Connecticut Environmental Justice Screening Tool

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CIRCA
Connecticut Institute for Resilience and Climate Adaptation

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CIRCA Project Team:

- Dr. Yaprak Onat – Associate Director of Research and Project Principal Investigator
- Dr. Mary Buchanan – Community Resilience Planner
- Dr. Joanna Wozniak-Brown – Former Assistant Director for Resilience Planning
- Caterina Massidda – Former GIS Data Analyst
- Libbie Duskin – GIS Data Analyst
- Defne Alpdogan – Environmental Justice Intern
- Kat Morris – Community Engagement Specialist
- Alexis Torres - Climate Change Intern
- Brandon Peate – 2021 GIS Intern
- Michael Pimenta – 2023 GIS Intern

CT DEEP Project Team:

- Edith Pestana – CT Deep Environmental Justice Administrator
- Cora Barber – 2022-2023 Environmental Justice Program Assistant
- Caroline Bitner – 2021 Environmental Justice Program Assistant

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Executive Summary

The Connecticut Environmental Justice Screening Tool (CT EJScreen) represents an innovative approach to identifying and addressing the state's environmental justice (EJ) challenges. Developed by the Connecticut Institute for Resilience & Climate Adaptation (CIRCA), this project was initiated in August 2021 and progressed over two years. Through continuous data collection and improvements based on feedback from the Equity and Environmental Justice Working Group (EEJ) of the Governor's Council on Climate Change, multiple advisory committees, community forums, and public comments, seven iterative versions of the tool were created, each enhancing the overall functionality and utility.

The primary purpose of the CT EJScreen tool is to provide a data-driven framework to assist policymakers, planners, and the public in understanding the environmental burdens and vulnerabilities within different communities. The tool employs a comprehensive GIS-based approach, examining various indicators related to environmental pollution exposures and potential health implications. The CT EJScreen tool uses a cumulative index score calculated by multiplying the Pollution Burden and Sensitive Population scores; these scores, in turn, are calculated from component scores representing Potential Pollution Sources, Potential Pollution Exposure, Socioeconomic Factors, and Health Sensitivity. Each of these component categories contains many individual data layers called indicators, and each component score is computed by averaging the ranks of all individual indicators within that specific component. Each indicator receives a percentile score relative to all the other census tracts within the state, thus illustrating where a particular census tract stands compared to others with regard to each indicator. These percentiles were converted into a 0 to 10 rank score from least impacted to highest impact, respectively, for easier user interpretation. All the indices and indicators have been converted into a web-based mapping tool for open access and easy application.

One of the core elements in developing the CT EJScreen tool has been the utilization of high-quality, precise, current, and comprehensive data. These rigorous data requirements ensure the tool's effectiveness and reliability. As we moved forward with this project, we worked closely with our partners, holding biweekly meetings with the DEEP-CIRCA team, regular meetings with multiple advisory committees, and community feedback forums in Bridgeport, Hartford, Groton, Waterbury, and New Haven. These engagements have been integral to the project's iterative development, providing crucial feedback and improvement suggestions.

While the CT EJScreen tool is a powerful broad-lens resource for understanding and addressing environmental justice issues, it's crucial to note that it is not designed to evaluate specific health risks, predict health outcomes, explain individual's health concerns, or identify the exact impact of specific facilities. Moreover, decisions regarding the cumulative impact of environmental health risks should incorporate additional sources of information and not rely solely on this tool.

In conclusion, the development of the Connecticut EJScreen Tool marks a significant stride in promoting environmental justice within the state. Going forward, it is important to note that this

tool, like any data-driven application, requires regular updates and maintenance to ensure its ongoing relevance and accuracy. The roadmap laid out by CIRCA, including their future recommendations, provides a strong foundation for the continual evolution of the tool, ensuring its value and usability for years to come.

Resumen Ejecutivo

La Herramienta de Detección de Justicia Ambiental de Connecticut (CT EJScreen) representa un enfoque innovador para identificar y abordar los desafíos de justicia ambiental (EJ) del estado. Desarrollado por el Instituto de Resiliencia y Adaptación al Clima de Connecticut (CIRCA), este proyecto se inició en agosto de 2021 y progresó durante dos años. A través de la recopilación continua de datos y mejoras basadas en los comentarios del Grupo de Trabajo de Equidad y Justicia Ambiental (EEJ) del Consejo del Gobernador sobre Cambio Climático, múltiples comités asesores, foros comunitarios y comentarios públicos, se crearon siete versiones iterativas de la herramienta, cada una de las cuales mejora la funcionalidad general y la utilidad.

El objetivo principal de la herramienta CT EJScreen es proporcionar un marco basado en datos para ayudar a los legisladores, planificadores y al público a comprender las cargas ambientales y las vulnerabilidades dentro de las diferentes comunidades. La herramienta emplea un enfoque integral basado en SIG, que examina varios indicadores relacionados con la exposición a la contaminación ambiental y las posibles implicaciones para la salud. La herramienta CT EJScreen utiliza un puntaje de índice acumulativo que se calcula multiplicando los puntajes de Carga de contaminación y Población sensible; estos puntajes, a su vez, se calculan a partir de los puntajes de los componentes que representan las fuentes potenciales de contaminación, la exposición potencial a la contaminación, los factores socioeconómicos y la sensibilidad a la salud. Cada una de estas categorías de componentes contiene muchas capas de datos individuales llamadas indicadores, y la puntuación de cada componente se calcula promediando las clasificaciones de todos los indicadores individuales dentro de ese componente específico. Cada indicador recibe un puntaje de percentil en relación con todos los demás tramos censales dentro del estado, lo que ilustra dónde se encuentra un tramo censal en particular en comparación con otros con respecto a cada indicador. Estos percentiles se convirtieron en una puntuación de rango de 0 a 10 desde el impacto más bajo hasta el más alto, respectivamente, para facilitar la interpretación del usuario. Todos los índices e indicadores se han convertido en una herramienta de mapeo basada en la web para acceso abierto y fácil aplicación.

Uno de los elementos centrales en el desarrollo de la herramienta CT EJScreen ha sido la utilización de datos completos, precisos, actualizados y de alta calidad. Estos rigurosos requisitos de datos aseguran la efectividad y confiabilidad de la herramienta. A medida que avanzábamos con este proyecto, trabajamos en estrecha colaboración con nuestros socios, celebrando reuniones quincenales con el equipo DEEP-CIRCA, reuniones periódicas con varios comités asesores y foros de comentarios de la comunidad en Bridgeport, Hartford, Groton, Waterbury y New Haven. Estos compromisos han sido parte integral del desarrollo iterativo del proyecto, brindando comentarios cruciales y sugerencias de mejora.

Si bien la herramienta CT EJScreen es un poderoso recurso amplio para comprender y abordar problemas de justicia ambiental, es crucial tener en cuenta que no está diseñada para evaluar riesgos de salud específicos, predecir resultados de salud, explicar las preocupaciones de salud de las personas o identificar el impacto exacto de instalaciones específicas. Además, las decisiones sobre el impacto acumulativo de los riesgos ambientales para la salud deben incorporar fuentes adicionales de información y no basarse únicamente en esta herramienta.

En conclusión, el desarrollo de la herramienta EJScreen de Connecticut marca un paso significativo en la promoción de la justicia ambiental dentro del estado. En el futuro, es importante tener en cuenta que esta herramienta, como cualquier aplicación basada en datos, requiere actualizaciones y mantenimiento regulares para garantizar su relevancia y precisión continuas. La hoja de ruta establecida por CIRCA, incluidas sus recomendaciones futuras, proporciona una base sólida para la evolución continua de la herramienta, asegurando su valor y usabilidad en los años venideros.

