twice the statewide average, determined using the agency’s EJ Start GIS screening tool; this definition institutionalizes demographic disparity as an explicit trigger for enhanced public outreach in permitting and related actions. [5]

## I. INTRODUCTION AND SCOPE

Environmental justice is commonly framed as the principle that all people and communities are entitled to equal protection and meaningful involvement in environmental decision-making, regardless of race, income, national origin, or other social status. In Illinois, this framing is not merely rhetorical: it is embedded in state EJ governance through the Illinois Environmental Justice Act, which established the Illinois Commission on Environmental Justice and assigns the Commission duties such as advising state entities, assessing law adequacy, and developing criteria to identify communities experiencing EJ issues. [11]

A central challenge for EJ analysis in Illinois is that pollution and risk are multi-source and multi-pathway. Communities may face overlapping exposures from industrial emissions, freight and traffic corridors, contaminated soil and legacy dumping, drinking water infrastructure risks, and broader social stressors that shape vulnerability (e.g., housing quality, limited access to health care, heat sensitivity, and displacement risk). Chicago’s executive order establishing a cumulative impact assessment (CIA) explicitly recognizes this multi-dimensional nature of burden and adapts federal definitions of cumulative impacts to local governance, reflecting the practical reality that communities experience pollution as combined exposures rather than siloed regulatory categories. [12]

Climate change raises the stakes and changes the exposure calculus. In Illinois, climate signals relevant to EJ include shifting precipitation regimes and more frequent/intense heavy rainfall, increased flood risk (including urban flooding outside mapped floodplains), and severe heat events in urban contexts. These climate hazards can increase pollutant exposures directly (e.g., wildfire smoke episodes, heat-driven ozone increases) and indirectly through infrastructure failure, contaminated floodwaters, mold growth, or mobilization of legacy contaminants from industrial or waste sites. [13]

This report focuses on Illinois as a whole while emphasizing several “EJ-critical geographies” where multiple burdens converge: (a) Chicago’s industrial corridors and adjacent neighborhoods; (b) the Metro-East region along the Mississippi River corridor (including hazardous waste and industrial legacy sites); (c) rural watersheds and agricultural landscapes where nutrients, pesticides, and climate-driven runoff interact; and (d) Great Lakes and nearshore communities with legacy contamination (e.g., Waukegan Harbor). [14]

Unspecified constraints (as requested) include: the target audience (e.g., general public vs. technical planners vs. policymakers), citation style details beyond APA parenthetical citations, and a preferred file format (e.g., Word document, PDF, or slide deck) for delivery. [15]

## II. METHODS AND DATA SOURCES

This report uses a mixed-methods synthesis approach: (1) policy and program review of official Illinois and federal documentation; (2) literature review of peer-reviewed studies relevant to Illinois EJ burdens and climate-health interactions; and (3) case-based triangulation using site profiles, surveillance publications, and documented community-driven initiatives. The evidence base is restricted to sources up to and including 2024, consistent with the user’s constraint. [16]

### Primary data tools and official datasets

EPA EJSCREEN and CDC/ATSDR Environmental Justice Index serve two complementary roles in this analysis. EJSCREEN is a screening tool that combines environmental indicators (e.g., PM2.5, ozone, air toxics, traffic proximity, Superfund proximity) with demographic indices to create EJ indexes used to identify communities with potentially higher pollution burdens and vulnerable populations; EPA publishes technical documentation describing indicator construction and caveats, emphasizing screening rather than definitive causal attribution. [17]

CDC/ATSDR’s Environmental Justice Index (EJI) is described as a national, place-based tool designed to measure cumulative impacts of environmental burdens through the lens of human health and health equity, producing ranks to identify communities most at risk. The 2024 EJI update adds climate data via a Climate Burden Module, explicitly linking EJ screening to heat, wildfire, and extreme-event indicators. [18] Illinois-specific official sources used here include the Illinois EPA annual air quality reporting (criteria pollutants, monitoring network summary, and emissions trend narratives), Illinois EPA EJ policy documents (EJ concern definition; EJ Start screening; enhanced outreach; notification process), the Illinois Commission on Environmental Justice yearly report (governance, priorities, and recent civil-rights resolution context), and water quality documentation (Nutrient Loss Reduction Strategy executive summary and PFAS program materials). [19]

Health outcomes are addressed using Illinois Department of Public Health (IDPH) climate-health reporting and asthma surveillance publications that include prevalence and hospitalization trends, including stratification by demographic groups. [20]

**Table of core data sources and how they support EJ analysis**

| Data source / program                               | What it provides for EJ analysis  | Illinois-specific value   | Key limitations for causal inference   |
|---|---|---|--|
| EPA EJSCREEN (Version 2.3 technical documentation)  | EJ indexes combining environmental indicators with demographic indices; screening maps and reports (U.S. Environmental Protection Agency, 2024). [21] | Supports tract/block-group screening for cumulative burden patterns relevant to urban corridors and industrial siting. [22] | Screening tool; does not establish individual exposure or causality; indicator uncertainties and spatial averaging. [23] |
| CDC/ATSDR Environmental Justice Index (2024 update) | Place-based cumulative ranking including environmental, health,   | Enables cumulative EJ + climate burden comparisons across Illinois  | Rank-based; sensitive to indicator selection and   |

| Data source / program  | What it provides for EJ analysis  | Illinois-specific value  | Key limitations for causal inference  |
|--|---|--|---|
|  | social vulnerability, and climate burden module (Agency for Toxic Substances and Disease Registry [ATSDR], 2024). [24]  | regions (urban/rural). [25]  | weighting assumptions. [26]   |
| Illinois EPA Annual Air Quality Report (2022 data; published 2024) | Monitoring results for criteria pollutants and some toxics; AQI characterization; network description (Illinois Environmental Protection Agency, 2024). [27]          | Provides statewide pollutant trends and highlights hotspots useful for EJ prioritization. [27] | Ambient monitors can miss hyperlocal gradients (near-road, fence-line); limited toxics coverage. [27] |
| IDPH Climate and Health in Illinois report                         | Heat hospitalization risk mapping and flood-health link narratives; flood disaster declarations and cost estimates (Illinois Department of Public Health, 2021). [28] | Links climate hazards (heat, flood) to health-relevant vulnerabilities statewide. [29]         | Often ecological and descriptive; limited exposure quantification for specific pollutants. [28]       |
| IDPH Asthma  | Trends in asthma  | Documents disparities  | Asthma is multi-  |