Abbreviations

ACS	American Community Survey
BRFSS	Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
CGS	Connecticut General Statutes
CIRCA	Connecticut Institute for Resilience & Climate Adaptation
CT	Connecticut
CT EJScreen	Connecticut Environmental Justice Screening Tool
CWA	Clean Water Act
DEEP	Department of Energy & Environmental Protection
DPH	Department of Public Health
EEJ	Equity and Environmental Justice Working Group
EJ	Environmental Justice
EJI	Environmental Justice Index
EPA	Environmental Protection Agency
EPA EJ Screen	Environmental Protection Agency Environmental Justice Screening Tool
EPCRA	Emergency Planning and Community Right-to-Know Act
GC3	Governor's Council on Climate Change
HS	Health Sensitivity Index
MRF	Materials Recovery Facility
MTAC	Mapping Tool Advisory Committee
NPL	National Priorities List
PPE	Potential Pollution Exposure Index
PM 2.5	Particulate Matter 2.5
PPS	Potential Pollution Sources Index
RCRA	Resource Conservation and Recovery Act
SDAC	State Data Advisory Committee
SF	Socioeconomic Factor Index
UConn	University of Connecticut

Glossary

Age-Adjusted Rate	In looking at the prevalence of specific indicators, it is sometimes necessary to adjust the rates by age to account for the fact that individuals of different ages can be more or less susceptible to different diseases and indicators. Changing the rates for these differences helps to clarify the common trend independent of the age structures. Please read the CDC explanation to learn more about the age adjustment here.
Behavioral Risk Factor Surveillance System	Behavioral Risk Factor Surveillance System (BFSS) is a telephone health survey conducted continuously by the CDC. This health survey allows the CDC and other health departments to monitor for risks and chronic diseases and provide data about these topics. Learn more about BFSS here.
Composite Risk	Composite risk is a term used to describe the combination of multiple risks or hazards that may be present in a particular location or situation. Composite risk refers to the overall risk to a particular population or area, considering the potential impacts of multiple hazards happening at once.
Cumulative Impact	Cumulative impact in the CT EJ Mapping Tool context refers to the overall effect of all combined indicators on a specific census tract and/or region. The main environmental justice index score is one way to assess the cumulative impact on overburdened communities.
Crude Rate	The crude rate is another adjusted rate used to interpret our indicators. The crude rate is the total number of events divided by the mid-year total population of the selected geography and multiplied by a constant (usually a multiple of ten). Crude rates are typically used for Pregnancy MICA (The Missouri Information for Community Assessment), Fertility, Pregnancy Rates, and Birth rates: for example, reporting how many babies were born per 1,000 people in a particular town.
Decile	We used decile ranking to represent the indicator scores. Decile ranking divides the population into ten groups, with ten percent of the census tracts in each group, and is reported out of 10. For example, a decile rank of 10 represents the top 10 percent of the census tracts, while a decile rank of 1 represents the bottom 10 percent of the census tracts.
Disparity	Disparity is a lack of equality or fairness in distributing resources, opportunities, or outcomes. In the context of environmental justice, the disparity may refer to the unequal distribution of environmental risks and impacts across different communities, particularly marginalized communities that may be more vulnerable to these effects and impacts due to factors such as race, ethnicity, income, education level, and other indicators of socioeconomic status.
Energy Poverty	While poverty relates to economic status, energy poverty is the lack of access to sustainable and affordable energy services and products. The CT

	EJ Screen tool shows that communities lacking access to energy often also have coinciding indicators demonstrating the socioeconomic factors that impact communities. Energy poverty leads to insufficient energy, unhealthy living conditions, and limited access to education and employment. To read more about energy poverty, please click here: Energy Poverty.
Environmental Justice	According to the United States EPA, environmental justice is the fair treatment and meaningful involvement of all people, regardless of race, color, culture, national origin, income, and educational level, concerning developing, implementing, and enforcing protective environmental laws, regulations, and policies. EJ 2020 Glossary | US EPA
Environmental Justice Index	An Environmental Justice Index is a term used to describe a measure or metric used to assess the distribution of environmental hazards and their impact on marginalized communities. Environmental justice indices are typically used to identify environmental impact patterns and highlight areas where certain communities may be disproportionately affected by environmental hazards. In the context of the CT EJScreen, the Environmental Justice Index is the "big-picture" score that incorporates all the other scores in the tool.
Equity	According to the Connecticut Governor's Council on Climate Change, the principles of equity mandate that race, national origin, socioeconomic status, religion, gender identity, gender, disabilities, sexuality, or other facets of identity must not inhibit a person's access to resources, including basic necessities such as safe shelter, water, food, heat, and light, as well as opportunities for secure employment to support oneself and one's family, equal access to the community keeps such as public education, public transportation, healthcare and mental health care. Equitable planning includes core distributive and procedural justice concepts: it considers existing disparities and provides communities with meaningful opportunities to participate in policy processes. (GC3 report from January 2021, pg 21.)
GIS	Also known as a geographic information system, GIS allows the user to store, analyze, and map computer spatial data. In the case of environmental justice, GIS can be used to map and highlight disparities and remarkable characteristics of various regions. For more information, please see the following link: Mapping environmental injustices: pitfalls and potential of geographic information systems in assessing environmental health and equity. (nih.gov)
Gentrification	Gentrification describes the process of a neighborhood change in which there is a cultural change, a shift of power, and a displacement of residents. This is usually associated with urban development and can be caused by

	outside forces using economic or political power. For more information, please see the following link: Gentrification
Health Equity	According to the CDC, health equity is when everyone has a fair and equal opportunity to attain their highest level of health. This incorporates and overcomes the healthcare system's economic, social, and other obstacles. Health equity aims to prevent health disparities and close the gap between existing health disparities. For more information, please see the following link: Health Equity.
Incidence Rate	Incidence rate refers to how quickly new cases of a disease occur in a population over a specific period, such as a year. For more information, please see the following link: Incidence Rate.
Indicator	An indicator is a measure or metric to represent a particular phenomenon or issue's status, trend, or condition. Indicators are often used to summarize complex information and to help track progress or identify patterns and trends. In the context of the CT EJScreen, an indicator is an individual data layer representing a specific type of pollution impact, socioeconomic characteristic, or health sensitivity.
Intersectionality	According to the Center for Intersectional Justice, intersectionality describes how systems of inequality based on gender, race, ethnicity, sexual orientation, gender identity, disability, class, and other forms of discrimination "intersect" to create unique dynamics and effects. For more information, please see the following link: Intersectionality
Percentile	A percentile is a measure that indicates the value below which a certain percentage of observations fall to quantify the prevalence and the frequency distribution of the indicators and the impact on communities and groups. For example, the 90th percentile is the value below which 90% of observations fall. When calculating percentiles, the observations in a data set are first arranged in numerical order. Then, the value that corresponds to a given percentile is found by taking the total number of observations, multiplying that number by the desired percentile (expressed as a decimal), rounding down to the nearest whole number, and finding the value that is at that position in the data set. For example, to find the 30th percentile in a set of 20 numbers, you would first put those 20 numbers in order, then multiply 0.3 x 20, which equals 6. This means that the sixth number in the data set marks the 30th percentile, and everything below that number is in the bottom 30% of the data set. For more examples of how to calculate percentiles, please see the following link: Percentiles.
Pollution	Pollution defines a wide spectrum of pollutants (harmful materials) introduced into the environment. These may be found in air, water, and

	land and often occur due to human activities. For example, burning garbage can release pollution into the air that people can breathe in. For examples of pollutants that can be found in the air, please see the following link: Air Pollution.
Prevalence	Prevalence is the percentage of a population affected by a particular condition or characteristic. In the context of environmental justice, the prevalence may refer to the percentage of a population that is exposed to environmental hazards or affected by the negative impacts of these hazards. Understanding the prevalence of environmental risks and impacts can be important for identifying inequality patterns and developing strategies to reduce these risks and protect marginalized communities. Prevalence data may be collected through various methods, including surveys, observational studies, and other research approaches.
Public Housing	Public housing is for low-income families and individuals, supported by federal U.S. Department of Housing and Urban Development (HUD) aid. HUD provides a dataset with the location and resident characteristics of HUD-administered public housing development buildings, which are included in the CT EJScreen. To learn more about public housing, please see the following: Public Housing.
Redlining	According to the U.S. Justice Department, redlining is the discriminatory practice by financial institutions of denying providing financial services to consumers in specific neighborhoods based on racial or ethnic demographics. These practices contributed to spatial concentrations of segregation and poverty, with lasting economic and social impacts on communities. To learn more about redlining, please see the following link: Redlining.

Introduction

Environmental Justice in CT

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, culture, national origin, income, and educational levels with respect to the development, implementation, and enforcement of protective environmental laws, regulations, and policies. The environmental justice movement in the United States emerged in response to the disproportionate impact on low-income and minority communities by environmental decisions – specifically, the siting of industrial pollution, landfills, disposal facilities, and exposure to sources of pesticides and lead poisoning. In Connecticut, the state Department of Energy and Environmental Protection (DEEP) administers an environmental justice program to address these disparities, working within agencies and with towns on illegal dumping, air pollution, lead paint, and other environmental concerns that impact Connecticut citizens. More information about DEEP's Environmental Justice program can be found here.

Connecticut's industrialization in the early 20th century led to widespread pollution and environmental degradation, particularly in cities such as Bridgeport, New Haven, and Hartford. This pollution disproportionately affected low-income communities and communities of color, who often lived near industrial plants and waste disposal sites.

In the 1970s and 1980s, activists and community organizations in Connecticut began to demand greater accountability from the government and industry for environmental injustices. In 1985, a group of residents in Bridgeport formed the Coalition Against Environmental Racism to fight against the disproportionate pollution burden in their community and successfully blocked the construction of a waste-to-energy plant in the city.

In 1993, Connecticut passed the Environmental Justice Act, which requires state agencies to consider the environmental and public health impacts on low-income and minority communities when making decisions about land use, transportation, and waste disposal. The act also requires public participation in decision-making and enforcement from the courts.

Overall, Connecticut's history of environmental justice highlights the ongoing struggle to ensure that all communities have access to clean air, water, and a healthy environment. Connecticut's Environmental Justice Screening tool aims to advance equity within the state of Connecticut by identifying communities with disproportionate pollution burdens and health impacts, guiding decision-making at multiple levels of government, and providing data to support community advocacy and investment.

To learn more about Environmental Justice, click these useful links:

An Act Reducing Lead Poisoning
Disproportionate Rates of Climate Change on Black/Brown Communities
Impact of Climate Change on Low Income
Environmental Justice Program Overview (ct.gov) Connecticut Equity and Environmental Justice Advisory Council
EPA's Environmental Justice website;
CT DEEP's Environmental Justice Program,
2021 Environmental Justice Communities in Connecticut map
History of Environmental Justice in America and the Frontlines of Climate Justice in Connecticut (Webinar from CT Green Bank)
A History of Environmental Justice and Racial Policies in Connecticut Webinar (9/10/2020, webinar from CT DEEP)

Policy – Major Environmental Justice Policy Within CT

Connecticut Policy Act - Passed in 1973 as one of the most important environmental legislations, this act was "designed to give the public protection against actions of state agencies which sometimes in their zeal to carry out their mandates of construction projects…overlook the impact the environment which is so precious to us all."

Environment Equity Policy - The mission of the Department of Energy and Environmental Protection is to maximize and ensure the public health and welfare of the resources of the state of Connecticut. In doing so, DEEP's Environmental Equity Policy bridges the gap between intersectionality and the environment. In this policy, the Department states that there should be no segment of the population, whether due to its racial and/or economic makeup, bearing disproportionate consequences of environmental pollution and/or other harms related to decisions associated with the environment. This Equity Policy has been in effect since 1993. Since then, the state of Connecticut has deepened its involvement in the field of environmental justice.

DEEP – Connecticut Equity and Environmental Justice Advisory Council- In 2021, Governor Lamont issued Executive Order No.21-3, establishing an advisory committee within the Department of Energy and Environmental Protection. This executive order founded the Connecticut Equity and Environmental Justice Advisory Council (CEEJAC). According to the executive order, "[t]he purpose and mission of the CEEJAC is to advise the Commissioner of DEEP on current and historic environmental injustice, pollution reduction, energy equity, climate change mitigation and resiliency, health disparities, and racial inequity…" Specific tasks for this council outlined in the executive order

include developing a model plan for community engagement, integrating environmental justice into programs, policies, and activities, and connecting with other departments for partnerships.

Background and Origins of the CT Environmental Justice Screening Tool

Under the initiative formed by the Governor's Council on Climate Change (the GC3), the Connecticut Institute for Resilience and Climate Adaptation (CIRCA) at the University of Connecticut merged science with action to inform policy and planning. Following examples from Washington, Maryland, and California, UConn CIRCA pushed initiatives and action toward forming the Connecticut Environmental Justice Screening Tool. Governor Lamont's Executive Order No. 3 expanded the scope and responsibilities of the Governor's Council on Climate Change (GC3) by recommending climate equity strategies such as mitigation of carbon emissions, climate change adaptation, and climate resilience. The group was charged with "prioritizing, integrating and advancing equitable distribution of the costs and benefits of climate change mitigation planning policies, specifically addressing disproportionate impacts of such strategies on environmental justice communities," and providing an Adaptation and Resilience Plan with "recommended strategies to prioritize climate change adaptation efforts to protect vulnerable communities that the effects of climate change may disproportionately impact." This charge led to the creation of the Equity and Environmental Justice Working Group (EEJ) of the GC3 and a commitment on the part of all members of the GC3 to look at every recommendation through an equity lens.

The specific GC3 recommendation that led to the origins of the Connecticut EJScreen was the following:

> ***"Develop, launch, maintain, and use a statewide environmental mapping tool*** *that provides a visual representation of the spatial distribution of environmental and climate health vulnerabilities across Connecticut, taking into account the social determinants of health and utilizing indicators. Make recommendations for how the statewide environmental mapping tool could be codified and utilized in existing state programs, including grant and bond funding distribution. Launch a public-private interagency effort as part of the 2021 phase of the GC3 to develop the tool."*

In 2020, working with the GC3 EEJ working group, students at Yale University produced a report (del Fierro et al., 2021), which reviewed environmental justice mapping efforts nationwide, including mapping tools produced by other states and the specific indicators used in these tools. Since 2021, researchers at CIRCA have built off the foundation established by this report and have formed a community-state partnership through a combination of statistical spatial analysis and engagement with vulnerable communities across the state.

In accordance with the goals of the GC3 EEJ, the CT EJScreen can provide communities with the evidence needed to advocate for addressing the state's environmental, social, and health disparities.

Communities can collaborate or partner with advocacy organizations to call on state representatives to improve their communities. For policy and planning purposes, this tool can identify communities in Connecticut where multiple pollution and health risk factors combine to produce higher cumulative impacts, as well as communities in Connecticut with a relatively high prevalence of poor health and socioeconomic strain. This tool can guide local, state, and federal agencies and policymakers to better support and uplift vulnerable communities, including local departments and commissions on economic development, education, health, housing, and town planning and zoning.

"I'm thrilled to be launching this critical project with our partners at CIRCA. Equity and environmental justice have been a major focus of the Lamont Administration, the GC3, and our work at DEEP, and this tool will provide indispensable information, informed by the very communities most disproportionately impacted by pollution and the changing climate, to better inform decisions and policy-making to address those disparities."

Approach for developing the CT EJ Screening Tool

In 2021, the Governor's Council on Climate Change (GC3) Equity and Environmental Justice Working Group recommended developing a statewide environmental justice mapping tool as a priority action for near-term implementation in Connecticut. CIRCA and DEEP have partnered to develop this mapping tool using GIS technology, input from state agencies, and input from Connecticut communities. Community input was gathered through five community evaluation workshops, a public comment period on the online map viewer, and the regular convening of the Mapping Tool Advisory Committee (MTAC).

The project consisted of three phases of work:

1. Preparation of the Initial Environmental Justice Map Viewer included collecting Geographic Information Systems (GIS) source layer data across major indicators, reviewing data for quality and comprehensiveness, and establishing protocols for updating and maintaining the data with support from the State Data Advisory Committee (SDAC). [Check out ESRI's What is GIS? website to learn more about the mapping process and software.]
2. The Community Feedback Process included an EJ Mapping Tool Advisory Committee (MTAC) that met regularly to review and refine the tool, five community evaluation focus groups held throughout the state in environmental justice communities, and a public review and comment period for the draft mapping tool. This stage also included translating the tool and its accompanying reference materials into Spanish.
3. Creation of EJScreen 2.0 and the Next Steps phase of the project will entail final meetings and discussions, revisions to the EJScreen, and the drafting and release of the final project report and launch of the EJScreeen 2.0.

The US Environmental Protection Agency offers some important definitions that informs this work:

Environmental justice (EJ) is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies.

Fair treatment means no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies.

Meaningful involvement means:

- People have an opportunity to participate in decisions about activities that may affect their environment and/or health;
- The public's contribution can influence the regulatory agency's decision;
- Community concerns will be considered in the decision making process; and
- Decision makers will seek out and facilitate the involvement of those potentially affected.

The EPA developed EJScreen, which "is an environmental justice mapping and screening tool that provides EPA with a nationally consistent dataset and approach for combining environmental and demographic indicators. EJScreen users choose a geographic area; the tool then provides demographic and environmental information for that area. All of the EJScreen indicators are publicly-available data. EJScreen simply provides a way to display this information and includes a method for combining environmental and demographic indicators into EJ indexes." Learn more about how it was developed, it is used, and how it works at EPA's EJScreen website.

UConn CIRCA Expertise

The Connecticut Institute for Resilience and Climate Adaptation (CIRCA), based at the University of Connecticut, merges science with action to inform policy and planning. Serving in the GC3, supporting climate legislation, conducting climate change research, and orchestrating a multi-county climate resilience project, CIRCA has the expertise and resources to deliver critical information, support communication, and engage with the public. CIRCA's current capacity includes but is not limited to expertise in project management, local and regional planning, geographic information systems (GIS), stakeholder engagement, modeling real scientific problems, and performing fieldwork to validate model results.

Project Timeline

This timeline (Figure 1) details the work to establish the CT EJ Screening Tool. The project began in August 2021 and was planned to span over two years. The project involves a rigorous and continuous data gathering and enhancement process, ensuring that the tool evolves in sync with the most recent data and feedback from advisory committees. During this timeline, CIRCA has developed multiple iterations of the tool, each version enhancing its predecessor. Each update accounts for new data availability and integrates insights from advisory committees to optimize the tool's effectiveness and relevance. The project has successfully produced eight advanced versions of the tool, each reflecting our commitment to ongoing improvement and the embodiment of lessons learned throughout the project's duration.