| Data source / program   | What it provides for EJ analysis   | Illinois-specific value   | Key limitations for causal inference   |
|---|--|---|--|
| surveillance publications   | prevalence and hospitalization disparities by demographics (Illinois Department of Public Health, 2018–2021). [30]   | consistent with EJ concerns and air-quality risks. [7]                                    | factorial; surveillance does not isolate environmental causal pathways. [7]                  |
| Illinois Nutrient Loss Reduction Strategy (NLRs) 2023 Biennial Report executive summary | Statewide nutrient load metrics and targets; sector efforts; climate change recognized as contributing factor (Illinois NLRs Partnership, 2023/2024). [31] | Connects agricultural and municipal loads, runoff/streamflow, and climate pressures. [32] | Loads reflect hydrology and legacy nutrients; attribution to particular sources varies. [31] |
| Illinois EPA PFAS statewide investigation and USGS PFAS report                          | Statewide PFAS occurrence in community water supplies; detection counts and confirmation sampling (Illinois Environmental Protection Agency, 2021; U.S.    | Provides statewide baseline for emerging contaminant equity analysis. [33]                | Evolving standards; exposure pathways extend beyond finished drinking water. [34]            |

| Data source / program | What it provides for EJ analysis | Illinois-specific value | Key limitations for causal inference |
|-----------------------|----------------------------------|-------------------------|--------------------------------------|
|                       | Geological Survey, 2023). [33]   |                         |                                      |

**Analytical framing and limitations**

This report treats EJSCREEN and EJI results as screening inputs that help characterize cumulative burden and prioritize inquiry, not as definitive causal evidence of harm. This distinction matters because EJ decisions often require both procedural safeguards (e.g., nondiscrimination, meaningful involvement) and robust, context-sensitive risk assessment where feasible. The Illinois EPA civil-rights informal resolution agreement (IRA) related to permitting provides an example of how screening tools (EJ Start and EJSCREEN) are incorporated into a broader permitting and engagement process that includes public notice, potential permit enhancements, and written analysis commitments. [35]

A second limitation is that some Chicago municipal documents hosted on Chicago.gov were not accessible within the research environment due to access restrictions; where relevant, this report uses alternate official copies (e.g., city clerk-hosted executive order PDF) and publicly available meeting materials describing the CIA process and governance. [36]

**III. FINDINGS**

**Pollution sources in Illinois**

Illinois’ pollution profile is best understood as a layered system of sources operating across time: (a) industrial emissions and discharges from manufacturing, refining, and waste management; (b) agricultural nonpoint source pollution (nutrients, sediment, and pesticide-related contamination); (c) transportation emissions embedded in freight and commuting networks; and (d) legacy contamination from historical dumping, contaminated sediments, and older industrial practices.

Industrial and waste-related sources include facilities regulated under Clean Air Act permitting and hazardous waste programs, and they often align with historical industrial corridors. Illinois EPA’s annual air quality report for 2022 summarizes monitoring for the six criteria pollutants (PM10, PM2.5, ozone, SO2, NO2, CO, and lead), reporting statewide AQI conditions and pollutant-specific findings, and it notes that stationary point

source emission data are included from state systems. This framework reflects the ongoing relevance of industrial emissions to statewide air quality planning. (Illinois Environmental Protection Agency, 2024). [27]

A critical EJ dynamic is that “source categories” tend to cluster: industrial point sources co-locate with freight corridors, rail yards, ports, and highways, producing combined exposure profiles (criteria pollutants + toxics + noise + safety risks). Chicago’s executive order on environmental justice and cumulative impacts explicitly notes that Chicago’s location in the U.S. transportation network contributes to burdens for residents living near industrial facilities, rail yards, waterways, highways, and airports, and it frames cumulative impacts as the appropriate governance lens. (City of Chicago, 2023). [37]

Agricultural pollution is prominent in Illinois’ water quality context because the state is both a major agricultural producer and a major contributor of nitrogen and phosphorus loads to downstream systems. The Illinois Nutrient Loss Reduction Strategy (NLRs) frames nutrient pollution as a major water quality threat; its 2023 biennial executive summary reports that statewide nutrient levels remained higher than interim targets, and it highlights the role of precipitation, water yield, and climate change in influencing nutrient loads. (Illinois NLRs Partnership, 2023/2024). [32]

Transportation emissions are especially important for EJ because they correlate strongly with land-use decisions and the spatial distribution of mobility infrastructure. Illinois EPA’s air monitoring includes near-road sites (e.g., carbon monoxide measurements at near-road locations) and ozone and PM2.5 statewide patterns; while statewide averages can obscure local hotspots, monitor networks provide evidence that mobile-source pollutants remain relevant across Illinois. (Illinois Environmental Protection Agency, 2024). [27]

Legacy contamination includes Superfund sites, contaminated sediments, and formerly industrial waterfronts. For instance, EPA’s Superfund site information for the Outboard Marine Corporation site identifies the site as located in the northern section of Waukegan Harbor and provides the federal site profile context for long-term remedial management. (U.S. Environmental Protection Agency, n.d.). [38]

**Spatial distribution of burden by race, income, and vulnerability**

Illinois’ official EJ screening definition and its implications Illinois EPA’s EJ policy operationalizes demographic disparity by defining an “area of EJ concern” as a census block group with low-income and/or minority population greater than twice

the statewide average and using a GIS mapping tool (EJ Start) to identify such areas; when permitting actions arise in areas of EJ concern, Illinois EPA conducts enhanced public outreach. (Illinois Environmental Protection Agency, 2024). [5]

This formal definition has two implications for the spatial distribution analysis. First, it reflects explicit recognition that low-income and minority populations can be systematically overburdened by pollution and that procedural safeguards are needed. Second, it creates an administrative trigger for engagement but does not, by itself, guarantee cumulative burden reductions, which depend on permit conditions, enforcement, land-use decisions (often local), and investment patterns. [39]

#### **Screening tools and cumulative-burden frameworks**

EPA's EJSCREEN Version 2.3 technical documentation describes how EJ indexes combine environmental indicators (e.g., PM<sub>2.5</sub>, ozone, air toxics cancer risk, traffic proximity) with demographic indices to screen for EJ concerns and provides technical details and caveats on indicator construction. (U.S. Environmental Protection Agency, 2024). [21]

CDC/ATSDR's Environmental Justice Index (EJI) offers an explicitly cumulative framing by integrating environmental burdens, social vulnerability, and health vulnerability to identify places most at risk. The 2024 EJI update adds climate data through a Climate Burden Module that includes indicators related to heat, wildfire, and extreme events, reinforcing that EJ burden is increasingly climate-mediated. (ATSDR, 2024). [40] While this report does not compute tract-by-tract rankings directly, it uses these tools conceptually to explain what "burden distribution" means and to interpret Illinois patterns documented in official and case-based sources (e.g., known industrial corridors, Superfund clusters, and documented air and water stressors). [41]

#### **Evidence of demographic disparities in pollution exposure**

Peer-reviewed national studies consistently find that people of color experience higher air pollution exposures than White populations, even when controlling for income, and that structural patterns of consumption and production contribute to these disparities. For example, Tessum et al. report that non-Hispanic White populations experience a pollution "advantage" (approximately 17% less PM<sub>2.5</sub> exposure than is caused by their consumption on average), while Black and Hispanic populations disproportionately inhale pollution relative to what they cause. (Tessum et al., 2019). [42]

EPA summarized related evidence in Science Matters, reporting that people of color breathe more particulate air pollution on average, a finding that holds across income levels and regions. (U.S. Environmental Protection Agency, 2021). [43]

Within Chicago, research connecting social vulnerability and industrial siting patterns indicates that the highest social vulnerability index (SVI) census tracts are home to a large share of industrial sites, consistent with an EJ pattern where industrial activity and high vulnerability co-locate. (Illgner et al., 2022). [44]

#### **Climate change impacts that exacerbate pollution exposure**

Illinois climate hazards interact with pollution through three core mechanisms: increasing exposure intensity (higher concentrations or more frequent exceedances), increasing exposure duration (longer seasons), and creating new or expanded pathways (flood mobilization, infrastructure failures).

#### **Heavy precipitation, flooding, and water contamination pathways**

The Illinois State Climate Summary reports a dramatic increase in 2-inch extreme precipitation events and provides examples of major flooding events and their impacts on infrastructure and agriculture. (NOAA National Centers for Environmental Information, 2022). [45]

Flooding has direct EJ relevance because it can disproportionately affect households with fewer resources to remediate damage, relocate, or access insurance. IDPH's climate and health report notes that floods from 1993–2013 cost Illinois more than \$5.6 billion, and it describes health hazards linked to flooding including mold-triggered asthma attacks, injuries during cleanup, and carbon monoxide poisoning associated with generator use after power outages. (Illinois Department of Public Health, 2021). [28]

Urban flooding issues are also framed as a statewide concern beyond mapped floodplains. The Prairie Research Institute factsheet highlights that a large share of flood insurance and private claims occurred in urban areas and many claims were outside mapped floodplains, indicating that stormwater and drainage system capacity can be as important as riverine flooding. (Ford, 2021). [46]

Flooding interacts with pollution exposure through (a) combined sewer overflow (CSO) events, (b) mobilization of contaminants from industrial and legacy sites, and (c) damp housing conditions that increase mold and indoor air hazards. These pathways are central to EJ because they often intersect

with older infrastructure and housing stock. (Ford, 2021; Illinois Department of Public Health, 2021). [47]

#### **Extreme heat, ozone formation, and compounding stressors**

The Illinois State Climate Summary describes the 1995 Chicago heat wave as a severe event with more than 700 deaths, underscoring that extreme heat is an acute mass-casualty risk in Illinois. (NOAA National Centers for Environmental Information, 2022). [45]

IDPH's climate and health report emphasizes that heat stress illness risk is a statewide issue and reports that overall risk is about 1.5 times greater for those living in rural counties compared to urban counties, suggesting that vulnerability is context-specific and not limited to large cities (e.g., outdoor labor, distance to care, social isolation). (Illinois Department of Public Health, 2021). [29]

Heat also interacts with air pollution. The Fifth National Climate Assessment's air quality chapter states that climate change is projected to worsen air quality in many U.S. regions and that extreme heat events—which can lead to high concentrations of air pollution—are projected to increase in severity and frequency. (U.S. Global Change Research Program, 2023). [48]

Illinois EPA's 2022 air quality report notes that ozone levels vary with meteorology, with higher ozone years occurring during summers more favorable for ozone formation. This aligns with a climate-relevant mechanism: warming and stagnation episodes can increase ozone formation and prolong ozone season risks. (Illinois Environmental Protection Agency, 2024). [27]

#### **Climate-driven runoff and agricultural nutrient loads**

The NLRs executive summary states that statewide nitrate-nitrogen and total phosphorus loads correlate with water yield, which correlates with precipitation, and it concludes that greater runoff and drainage associated with climate change tend to increase river loads—meaning more implementation will be needed to achieve water quality goals. (Illinois NLRs Partnership, 2023/2024). [31]

This dynamic has EJ implications for rural communities reliant on private wells or small systems, for downstream communities impacted by algal blooms and water treatment costs, and for communities facing compounded flood-water contamination risks. The NLRs also highlights “legacy nutrients” as a driver, implying that even with present-day improvements, historical load accumulation can continue to affect water quality outcomes. (Illinois NLRs Partnership, 2023/2024). [31]

Public health outcomes linked to pollution and climate stressors Public health impacts in EJ contexts are typically multi-causal: exposures (air, water, soil), underlying disease prevalence, access to care, psychosocial stress, housing quality, and community capacity interact. This report focuses on outcomes with relatively strong evidence links to pollution/climate factors: respiratory disease (asthma and exacerbations), heat illness, flood-related health impacts, and long-term chronic disease risks linked to air pollution.