Changes from previous versions

The development and evolution of the Connecticut EJScreen Tool has been a collaborative and iterative process, as demonstrated by the numerous updates implemented over time. The initial version 1.0 integrated GC3 EEJ workgroup suggestions, drew on the earlier Yale report (del Fierro et al., 2021) for the initial indicator suggestions, and established foundational new data sources. In version 1.1, suggestions from the SDAC were incorporated, leading to significant improvements in the web application.

Version 1.2 marked a substantial upgrade, including new sources of pollution and air data. This version also integrated all the data layers provided by the Department of Public Health (DPH), accommodated further SDAC suggestions, included feedback from multiple state meetings, and applied decile ranking. In version 1.3, the tool was adapted to the new municipal boundaries and encompassed suggestions from the MTAC. In developing version 1.3, all indicators were meticulously reviewed and vetted by relevant data stewards at the DPH and DEEP. This process ensured the accuracy and relevance of the language used in the tool, effectively integrating their valuable feedback into the finalized version.

As the project progressed to version 1.4, the changes reflected the updated 2020 census tract boundaries, further refined the data accuracy, and continued incorporating MTAC's suggestions. Version 1.5 introduced additional feedback from DEEP, DPH and the community evaluation forums, including adjusting the health data layers and creating additional resources to answer common questions from the public. Version 1.9 reflected an even more diverse set of inputs, incorporating suggestions received during the public comment period.

Finally, version 2.0 included feedback from technical review and online platform improvements. This allowed for a wider array of perspectives and concerns to be considered, enhancing the tool's functionality and relevance. These iterations demonstrate the project's dedication to continuously improving the tool, making it a more comprehensive, user-friendly, and valuable resource for addressing environmental justice concerns in Connecticut.

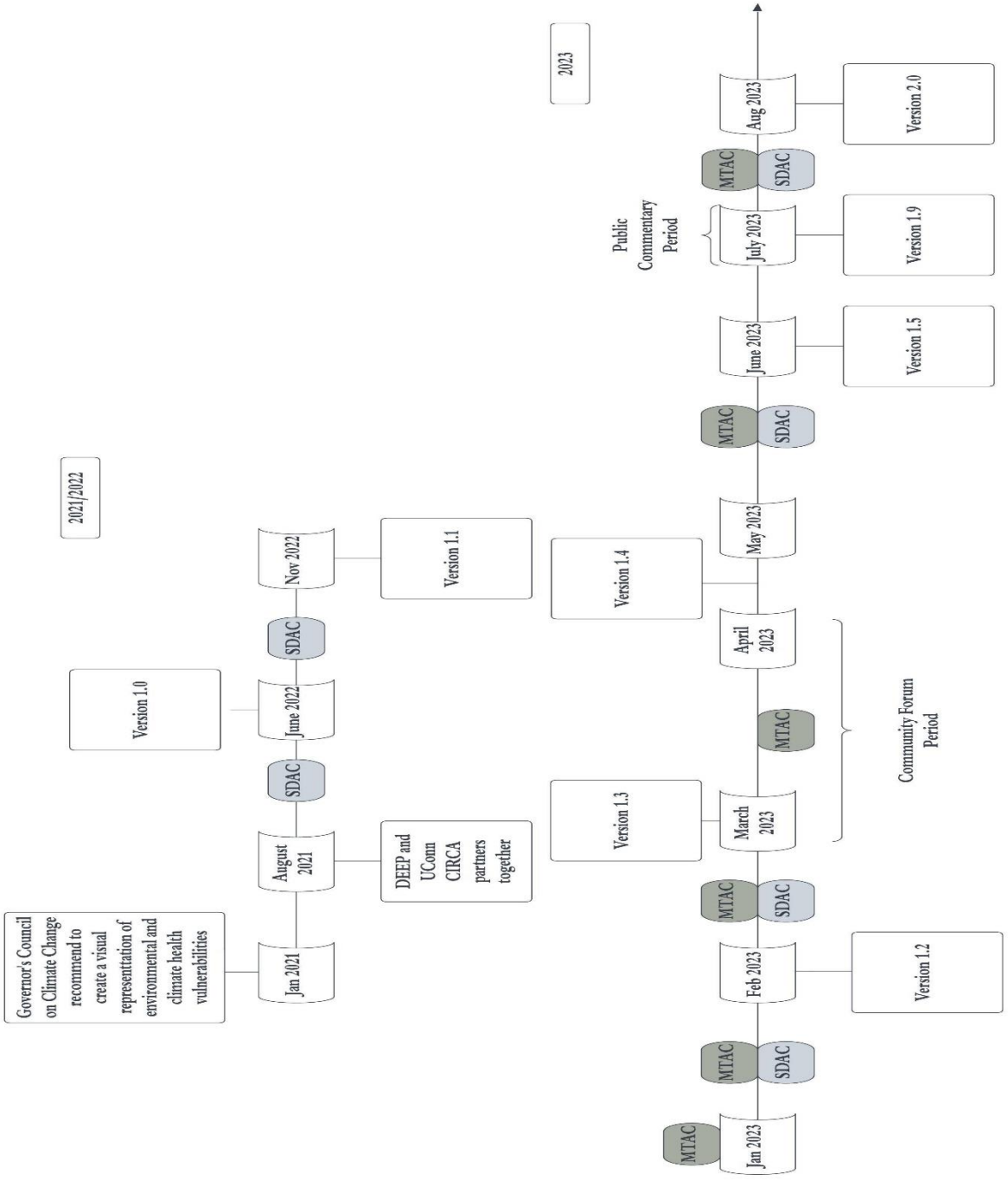

Figure 1: The Project Timeline

The purpose and intended use

Mapping is useful for identifying patterns and trends related to environmental hazards and their impact on marginalized communities. A map can help illustrate the geographic distribution of environmental impacts and their relationship to vulnerable communities, which can help inform the scope and scale of environmental justice issues and efforts to address these issues.

The Connecticut Environmental Justice Screening Tool has been created from a recommendation by the Equity and Environmental Justice Working Group of the **Governor's Council on Climate Change (GC3)** in its **January 2021 Report**. This tool is designed to help identify and analyze patterns of pollution's disproportionate impact on vulnerable populations impacted by chronic health conditions and social stressors. This tool can also assist with addressing environmental health risks. The CT EJ Screening Tool intends to uphold a commitment to equity and environmental justice by informing the public and policymakers about the cumulative impacts of environmental burdens, social vulnerabilities, and health vulnerabilities throughout communities in Connecticut.

The tool is designed to be used at the state, regional and community level. It may inform decision-making, policy, or planning. Various stakeholders, including community groups, advocacy organizations, and government agencies, may use the tool to support advocacy and policy efforts to address environmental justice issues, help prioritize resources and interventions for addressing environmental health hazards, provide a basis for community outreach and education efforts, and facilitate dialogue and collaboration among stakeholders.

The Connecticut Environmental Justice Screening tool (CT EJScreen) aims to identify vulnerable populations disproportionately impacted by environmental pollution and inform initiatives for creating healthy and equitable communities. The project built a community-state partnership through a research institute, drawing on multiple sources of academic, professional, and lived expertise to understand environmental and population indicators, provide environmental justice findings, and create transparent engagement for developing a high-resolution tool for planning and screening.

The approach followed by this project is as follows:

i) driven by scientific rigor and the highest available quality data,
ii) guided by community feedback,
iii) aligning government and state guides,
iv) open access,
v) created by a public engagement process.

The project incorporated the lessons learned from (Lee, 2009) and included:

- Examining the available smallest scale data
- Examining the redundancy of the datasets
- Producing cumulative index scores for assessment
- Prioritizing community co-creation, leadership, and engagement

- Stating the limitations and data gaps to improve the forthcoming versions of the tool
- Developing technical assistance materials for users

What can the CT EJ Screening Tool be used for?

Identifying vulnerable communities that may be experiencing the cumulative impact of environmental, social and health related burdens.

- This tool combines environmental, health and demographic data, layers them over a map, and presents the map in a web-based format. Users can zoom in on a certain geographic area and see data specific to that area.

Prioritization of resources to enhance environmental equity.

- Obtain a better understanding of the conditions in communities overburdened by environmental, health, and socioeconomic disparities to make better informed policy decisions at the state and local levels of government.
- Provide data to support business and financial institution investments, government and community foundation grant programs, Brownfield redevelopment, as well as community investment in health and housing programs, green technologies, and infrastructure.

Provide data to enhance and guide the decision-making process and between different stakeholders.

- Guiding local, state, and federal agencies and policymakers to support better and uplift vulnerable communities, including local departments and commissions on economic development, education, health, housing, and town planning and zoning.