#### **Respiratory health: asthma and air pollution**

IDPH asthma surveillance provides Illinois-specific evidence of disparity: the asthma hospitalization rate in Illinois among non-Hispanic Black residents is reported as over three times higher than other race/ethnic groups in the 2016–2019 period. (Illinois Department of Public Health, 2021). [7]

IDPH trend publications also report that adult lifetime asthma prevalence in Illinois remained relatively constant at around 14% during 2011–2017, providing baseline prevalence context for exposure and vulnerability analyses. (Illinois Department of Public Health, 2018). [49]

Air pollution epidemiology supports the plausibility of disproportionate respiratory impacts in overburdened neighborhoods. EPA's particulate matter science assessments and supplements provide the scientific basis for understanding that PM exposure is linked to serious health effects, including premature death and cardiovascular harms; these health risks are especially concerning where exposures are elevated and vulnerabilities are high. (U.S. Environmental Protection Agency, 2024). [50]

In Chicago specifically, recent research examining combined exposure to PM<sub>2.5</sub> and extreme heat found that combined exposures vary within the city and have environmental justice relevance when analyzed alongside socioeconomic characteristics. (Ahn et al., 2024). [51]

#### **Heat illness and climate-health inequities**

IDPH documents statewide heat hospitalization patterns and notes higher risk in rural counties relative to urban counties, while also acknowledging that determinants are not fully understood—likely involving occupational exposure, social isolation, and access-to-care differences. (Illinois Department of Public Health, 2021). [28]

Prairie Research Institute's climate factsheet emphasizes that extreme heat and urban heat island effects can combine with neighborhood inequities (e.g., limited green space, limited access to air conditioning) to increase heat-related illness risk,

particularly for people with chronic conditions and those facing economic barriers. (Ford, 2021). [46]

Flooding, damp housing, and infectious/indoor exposure risks IDPH links increased rainfall and flooding to public health threats such as mold exposure, diarrhea illness risk in contexts with sewer impacts, injury during cleanup, and disruptions to healthcare access when facilities are in floodplains or transportation routes are compromised. (Illinois Department of Public Health, 2021). [29]

Flooding also intersects with industrial legacy risks in communities near waste sites and contaminated waterways; while site-specific risk depends on contamination profiles and flood dynamics, the mechanism of contaminant mobilization is central to EJ risk planning in flood-prone areas. (NOAA National Centers for Environmental Information, 2022; Illinois Department of Public Health, 2021). [52]

**Emerging contaminants: PFAS and drinking water equity**

Illinois EPA reports that in 2021 it completed a statewide investigation into PFAS occurrence in finished drinking water representing all 1,749 community water supplies in Illinois, establishing a broad baseline for PFAS occurrence and related public communication protocols. (Illinois Environmental Protection Agency, 2021). [53]

A U.S. Geological Survey report describing Illinois’ PFAS sampling indicates that finished drinking water was sampled and analyzed for 18 PFAS at 1,428 entry points in 1,017 Illinois community water supply systems; at least one PFAS was detected in 163 initial samples, with detections confirmed at 149 of 164 resampled locations. (Gahala et al., 2023). [34]

PFAS in aquatic systems can also create food-chain exposure pathways. A 2024 study assessing PFAS in fish samples from Illinois waters found elevated PFAS levels in samples collected from regions adjacent to urban zones and noted patterns consistent with bioaccumulation. (Sands et al., 2024). [54]

These PFAS findings are EJ-relevant because exposure burdens can be shaped by differential reliance on fishing for subsistence or recreation, limited information access, and uneven capacity to install filtration or relocate water sources. [55]

**Quantitative illustration: nutrient loads, hydrology, and climate linkage**

Illinois’ nutrient challenges provide a clear example of how climate-driven hydrology can amplify pollution burdens. The NLRs executive summary provides statewide baseline and recent (2017–2021 five-year average) load and water-yield

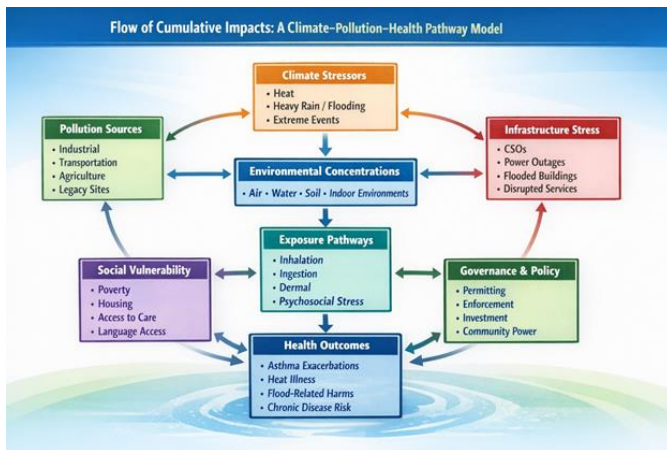
comparisons, while also noting that interim goals may be missed, particularly for phosphorus. (Illinois NLRs Partnership, 2023/2024). [31]

| Metric                          | Baseline Value | 2017–2021 Average |
|---------------------------------|----------------|-------------------|
| Water yield (in/yr)             | 13.0           | 15.9              |
| Nitrate-N load (million lbs/yr) | 397            | 416               |
| Total P load (million lbs/yr)   | 34             | 46                |

The baseline and recent values shown above are taken from the NLRs 2023 biennial report executive summary figure narrative, which reports water yield at 13.0 in/yr baseline and 15.9 in/yr for 2017–2021 (23% higher), nitrate-nitrogen load increasing 4.8% compared to baseline, and total phosphorus load increasing 35% compared to baseline. (Illinois NLRs Partnership, 2023/2024). [31]

This relationship reinforces a central EJ planning insight: climate adaptation for water quality is not only about infrastructure hardening; it also requires accelerating upstream nutrient reduction practices, increasing vegetative buffers, and improving wastewater and stormwater management to counteract higher runoff regimes. (Illinois NLRs Partnership, 2023/2024). [32]

**Flow of cumulative impacts: a climate–pollution–health pathway model**



This conceptual model aligns with the structure of EJSCREEN (environmental + demographic screening), EJI’s cumulative burden approach (including a climate burden module), Illinois’ EJ policy focus on areas of EJ concern and enhanced public participation, and IDPH documentation of climate-health pathways. (U.S. Environmental Protection Agency, 2024; ATSDR, 2024; Illinois Environmental Protection Agency, 2024; Illinois Department of Public Health, 2021). [56]

#### IV. CASE STUDIES

The case studies below illustrate how cumulative burden manifests in specific Illinois geographies and how community-led initiatives shape both data and policy responses.

##### Chicago: cumulative impacts and industrial corridors

Chicago’s cumulative impact assessment initiative is explicitly framed as a community-led and city-partnered process to identify neighborhoods experiencing the greatest cumulative burdens and to inform city decision-making and targeted investments. A city committee briefing describes the CIA as co-led by community groups and the city, guided by an Environmental Equity Working Group, with working groups on data/methods, community engagement, policy, and interdepartmental strategy. (Chicago Department of Public Health briefing materials, 2023). [57]

The executive order establishing this structure—issued by Lori Lightfoot[58]—defines “Cumulative Impact Assessment” as a jointly completed report detailing how environmental burdens, health conditions, and social stressors vary across Chicago and identifying “Environmental Justice Neighborhoods.” It also defines environmental justice in terms of fair treatment and meaningful involvement, and it sets deadlines for producing an

EJ action plan and publishing annual progress. (City of Chicago, 2023). [59]

A key feature of this case is institutionalization of “cumulative burden” in local governance: the CIA is intended to inform land use and zoning, transportation planning, permitting, enforcement, and other interventions. This emphasis directly addresses a common EJ challenge: pollution is often permitted, regulated, and contested within siloed systems, while communities experience cumulative exposure. (City of Chicago, 2023; CDPH briefing materials, 2023). [60]

##### Little Village: coal plant legacy, demolition, and freight transition

Little Village’s EJ profile reflects a common transition dilemma: fossil-fuel infrastructure closures can reduce some emissions over time, but deconstruction and redevelopment can create acute exposures and new burdens (e.g., dust events, truck traffic from logistics redevelopment). The Crawford coal plant demolition and subsequent redevelopment were associated with a widely reported smokestack implosion and a dust event that became a focal EJ incident and accountability case. (WBEZ, 2022; Borderless Magazine, 2024; Joshi, 2023). [61] Community-based EJ organizing in Little Village is also institutional: the committee briefing on Chicago’s CIA notes that the Data & Methods working group was co-chaired by the Little Village Environmental Justice Organization and others, reflecting how frontline groups shape municipal tool development. (CDPH briefing materials, 2023). [57]

##### Southeast Side and Altgeld Gardens/Riverdale: the “toxic doughnut” and legacy infrastructure

Southeast Chicago and the Altgeld Gardens/Riverdale area are among the most cited EJ landscapes in Illinois. A peer-reviewed study on resident perceptions describes Altgeld Gardens as surrounded by landfills and hazardous facilities and identifies the “toxic doughnut” concept as part of local EJ framing. (White et al., 2015). [62]

People for Community Recovery[63], founded in the Altgeld Gardens context and associated with Hazel M. Johnson[64], emphasizes education and accountability through “toxic tours” of the Lake Calumet Industrial Area and related community programming. (People for Community Recovery, n.d.). [65]

This case is also intertwined with broader industrial corridor conflicts (bulk storage, metal shredding/recycling proposals, and enforcement disputes). Illinois EPA’s 2024 civil-rights resolution letter documents that a Title VI-related complaint was filed regarding an air construction permit for a metal shredder in southeast Chicago and that Illinois EPA entered an

informal resolution agreement (IRA) to address procedural safeguards and revisions to public participation and language access planning. (U.S. Environmental Protection Agency, 2024). [66]

This demonstrates a critical EJ governance pathway: civil rights enforcement intersects with environmental permitting, requiring not only pollutant control but nondiscrimination safeguards in procedures (notice, engagement, translation, recordkeeping, and public access). [67]

#### **Metro-East and Sauget: hazardous waste legacies and industrial corridor remediation**

Metro-East Illinois (bordering Missouri along the Mississippi River) contains some of the state's most significant industrial legacy burdens. EPA's Superfund profile for the Sauget Area 2 site describes a 312-acre area including landfills and backfilled lagoons contaminated with PCBs, pesticides, and metals, and notes that while parts have been cleaned up, long-term cleanup remains ongoing. (U.S. Environmental Protection Agency, n.d.). [68]

The U.S. Department of Justice[69] announced in 2021 that Monsanto successor companies would complete cleanup of former landfills and waste lagoons in Sauget, including cost reimbursement and implementation of EPA's cleanup plan. (U.S. Department of Justice, 2021). [70]

This case illustrates how EJ concerns can persist even when remediation is underway. Communities may remain exposed through groundwater pathways, sediment resuspension, restricted land uses, or stigma and economic disinvestment. Moreover, industrial corridor cleanup is often a decades-long process, requiring sustained governance and community engagement rather than one-time interventions. (U.S. Environmental Protection Agency, n.d.; U.S. Department of Justice, 2021). [71]

#### **Downstate and rural watersheds: nutrient pollution, flooding, and rural EJ capacity**

Rural Illinois EJ stressors are often less visible in national EJ conversations but can be acute. The Illinois climate and health report notes higher heat hospitalization risk in rural counties and emphasizes that pathways may include agricultural work exposure and reduced social connectivity and care access. (Illinois Department of Public Health, 2021). [28]

Water quality is a core rural EJ concern. USGS reporting on nutrients in the Mississippi River Basin notes the Illinois River as having high nitrate concentrations and indicates the role of

extensive agricultural areas and municipal wastes in the basin's nutrient profile. (Rostad, 1997/USGS Circular). [72]

Illinois' NLRS explicitly frames nutrient reductions as necessary for both local and downstream benefits, sets long-term goals (45% reduction in total nitrogen and total phosphorus loads originating in Illinois), and reports concern that interim goals may not be met, with climate change recognized as a contributing factor through runoff and drainage dynamics. (Illinois NLRS Partnership, 2023/2024). [32]