Retrospective Reporting for Grant applications:

- Generating data reports, map images, and visual graphics for grant applications to support the case for prioritized community infrastructure investment, workforce training opportunities, public health, and environmental education programs.

Education and Outreach

- Support outreach for environmental and public health education to improve the health and well-being of communities that may be experiencing environmental, social, and health-related challenges.

Community Resources, Grants, and Financial Assistance Opportunities:

Connecticut Department of Economic and Community Development grants: https://portal.ct.gov/DECD/Services/Business-Development/Funding-Opportunities
Connecticut Equity and Environmental Justice Advisory Council (CEEJAC): https://portal.ct.gov/DEEP-CEEJAC
Connecticut Health Foundation: https://www.cthealth.org/what-we-do/grantmaking/seeking-a-grant/
CT DEEP grants: https://portal.ct.gov/DEEP/Business-and-Financial-Assistance/Grants-Financial-Assistance/Grants-and-Financial-Assistance
CT Environmental Groups: https://www.environmentalgroups.us/connecticut/
CT Grants and Financial Assistance Programs: https://portal.ct.gov/DEMHS/Grants/Grant-Programs
CT Green Bank: https://www.ctgreenbank.com/about-us/rfps/
Free Legal Advice for Low-Income Residents: https://www.ctbar.org/public/pro-bono-legal-aid-services/ct-free-legal-answers
Infrastructure (+IRA) Funding Tracker: https://iijatracker.substack.com/
Long Island Sound Study grants: https://longislandsoundstudy.net/about/grants/
Sustainable CT Community Match Fund: https://www.patronicity.com/sustainablect
Sustainable CT Grants Portal: https://sustainablect.org/support-for-your-town/externalgrants
U.S. Department of Housing and Urban Development grants: https://www.hud.gov/program_offices/spm/gmomgmt/grantsinfo
U.S. Department of Transportation grants: https://www.transportation.gov/grants
U.S. EPA Grant Resources: https://www.epa.gov/grants

Ideas for what to do with CT EJ Screening Tool

Environmental justice screening tools have been used for advocacy, planning, decision-making, reporting, educating, and more, at the local, state, and even federal scale. The Connecticut EJ Screen Mapping Tool (CT EJ Screen) has been developed using Connecticut-specific data and is intended to be useful for all types of Connecticut residents at multiple geographic and governance scales. At community feedback sessions across the state, the researchers behind the CT EEJ Screen heard the same question from every audience: How do we make our community better with this information? Here are some ideas, inspired by the usage of similar EJ screening mapping tools in other states and by ideas from community feedback session participants.

Possible Actions for Individuals:

- Learn about how your community and communities you are concerned about compared to others.
- Learn about the benefits and risks various facilities bring to your community and others.
- Learn why things developed as they did.
- Think about ways to make your community better, given what you learned.

- Share your knowledge and ideas with your friends, family and neighbors.
- Work with your representatives in the state legislature sharing what you've learned in the tool
    - You can find your representatives here: https://www.cga.ct.gov/webapps/cgafyl.asp
    - Tips for contacting elected officials (Berkeley Library): https://guides.lib.berkeley.edu/ContactingOfficials/Tips
- Contact the mayor, city manager, or first selectperson of your town sharing what you've learned in the tool.
- Provide public comments on proposed city, town, or state legislation related to pollution in Connecticut
    - You can find proposed and in-progress regulations here: https://eregulations.ct.gov/eRegsPortal/Browse/ProposedRegulations
    - You can find Connecticut regulations that are available for comment here: https://eregulations.ct.gov/eRegsPortal/Browse/OpenForComment
- Share the tool with your teachers or your children's teachers
- Educators and High School Students:
    - Use the tool as a resource for developing an inquiry-based capstone project.
    - Incorporate the tool as a secondary resource for equity-based discussions.
    - Incorporate the tool as a curricular resource for interdisciplinary units.
    - You can find a lesson plan about CT EJ Screen.

Possible Actions for Community Organization:

- Incorporate the CT EJ Screen into your grant applications (for example, as part of your grant narrative to support your case for why your organization's work is so critical for your community).
    - CIRCA will be holding a webinar on how to use the CT EJ Screen tool in grant applications in Fall 2023.
- Incorporate the CT EJ Screen tool into your advocacy work (for example, to support your case to lawmakers to direct more resources to your community).
- Share CT EJ Screen and the accompanying resource pages with the community you serve.

Possible Actions for Local/Regional Government:

- Incorporate the CT EJ Screen into your town/region's planning discussions and products (for example, when you work on your town/region's Plan of Conservation and Development and Natural Hazard Mitigation Plan, or if your town/region is engaged in additional planning processes like climate resiliency plans, open space plans, or affordable housing plans).
- Incorporate the CT EJ Screen tool into your town/region's infrastructure and investment discussions (for example, by prioritizing high-scoring census tracts for economic development strategies or for green infrastructure installation).

- Incorporate the CT EJ Screen tool into your grant applications (for example, as part of your grant narrative to support your case for why federal funds should be invested into your town).

Possible Actions for State Agencies:

- Train agency staff on how to use the CT EJ Screen (see CIRCA's tutorials and user guide).
- Incorporate the CT EJ Screen into state planning discussions and products (for example, the state Plan of Conservation and Development and the state Natural Hazard Mitigation Plan).
- Incorporate the CT EJ Screen into state infrastructure and investment discussions (for example, by prioritizing high-scoring census tracts for economic development strategies or for green infrastructure installation).
- Incorporate the CT EJ Screen into the application and evaluation process for state grants and other funding opportunities (for example, by ensuring that a certain percentage of projects selected to receive grants are located in high-scoring census tracts).
- Incorporate the CT EJ Screen into the implementation of state policies related to cumulative impacts (for example, SB 1147).

Other Useful Resources:

- CT Department of Energy and Environmental Protection, *Reporting Environmental Concerns and Problems*: https://portal.ct.gov/DEEP/About/Reporting-Environmental-Problems
- CT Department of Energy and Environmental Protection, *Improving Transparency Around Regulations and Public Participation*: https://portal.ct.gov/DEEP/About/Transparency-Predictability-and-Efficiency/Developing-Better-Transparency-Around-Regulation-and-Public-Participation-Initiative
- United Way 211 Search Engine for Finding Assistance with Health and Human Services: https://www.211ct.org/
- *Air Quality Index*, updated daily: https://portal.ct.gov/DEEP/Air/Forecasting/AQI/Air-Quality-Index
- *Air Quality Now*: https://www.airnow.gov/ enables you to type an address and see the air quality status for those geographic areas.
- *Find your local health department*: https://portal.ct.gov/DPH/Local-Health-Admin/LHA/Local-Health-Administration---Site-Map
- CT Department of Public Health, *Lead Poisoning Prevention and Control Program*: https://portal.ct.gov/DPH/Environmental-Health/Lead-Poisoning-Prevention-and-Control/Lead-Poisoning-Prevention-and-Control-Program
- CT Department of Public Health, *Asthma Program*: https://portal.ct.gov/DPH/Health-Education-Management--Surveillance/Asthma/Asthma-Program
- American Lung Association, *Share Your Story About Air Quality*: https://www.lung.org/policy-advocacy/healthy-air-campaign/share-your-story

Limitations and Disclaimer

This Mapping Tool **DOES NOT**: evaluate health risks; predict health outcomes of communities or individuals; explain the cause of health issues or health concerns of individuals; identify a population's health risk due to a potential source of pollution; release private addresses, information, or names.

The CT EJ Screen Mapping Tool is NOT a detailed risk assessment. The tool provides demographic, environmental, and health data from various government agencies and third parties. In this tool, health and socioeconomic data are included as a characteristic that has the potential to make people more vulnerable if they are potentially exposed to pollutants. Health and socioeconomic data estimate a whole population by census tract and do not represent a risk to people on an individual level. The Connecticut EJScreen tool is currently constrained by the available statewide data, which, unfortunately, only exists at the census tract scale and therefore is impacted by census count errors and other census limitations. While this scale of data provides a broad overview, it can, regrettably, obscure specific environmental justice issues occurring within smaller communities or sub-regions of a census tract. Consequently, injustices occurring below the census tract scale are not clearly highlighted in the tool's current configuration. Therefore, this mapping tool is a screening tool that identifies some possible issues related to environmental justice. It displays environmental, demographic, and health data as a rank between census tracts within the state to compare how various communities and geographic areas are affected as a whole by each potential issue.

This mapping tool cannot explain health issues of individuals or communities. All issues related to environmental justice cannot be included in this tool due to a lack of comprehensive and accurate data, such as indoor air quality or drinking water quality for example. Users of this tool are responsible for ensuring the accuracy, currency, and other qualities of this data. They should independently verify information prior to any decision-making relating to this data. CT DEEP and CIRCA attempt to ensure data accuracy but cannot guarantee the completeness or accuracy of the information contained within these datasets. CT DEEP and CIRCA do not assume responsibility for the spatial accuracy and attribution of GIS features. This tool is only intended to be used to understand the issues and empower distressed and disadvantaged communities. CT DEEP and CIRCA are not responsible for any private party interpretation of the map.

Overview of Methodology

The screening tool aims to generate cumulative environmental impact comparisons among census tracts by considering pollution burdens that disproportionately affect the communities as well as their socioeconomic variabilities and health tendencies. The term "cumulative impacts" refers to the combined effects from multiple stressors; in this context, these stressors include prolonged exposure to pollution in communities already experiencing pre-existing health issues and negative social variables. Cumulative impact assessments shouldn't be confused with exposure assessments, which measure exposure in individuals or communities and are typically paired with in-depth data on

environmental mediators and dose-response relationships to assess if a toxic exposure could have health consequences (Mckenzie et al., 2022). Health risk assessments aim to calculate the probability of a population experiencing harm from a hazardous event or chemical exposure, using detailed data such as chemical exposure levels, dose-response relationships, and contaminant fate and transport. In contrast, cumulative impact assessments offer an alternative approach to conventional risk and exposure assessments by incorporating both quantitative and semi-quantitative data to evaluate the collective and synergistic impacts of social and environmental factors, as well as pre-existing chronic conditions, on a community's overall health and well-being. (Alexeeff et al., 2012; Morello-Frosch et al., 2011; Murphy et al., 2018; Solomon et al., 2016). CT EJ Screening Tool is a cumulative impact assessment tool to screen for census tracts experiencing disproportionate environmental burdens.

CT EJ Screening Tool bases its methodology on Washington State Health Disparity Map, CalEnviroScreen, and EPA EJScreen. When comparing and combining the methodology of different EJScreen tools from different states, it's important to understand that while the core concept is the same, the specifics may vary based on each State's unique environmental and demographic considerations. The CT EJ Screening Tool methodology is adjusted based on the State's specific needs.

The methodology for developing a screening tool is given in Figure 2.

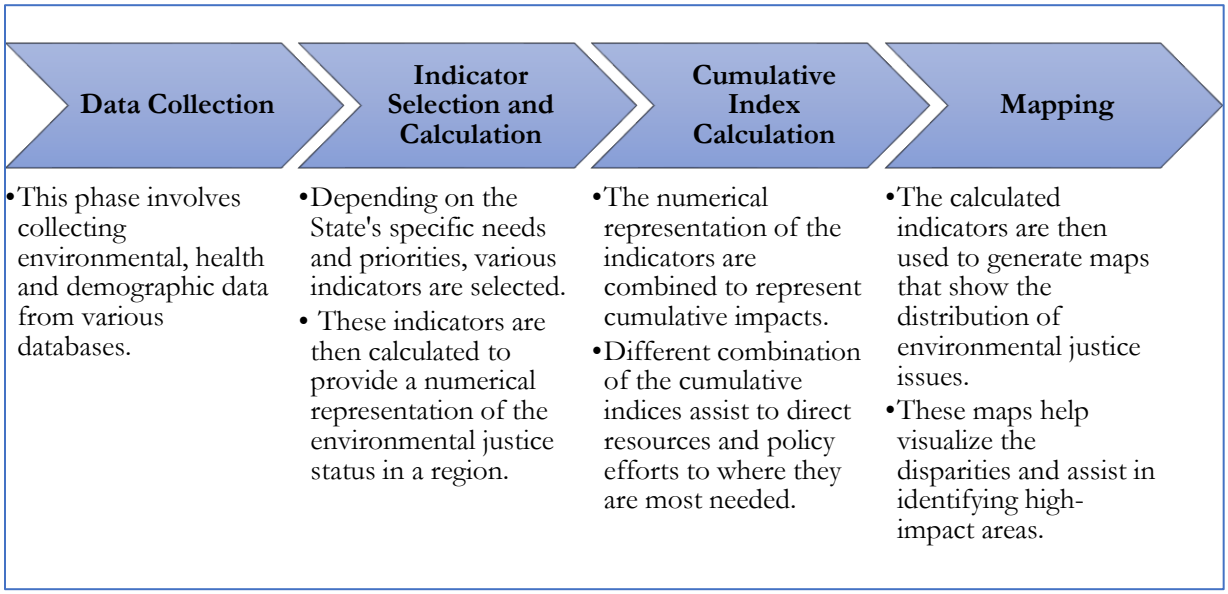

Figure 2: The general methodology of CT EJ Screening Tool

Developing the cumulative impact model

The concept of the cumulative impact model is based on calculating cumulative effect scores across several environmental hazards and demographic variables for communities throughout the state rather than evaluating risk based on individual hazards (Min et al., 2019a). This is a departure from the traditional method of assessing risk for each hazard separately. Hence, this model combines measures of potential pollution sources, potential pollution exposures, health sensitivities, and socioeconomic factors to formulate a single composite score that is geographically based, similar to

approaches used in CalEnviroScreen and Washington Environmental Health Disparities Map (Min et al., 2019a; Rodriquez and Zeise, 2017).

The approach utilized by the model is based on the formula of Risk = Threat × Vulnerability. (Brody et al., 2012). The principle of risk assessment posits that the degree of susceptibility within a given community impacts the level of environmental risk (Brody et al., 2012; Min et al., 2019a). This reflects consistent findings from research on environmental pollutants and health risks, revealing that socioeconomic and sensitivity factors operate as "effect modifiers" that compound the threats caused by pollutants, highlighting the significance of multiplication in models of this kind (August et al., 2021b; Min et al., 2019b).

CT EJ Screening Tool uses the approach from (Brody et al., 2012). It defines the communities' pollution burden as the "threat" in the model, while the communities' "vulnerability" is represented through socioeconomic factors and health sensitivities. The discussed calculation clearly shows that certain characteristics of a population can alter and amplify the impact of pollution exposure on more vulnerable groups (Min et al., 2019a, 2019b). The pollution burden consists of several measures which evaluate the buildup of environmental exposures and their consequences within communities. These measures represent potential sources and exposures to pollution. Evaluating sensitivity involves using socioeconomic measures and health predispositions that contribute to increased vulnerability to heightened pollution exposure. To comprehend the total impact for each census tract, the model calculates an impact score, then assigns percentiles in line with their rank order. The impact scores are calculated by the average of indicators or related component indices. The rank order allows users to grasp the position of a particular census tract relative to the whole state.

The Environmental Justice Index represents the impact score in the CT EJ Screening Tool model (Figure 3). The Pollution Burden composite category is divided into two components: Potential Pollution Sources and Potential Pollution Exposures. The Sensitive Populations composite category is divided into Socioeconomic Factors and Health Sensitivity. Together, all these categories represent the seven cumulative impact scores.

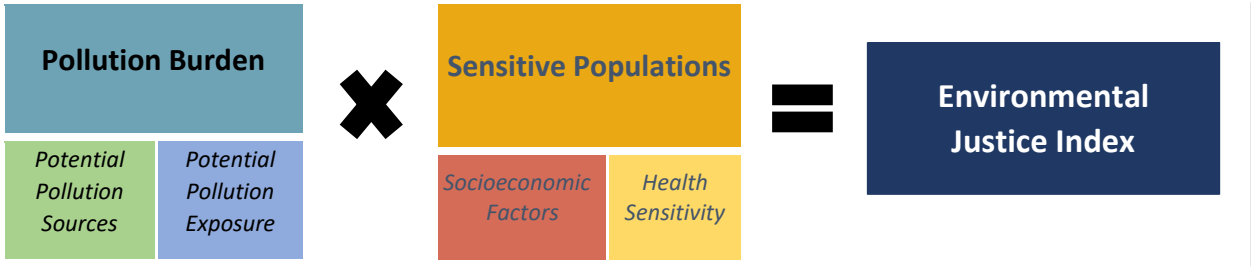

Figure 3: The components of CT EJ Screening model.

Resolution of the model

The Census Bureau divides the information that they collect in several geographic levels: blocks, block groups, and tracts. Census blocks are the smallest geographic level and generally have the most detailed data. However, because of their small size, the data can be quite variable and can be affected by small changes in population or housing. Additionally, the American Community Survey (ACS) does not publish data at the block level due to privacy considerations. Block groups are larger geographic units that each consist of several blocks. ACS data is available at the block group level, but it is subject to a high level of sampling error because of the small population sizes in many block groups. Census tracts are relatively sizable geographic subdivisions, typically encompassing a population range of 1,200 to 8,000 individuals, with an ideal population size of approximately 4,000 persons (United States Census Bureau, 2022). ACS data is also available at the tract level and tends to be more reliable than block group data because of the larger population size. Census areas are meant to be groups of people and places that are similar in terms of population, economic status, and living situations (United States Census Bureau, 2022).