A 2024 rural Illinois EJ needs assessment (from the University of Illinois Extension[73]) highlights rural environmental justice perspectives and needs, indicating a growing focus on rural EJ capacity and the distinct challenges of smaller communities. (University of Illinois Extension, 2024). [74]

## **V. POLICY ANALYSIS**

### **State EJ governance and Illinois EPA implementation**

Illinois' EJ governance architecture includes the Illinois Environmental Justice Act and the Illinois Commission on Environmental Justice. The Commission's 2024 yearly report describes the Commission's duties (advising state entities; assessing laws and policies; developing criteria for EJ issues) and notes that Illinois EPA provides administrative support. (Illinois Commission on Environmental Justice, 2024). [75]

Illinois EPA's EJ policy provides the operational bridge from EJ principle to agency practice. It defines key goals (ensuring communities are not disproportionately impacted; strengthening public involvement; developing common practices across staff; adapting strategy over time), establishes the "area of EJ concern" demographic threshold, and describes an EJ notification process linked to permitting. (Illinois Environmental Protection Agency, 2024). [5]

### **Procedural safeguards and civil-rights compliance in permitting**

A major 2024 development in Illinois EJ governance is the EPA-Illinois EPA informal resolution agreement (IRA) connected to a Title VI civil rights complaint regarding an air construction permit for a metal shredder in southeast Chicago. EPA's resolution letter notes that the complaint alleged discrimination in permitting and procedural safeguards (including meaningful access for limited English proficiency). (U.S. Environmental Protection Agency, 2024). [76]

The IRA text includes several commitments relevant to EJ and resilience governance: use of EJ Start and EJSCREEN screening in permit review; provision of written analysis of

compliance and enforcement history and additional civil rights analysis or mitigation measures; revision of EJ notification letter templates; and staff awareness and training requirements. (U.S. Environmental Protection Agency, 2024). [77]

It also commits Illinois EPA to revising its Enhanced Public Participation Plan to ensure accessibility regardless of race, national origin (including limited English proficiency), disability, sex, or age; and to revising its Language Access Plan with commitments to meaningful access for persons with limited English proficiency. (U.S. Environmental Protection Agency, 2024). [78]

These procedural elements matter for EJ because they determine who can participate effectively and how information (technical modeling, permits, compliance history) becomes available for community decision-making. They also provide infrastructure for climate-resilient governance—since climate impacts often require rapid, multilingual emergency communications and accessible public participation in adaptation decisions. [79]

Climate and Equitable Jobs Act and EJ-linked decarbonization  
The Climate and Equitable Jobs Act (CEJA), signed into law in 2021, is Illinois’ flagship climate-energy transition framework. Illinois EPA’s CEJA overview page notes that CEJA includes provisions to phase out carbon emissions from the energy and transportation sectors and directs Illinois EPA to establish rebate and grant programs for electric vehicles and charging stations and to oversee phase-out schedules for certain fossil-fuel-fired electrical generation units and other large greenhouse gas-emitting units. (Illinois Environmental Protection Agency, 2021/2024). [80]

The enrolled Public Act 102-0662 text reflects the breadth of CEJA beyond emissions: it includes workforce and barrier-reduction programs aimed at equity-focused populations and economically disadvantaged communities, supporting a “just transition” framing. (Illinois General Assembly, 2021). [81]

From an EJ perspective, CEJA’s relevance is twofold. First, climate mitigation policies can reduce co-pollutants (NO<sub>x</sub>, SO<sub>2</sub>, PM precursors) that disproportionately burden over-exposed communities—if implementation is targeted and avoids shifting burdens. Second, equitable workforce and investment provisions can build local resilience capacity in communities historically excluded from the economic benefits of energy systems. (Illinois Environmental Protection Agency, 2021/2024; Illinois General Assembly, 2021). [82]

### **Water quality policy: nutrient strategy and climate adaptation**

Illinois’ Nutrient Loss Reduction Strategy (NLRS) represents a statewide cross-sector framework involving Illinois EPA, the Illinois Department of Agriculture, and University of Illinois Extension facilitation. The NLRS aims to reduce nitrogen and phosphorus loads from agriculture, point sources, and urban stormwater and explicitly acknowledges that climate change influences runoff and loads, increasing the implementation challenge. (Illinois NLRS Partnership, 2023/2024; Illinois Environmental Protection Agency, n.d.). [32]

### **Drinking water infrastructure equity: lead service lines and PFAS**

Illinois’ Lead Service Line Replacement and Notification Act, effective January 1, 2022, requires community water supplies to develop and maintain comprehensive service line material inventories and replacement plans and is codified in Illinois law, with Illinois EPA providing guidance and oversight. (Illinois Environmental Protection Agency, 2022). [83]

A Chicago Federal Reserve analysis points to Illinois EPA inventory data indicating that Chicago has a very large number of known lead service lines (with additional unknown materials), illustrating how legacy infrastructure risk can become an EJ issue at scale in older cities and specific neighborhoods. (Federal Reserve Bank of Chicago, 2021/2024 commentary citing Illinois EPA inventory). [84]

PFAS policy remains evolving, but Illinois EPA’s statewide investigation and related health advisories and communication protocols represent an emerging contaminant governance approach that can be evaluated through EJ lenses (e.g., who is notified, who can afford filtration, and how remediation is funded). (Illinois Environmental Protection Agency, 2021; Gahala et al., 2023). [85]

### **Recommendations**

The recommendations below are oriented toward actionable policy, planning, and community resilience strategies that can be monitored with measurable metrics. They are designed to align with Illinois’ existing EJ governance (Illinois EPA EJ policy; EJ Commission duties) and with cumulative burden frameworks (EJSCREEN and EJI). [86]