The CT EJ Screening Tool utilizes diverse data resolution levels within its raw files. These data vary from point locations and parcels to socioeconomic information presented at the tract level to health data layers from the CT Department of Public Health that are only available by town. This disparity necessitates making a careful assumption to consolidate the model optimally at the census tract resolution. Census tracts offer a favorable compromise between data detail and reliability found in the ACS data. Due to their larger population size, census tracts offer better accuracy than block groups, resulting in less sampling variability.

The weighting of indicators and cumulative indices

In the CT EJ Screening Tool, all indicators are given equal weighting within their assigned category due to the absence of scientific evidence advocating a particular weighting system (Sadd et al., 2011). However, a differentiation is made when integrating pollution exposures and pollution sources. Pollution sources, which are viewed as environmental effects, are given half the weight of pollution exposures. This approach was adopted because it was believed that pollution sources' contributions to potential pollution burden were less significant than those from the pollution exposures component (August et al., 2021b). In more precise terms, the pollution sources components signify the presence of pollutants in a community, not necessarily exposure to them. Therefore, the Potential Pollution Exposure component is assigned to double the weight of the Potential Pollution Sources component.

Percentile and Normalization Calculations to obtain Impact Rank Scores

All the raw values of the indicators and components are processed to obtain percentiles and normalized rank scores. A percentile is a statistical term representing a value below which a specific percentage of data points in a dataset fall. Utilizing percentiles allows us to understand how a particular census tract compares to the rest, indicating its relative position within the entire group. For instance,

the 20th percentile is the value (or score) below which 20% of the observations may be found, or if the percentile is 98th value, then that score is higher than the 98% of the tracts, being in the top 2%. The general steps for calculating percentiles are as follows:

a. Find values for a particular indicator by census tracts (excluding any tracts with invalid/unavailable data for that indicator).
b. Arrange the values from step a. in ascending order.
c. Find the percentile that corresponds to a specific value in the ascending order by using the following equation (Equation 1):

$$Percentile = \frac{\text{all valid data values that are smaller than the current value}}{\text{total number of data}} \times 100, \quad (1)$$

(Equation (1) is derived from Ordinal rank of the given value or value below the number = (Percentile / 100) * Total number of data points, organized in ascending value.

The CT EJ Screening Tool employs percentiles to add perspective to each indicator's values, but a lower percentile doesn't inherently imply a less significant impact. To illustrate, consider a scenario where an examination is given to a group of 100 students. If only one student achieves the highest raw score, that student would be placed in the 99th percentile because their score surpasses the other 99 students. Conversely, if ten students achieve that top score, they would be positioned in the 90th percentile. Thus, percentile placement doesn't always correlate directly with the impact or significance of the measured indicator. Places in the 40th percentile are not necessarily four times as affected as places in the 10th. It is important to recognize that the percentile value represents a position and not a numeric evaluation of significance.

In the CT EJ Screening Tool, an indicator with generally common raw values may lead to a specific tract having a lower percentile. If a particular score is prevalent, overall percentiles may be lower. This is because the percentile of a given score denotes its relative placement within a distribution rather than the score's absolute value. Consequently, a frequently occurring score could potentially result in a reduced percentile, owing to a substantial proportion of the dataset having an equivalent or greater score. Hence, it is imperative to bear in mind that percentiles pertain to the placement of a data point within a dataset rather than the actual numerical value of the scores. It is crucial to scrutinize the data encapsulated by the indicator and any other pertinent data to comprehend the implications of the findings. For example, when assessing the specific risks from pollution sources, release and emission values should be considered in the context of legal safety thresholds. The CT EJ Screening Tool, as a general screening tool for cumulative impact, does not measure these specific values or indicate how the data observations compare to these thresholds.

Percentile calculation excludes tracts for which raw data are unavailable or unreliable. Therefore, the percentile score can be interpreted as comparing one tract to another within the state where the indicators are present (August et al., 2021b).

After the percentiles are calculated, percentiles are normalized to a rank ranging from 0 to 10 to standardize units among the indicators. This involves transforming the data so that all the indicators are on the same scale and can be compared and added directly. To normalize percentile data to 0-10, linear transformation method is used. This method works for each data point as

$$Rank_n = \frac{(P_n - P_{min})}{(P_{max} - P_{min})} + (Decile\ Range), \quad (2)$$

where, P_n is the original percentile for a particular tract n, P_{min} is the minimum value of among all the tracts, which is 0 for percentiles. P_{max} is the maximum value of among all the tracts. $Decile\ Range$ is the difference between the maximum and minimum values of the new range, which is 10 - 0 = 10, in this case. Equation (2) transforms each tract percentile to the normalized decile range. In this case, 0 percentile and rank often mean there are no data available below that tract, in other words, that tract has the minimum value compared to all the other tracts.

Although this transformation modifies the data's scale, it does not affect the relative position of data elements within the data set. A region with a greater percentile before the transformation continue to have a greater percentile following the transformation. The ranking system serves as a unified scale for comparing diverse issues within communities and evaluating the indicators' collective influence across different communities. This system helps prevent the general public's misinterpretation of percentiles as percentages or actual exposure levels. It also ensures that the highest tract always exhibits higher rankings, regardless of prevalence. However, this tool does not display the exact numeric difference between each rank; it merely highlights the existence of a difference without quantifying it. The map displays a range of final cumulative scores, which span from 0, representing the communities with the least impact, to 10, representing the communities with the most impact.

Data Processing

The tool includes various datasets that demonstrate the geographic distribution of pollution in communities and the prevalence of chronic diseases. The tool categorizes the data into indicators and cumulative indices. An indicator is a metric for quickly summarizing large amounts of data to reveal trends (Min et al., 2019a). For example, indicators may display changes in air quality throughout a geographic area or the distribution of the prevalence of a particular disease. A cumulative index represents a combination of multiple indicators to reflect the overall impact in a specific area. For instance, a community may be exposed to multiple environmental hazards at once, such as air pollution, water pollution, and toxic chemicals. In this case, the combined impact would be the average of the impacts of exposure to each hazard, taking into account the likelihood and severity of each impact. This section explains the general processing that is required for all data used in the model. Detailed explanations for each dataset are given under the Data section.

Indicator Processing

An indicator is a measure or metric to represent a particular phenomenon or issue's status, trend, or condition, produced by processing raw data so that it can be used in the cumulative index model. Raw data is unprocessed information from a dataset. In general, the preparation of each indicator follows this pattern:

a. Discover and decide on potential indicators for each segment. This phase involves reviewing scientific literature and other mapping tools to comprehend the correlation between different types of pollution sources, socioeconomic characteristics, or health sensitivities and environmental justice.
b. Source datasets that will aid in the creation of indicators.
c. Geographically assign each piece of raw data according to its regional impact. This may involve creating necessary buffers to estimate the range of impact. For instance, if the addresses are available for municipal transfer stations, then geocode the municipal transfer stations and generate necessary buffest for each points that represents that data.
d. Intersect the processed raw data with the designated grid scale, typically defined by Census Tract boundaries.
e. Assign a percentile for each indicator within each grid, based on a rank-order comparison of the grids.
f. Standardize the percentiles within each grid to use decile ranking. This final step results in the creation of the indicator.
g. Develop maps to provide a visual representation of the data.

Criteria for Indicator Selection

To make an informed decision on which specific indicators to use, it is necessary to contemplate not only the type of data that will most accurately depict the pollution burden and demographics of the entire state, but also the availability of such data and the degree to which it satisfies certain standards throughout the entire state. The indicators should provide a relevant measurement for the specific component they are representing (del Fierro et al., 2021). When combined, these indicators should accurately depict each respective cumulative index component. The key considerations for generating an indicator are:

a. Relevance: The indicator should capture an important aspect of environmental justice.
b. Data Quality: The data used should be current, accurate, and comprehensive.
c. Coverage: The raw data should be available for all of Connecticut.
d. Resolution: The data should be available at a relatively fine level of geographic resolution.
e. Concise: The indicator should not significantly overlap or be redundant with existing indicators.
f. Consistency: The methodology for deriving the indicator should be consistent and replicable over time and across different geographic locations.

The indicator selection has been significantly influenced by (del Fierro et al., 2021), data advisory committee suggestions, public feedback, and literature review.