### **Institutionalize cumulative burden decision-making**

Illinois should expand cumulative impact approaches beyond pilot or city-specific programs by developing a statewide cumulative burden and resilience framework usable by state agencies, counties, and municipalities. This can build from Illinois EPA’s EJ Start screening, EPA’s EJSCREEN

indicators, and CDC/ATSDR's EJ + Climate Burden module to create a consistent baseline for identifying priority areas. (Illinois Environmental Protection Agency, 2024; U.S. Environmental Protection Agency, 2024; ATSDR, 2024). [87]

A core governance recommendation is to require that major permitting and siting decisions in "areas of EJ concern" include: (a) a written cumulative burden analysis that integrates existing sources and vulnerabilities; (b) an explicit review of applicant compliance history; and (c) an enforceable mitigation plan with monitoring and community reporting. The 2024 IRA process provides a concrete procedural model for written analysis and consideration of compliance history and mitigation options. (U.S. Environmental Protection Agency, 2024). [88]

## VI. REDUCE EXPOSURES THROUGH TARGETED, CO-BENEFIT INTERVENTIONS

Priority exposure-reduction interventions should focus on measures with strong co-benefits for climate and health:

1) Transportation and freight: accelerate electrification of vehicles and charging infrastructure with EJ targeting (as CEJA directs), while also reducing near-road exposure through anti-idling, rerouting, and buffer/vegetation strategies near sensitive receptors. (Illinois Environmental Protection Agency, 2021/2024). [80]

2) Industrial emissions and toxics: apply enhanced permit conditions and screening in EJ areas (as described in the IRA) including improved monitoring, emissions testing, and enforceable operational constraints; pursue fence-line monitoring for high-risk facilities where appropriate. (U.S. Environmental Protection Agency, 2024). [89]

3) Water quality and nutrient reduction: scale conservation practices and wastewater/stormwater improvements to counter climate-driven increases in water yield and nutrient loads; use NLRs targets as a performance backbone while explicitly integrating climate adaptation. (Illinois NLRs Partnership, 2023/2024). [32]

4) Drinking water equity: prioritize lead service line replacement and PFAS risk communication in disadvantaged communities, using inventories to transparently track progress; ensure financing mechanisms reduce cost burdens on low-income households. (Illinois Environmental Protection Agency, 2022; Illinois Environmental Protection Agency, 2021; Gahala et al., 2023). [90]

### Build climate-resilient EJ infrastructure

Given evidence of increasing extreme precipitation events and flood losses, Illinois should expand investments in stormwater capacity, green infrastructure, and floodproofing in high-burden communities, particularly where flooding intersects with industrial sites or aging combined sewer systems. (NOAA National Centers for Environmental Information, 2022; Illinois Department of Public Health, 2021; Ford, 2021). [91]

Heat resilience investments (cooling centers, tree canopy, building retrofits, worker protections) should be prioritized using EJ climate burden indicators and IDPH heat hospitalization risk mapping. (ATSDR, 2024; Illinois Department of Public Health, 2021). [92]

### Strengthen community capacity, language access, and procedural equity

Illinois should treat language access and meaningful participation as EJ infrastructure, not optional add-ons. The IRA commitments to revise public participation and language access planning provide a blueprint for ensuring LEP communities can access information and participate effectively in permitting decisions. (U.S. Environmental Protection Agency, 2024; Illinois Environmental Protection Agency, 2024). [93]

State and local agencies should also invest in community science capacity and participatory monitoring to complement official networks, consistent with evidence that hyperlocal monitoring can support EJ advocacy and accountability. (Illgner et al., 2022). [44]

### Create a metrics-based accountability system

Illinois should adopt a public EJ-climate progress dashboard with metrics at the census-tract or block-group scale, aligned with existing screening tools but grounded in measurable outcomes. Suggested metrics include:

- Air: PM2.5 annual averages and exceedances; ozone 8-hour fourth-high values; near-road NO<sub>2</sub>; number and severity of "unhealthy" AQI days; monitoring coverage in EJ neighborhoods. (Illinois Environmental Protection Agency, 2024). [27]
- Water: nitrate-nitrogen and total phosphorus loads (NLRs benchmarks); CSO frequency where applicable; PFAS detections and remediation milestones; drinking water violations/disadvantage targeting metrics. (Illinois NLRs Partnership, 2023/2024; Illinois Environmental Protection Agency, 2021). [94]
- Built environment: lead service line inventory completion and replacement rates; percentage of replacements in high-

- burden tracts; flood damage claims outside floodplains; heat-resilience infrastructure coverage. (Illinois Environmental Protection Agency, 2022; Ford, 2021). [95]
- Health: asthma hospitalization rates by race/ethnicity; heat stress hospitalization rates; flood-related injury/illness indicators where available; tracking of climate-sensitive vector-borne disease trends where relevant. (Illinois Department of Public Health, 2021; Illinois Department of Public Health, 2018–2021). [96]
  - Process and civil-rights compliance: number of permits in areas of EJ concern receiving enhanced outreach; timeliness and accessibility of public notices; translation/interpretation provision metrics; publication of written analyses and responsiveness summaries. (Illinois Environmental Protection Agency, 2024; U.S. Environmental Protection Agency, 2024). [97]

## VII. CONCLUSION

Environmental justice in Illinois is fundamentally a cumulative problem: layered pollution sources (industrial, agricultural, transportation, and legacy contamination) interact with social vulnerability and are increasingly intensified by climate change hazards such as extreme precipitation, flooding, and heat. Official tools (EJSCREEN and EJI), state policies (Illinois EPA EJ policy and enhanced public participation commitments), and health surveillance evidence (e.g., asthma disparities and climate-health pathways) collectively show that reducing inequities requires more than compliance with single-media standards—it requires institutionalized cumulative burden governance, targeted exposure reduction, climate-resilient infrastructure investment, and procedural equity (including language access and meaningful participation). [98]

Illinois also has clear assets: a formal EJ governance structure, robust state monitoring and reporting programs, climate-energy transition policy through CEJA, and strong community-led EJ networks that are already co-designing tools and accountability systems. The central strategic challenge through 2024 is accelerating measurable outcomes—reductions in exposure and health disparities—while adapting to climate conditions that intensify baseline risks. [99]

## REFERENCES

1. Agency for Toxic Substances and Disease Registry. (2024). Environmental Justice Index (EJI) 2024 update. U.S. Department of Health and Human Services. [100]
2. Agency for Toxic Substances and Disease Registry. (2024). Technical documentation for the Environmental Justice Index (EJI) 2024. U.S. Department of Health and Human Services. [101]
3. Agency for Toxic Substances and Disease Registry. (2024). EJI indicators: Climate burden module. U.S. Department of Health and Human Services. [102]
4. Ahn, Y., et al. (2024). Disparities of compound exposure of particulate matter (PM<sub>2.5</sub>) and extreme heat within Chicago considering socioeconomic aspects. *The Lancet Regional Health – Americas* (article page). [51]
5. *Borderless Magazine*. (2024). Federal judge approves settlement in botched Hilco smokestack implosion case (Little Village). [103]
6. City of Chicago. (2023). Executive Order No. 2023-3 (Environmental justice, cumulative impact assessment, EJ action plan). [104]
7. Chicago Department of Public Health. (2023). Cumulative Impact Assessment: Committee on Environmental Protection and Energy briefing materials (July 12, 2023). [57]
8. Federal Reserve Bank of Chicago. (n.d.). Getting the lead out: New opportunities and challenges for the Great Lakes region (citing Illinois EPA lead service line inventory information). [84]
9. Ford, T. (2021). PRI factsheet: Climate change impacts and costs to Illinois communities (Prairie Research Institute / Illinois State Climatologist). [46]
10. Gahala, A. M., et al. (2023). Per- and polyfluoroalkyl substances (PFAS) in Illinois community water supplies (USGS Scientific Investigations Report). U.S. Geological Survey. [34]
11. Illgner, T., et al. (2022). Data to improve air quality environmental justice outcomes in Chicago (mapping social vulnerability and industrial sites). *Frontiers in Public Health* (PMC full text). [44]
12. Illinois Commission on Environmental Justice. (2024). Yearly report 2024: State of Illinois Commission on Environmental Justice. [105]
13. Illinois Environmental Protection Agency. (2021). Per- and polyfluoroalkyl substances (PFAS) in Illinois drinking water: Statewide investigation overview. [53]
14. Illinois Environmental Protection Agency. (2022). Lead service line information: Lead Service Line Replacement and Notification Act guidance and requirements (415 ILCS 5/17.12). [83]
15. Illinois Environmental Protection Agency. (2024). Illinois annual air quality report 2022 (published January 2024). [27]
16. Illinois Environmental Protection Agency. (2024). Environmental Justice (EJ) Policy (including “area of EJ concern” definition and EJ Start screening). [5]

17. Illinois Environmental Protection Agency. (2024). Enhanced Public Participation Plan (EJPPP) overview. [106]
18. Illinois Environmental Protection Agency. (2021/2024). Climate and Equitable Jobs Act (CEJA) overview (Illinois EPA CEJA page). [80]
19. Illinois General Assembly. (2021). Public Act 102-0662: Climate and Equitable Jobs Act (CEJA). [81]
20. Illinois Department of Public Health. (2018). Asthma trends: Adult prevalence, 2011–2017 (surveillance publication). [49]
21. Illinois Department of Public Health. (2021). Asthma trends: Hospital discharge data, 2016–2019 (surveillance publication). [7]
22. Illinois Department of Public Health. (2021). Climate and health in Illinois (BRACE report). [107]
23. Illinois NLRs Partnership (Illinois EPA, Illinois Department of Agriculture, University of Illinois Extension). (2023/2024). Illinois Nutrient Loss Reduction Strategy 2023 biennial report: Executive summary (covers 2021–2022 efforts). [32]
24. Joshi, T. (2023). A case study of the Crawford coal plant implosion and environmental negligence toward Little Village (University of Chicago Harris School PDF chapter/case study). [108]
25. NOAA National Centers for Environmental Information. (2022). Illinois State Climate Summary (2022). [109]
26. People for Community Recovery. (n.d.). Organization website and program description (toxic tours; community EJ work). [110]
27. Rostad, C. E. (1997). Nutrients in the Mississippi River (USGS Circular 1133). U.S. Geological Survey. [72]
28. Sands, M., et al. (2024). PFAS assessment in fish – samples from Illinois waters. *Science of the Total Environment* (article page). [54]
29. Tessum, C. W., et al. (2019). Inequity in consumption of goods and services adds to racial–ethnic disparities in air pollution exposure. *Proceedings of the National Academy of Sciences (PNAS)*. [111]
30. U.S. Department of Justice. (2021). Monsanto successor companies agree to clean remaining surface contamination at Sauget Superfund site (press release). [70]
31. U.S. Environmental Protection Agency [112]. (2021). Study finds exposure to air pollution higher for people of color regardless of region or income (Science Matters summary). [43]
32. U.S. Environmental Protection Agency. (2024). EJSCREEN technical documentation for version 2.3 (revised July 31, 2024). [23]
33. U.S. Environmental Protection Agency. (2024). Resolution of EPA Complaint No. 01RNO-21-R5: Resolution letter and Informal Resolution Agreement (IRA) with Illinois EPA (February 2024). [113]
34. U.S. Environmental Protection Agency. (n.d.). Outboard Marine Corporation (OMC) Superfund site information and profiles (Waukegan Harbor, Illinois). [38]
35. U.S. Environmental Protection Agency. (n.d.). Sauget Area 1 and Sauget Area 2 Superfund site profiles (Illinois). [114]
36. U.S. Environmental Protection Agency. (2024). Supplement to the 2019 Integrated Science Assessment for Particulate Matter (PM) (final supplement page). [115]
37. U.S. Global Change Research Program. (2023). Fifth National Climate Assessment: Air Quality chapter and national assessment overview. [116]
38. University of Illinois Extension. (2024). 2024 rural Illinois environmental justice needs assessment. [74]
39. WBEZ. (2022). Botched Little Village Crawford coal plant implosion fallout (reporting and context). [117]
40. White, B. M., et al. (2015). Perceptions of environmental health risks among residents in a community in southeast Chicago (Altgeld Gardens “toxic doughnut” context). *International Journal of Environmental Research and Public Health (PMC full text)*. [62]