Pollution Indicator Proximity Estimations with Buffers

The point data-based pollution indicators does not calculate actual exposures or ranges that pollution impacts. Instead, it assumes that census tracts within a 1-kilometer (km) radius of a point source of pollution are likely to be affected. The underlying rationale is that proximity to a pollution source increases the likelihood and intensity of impact. This 1 km (or 0.62 miles) radius is divided into increments of 0.25 km or (0.16 miles), with the impact assumed to be higher for individuals within the 0.25 km diameter compared to those situated in the 0.25-0.5 km radius and so forth. The model presupposes that the impact of pollution is zero beyond 1 km. That way, not being closed to the pollution source (zero weighting) is also considered for tract data comparison in the percentile calculation. The general method involves the following steps:

i. Geocoding to locate the point source of pollution.
ii. Creating buffers for 250m, 500m, 750m, and 1000m distances.
iii. Intersecting these buffers with census tract boundaries.
iv. Assigning weights to each intersected buffer zone. These weights are calculated by multiplying by 1 for sites less than 250m away, 0.5 for sites 250-500m away, 0.25 for sites 500-750m away, and 0.1 for sites 750-1000m away and 0 for sites beyond 1km away from the closest populated census tract (**Error! Reference source not found.**). The buffe distances are doubled for areas with odor concerns as odor complains for facilities impact more than the 1 km range. Double buffers consider 1 for sites less than 500m away, 0.5 for sites 500-1000m away, 0.25 for sites 1000-1500m away, and 0.1 for sites 1500-20000 away and 0 for sites beyond 2km away from the closest populated census tract. Please check each indicator methodology to see which buffers are used.
v. Summing up all the weights within the census tract.
vi. This sum of weights is then used for percentile calculation. Percentiles are then normalized into the decile ranks.

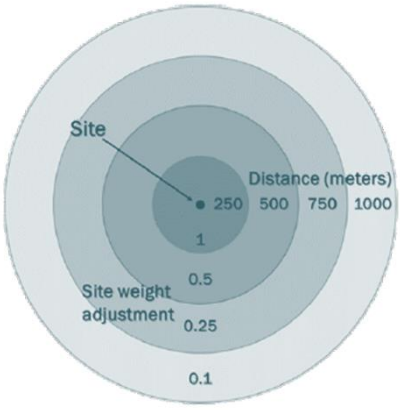

Figure 4: Site weight adjustments (Faust et al., 2017).

The above procedure may slightly differ depending on the specific raw data. The 1 km buffer estimate is adapted from (August et al., 2021a; Faust et al., 2017). (U.S. Environmental Protection Agency (EPA), 2022) describes the buffer selection as a delicate decision. Utilizing an excessively large buffer misinterprets the impacted population by diluting the outcome of the minimally affected residents who are distant from the more significantly impacted residents who are closer.

On the other hand, an extremely small buffer excludes the significantly impacted residents and is prone to sampling errors. Air pollution-related facilities commonly have more than

1 km buffer odor complaints. Scents and the evident existence of solid waste can diminish how a community is viewed and impact the well-being and living standards (Heaney et al., 2011). In response to this concern, adjustments were made by doubling the buffer distances and site weights for air pollution or composting sites (August et al., 2021a; Faust et al., 2017). A weightage of 1 is assigned to sites located within a distance of less than 500 meters from the nearest populated census tract. Sites located within a distance range of 500 to 1000 meters are assigned a weightage of 0.5. Similarly, sites located between 1000 to 1500 meters and 1500 to 2000 meters from the nearest populated census tract are assigned weights of 0.25 and 0.1, respectively. The indicators that used the double buffers are incinerators, landfills, municipal transfer stations, major air pollution, minor air pollution sources, and minor air pollution facilities.

Socioeconomic data processing

All the socioeconomic data (except unemployment rates) is obtained from the American Community Survey, 5-year estimates between 2017-2021. The estimates for the tracts sometimes might be needed to be summed, i.e., in order to calculate the population over 25 with no high school diploma, all the population over 25 categories with no high school diploma is summed. The socioeconomic data is based on percentages: the estimate values for the specific population or variable described in the indicator are divided into the same tract's total population. These percentages determine the percentile rank for a particular indicator in each tract. As with the previously described pollution indicators, the normalized rank for the socioeconomic indicators is calculated based on the percentiles.

Connecticut Department of Health-provided health data processing.

The Connecticut Department of Health (DPH) has supplied data for asthma, chronic lung disease, childhood blood lead levels and low birth weight rates for each town. Some town cases have been concealed to comply with data confidentiality standards, primarily when case numbers are exceptionally low. Data over several years have been combined for these instances to form a more substantial set. These rates are age-adjusted. DPH has also offered decile ranges for the towns, which include their 95th percentile confidence levels in the upper and lower bounds, alongside the standard errors for additional information. It's important to note that no transformations, such as percentile calculations or ranking, have been performed on these decile values; they are utilized in their original form. DPH provided these data with town-level resolution. However, during the composite index calculation and to keep the final index score in tracts, all the tracts within the specific towns are assumed to have the same data rate for the DPH-provided layers. It must also be recognized that no health data establishes a causal link with pollution.

Other indicator datasets and processing

Additional datasets, publicly accessible and procured from sources such as the Environmental Protection Agency (EPA), Centers for Disease Control and Prevention, and NASA, among others, are provided at the census tract level. These datasets often given as a numerical model estimate values

are processed according to their respective tract values. The raw data for each tract are systematically arranged in ascending order, converted into percentiles, and subsequently assigned ranks.

Cumulative Index Processing

The cumulative index is a reductionist representation of intricate environmental, health and demographic scenarios. It should function as an instrument for pinpointing possible areas requiring attention rather than serving as an absolute quantification of environmental justice. Furthermore, the effectiveness and precision of the index are contingent on the quality of the input data, the suitability of the selected indicators, and the weighting system implemented.

The CT EJ Screening Tool incorporates seven cumulative indices, with the Environmental Justice Index (EJ Index) being the most comprehensive, encapsulating all the datasets included. This EJ Index is structured into two principal composite indices: Pollution Burden and Sensitive Populations, which are further broken down into four additional component indices to classify the indicators systematically. Pollution Burden is divided into Potential Pollution Sources (PPS) and Potential Pollution Exposure (PPE). Sensitive Population is divided into Socioeconomic Factors (SF) and Health Sensitivity (HS).

The scores for each component index are derived by taking the average of the ranks for all individual indicators within that component (Alexeeff et al., 2012). These scores are then standardized to ranks, ranging from 0 to 10, to formulate the respective component cumulative index, i.e., Potential Pollution Exposure, Potential Pollution Sources, Socioeconomic Factors, and Health Sensitivity. Not available data is not included in the cumulative index calculations.

The respective component indices are combined by taking their average to obtain two composite indices: Pollution Burden and Sensitive Populations. While combining the Potential Pollution Exposure and Potential Pollution Sources components, the Potential Pollution Sources score was given half the weight of the Potential Pollution Exposures score. (August et al., 2021b) explains that rationale: the Potential Pollution Sources components represent the presence of pollutants within a community, as opposed to direct exposure, and are deemed to contribute less. The Sensitive Population composite score is the average of Socioeconomic Factors and Health Sensitivity component indices. The scores for Pollution Burden and Sensitive Population are then scaled /normalized to have a maximum value of 10 and a range between 0 and 10. Usually, a number of zero means that tracking or reporting occurred but revealed minimal effects. Any track with empty, unavailable, or unreported data is not considered for cumulative index calculations.

$$Pollution\ Burden = \frac{(0.5 \times Average\ of\ PPS) + (Average\ of\ PPE)}{1.5}, \quad (3)$$

$$Sensitive\ Population = \frac{(Average\ SF) + (Average\ of\ HS)}{2}, \quad (4)$$

where, average of each component is calculated as the summation of the rank scores for all the indicators over the total number of available (not invalid) indicator count. Equations (3) and (4) are the weighted average of the component indices.

The final cumulative Environmental Justice Index score is the product of the Pollution Burden and Sensitive Population in accordance with the (Brody et al., 2012) model. The EJI is again normalized to give an impact rank ranging from 0 (least impacted) to 10 (most impacted).

$$Environmental\ Justice\ Index\ (EJI) = Pollution\ Burden\ \times Sensitive\ Population, \quad (5)$$

Uncertainty and data limitations

The CT Environmental Justice Screening Tool involves the handling and analysis of massive volumes of complex environmental and demographic data, which brings an inherent degree of uncertainty. This tool does not contain information about every environmental, health, or demographic factor. It cannot guarantee the completeness or accuracy of the information contained within these datasets. Determining cumulative environmental health hazards should not rely exclusively on this map. Furthermore, it is not designed to depict specific environmental-related diseases or conditions. It is important to consider additional information and local knowledge when assessing a community's needs and addressing environmental justice concerns.

Uncertainty in the CT Environmental Justice Screening tool arises from various factors, including data quality and availability, spatial resolution, indicator selection, normalization and weighting, model assumptions, temporal variability, and inherent complexity. Data quality and availability are crucial for accurate results, as outdated, imprecise, or unavailable data can lead to uncertain results. Geographical units can also cause inaccurate representations of pollution, health, or demographic variations. The diversity of data sources and their spatial representation add complexity to the composite index creation process within the mapping tool. The agency-provided health data, for example, is organized by towns, pollution sources data is provided with exact coordinates, and socioeconomic data is mapped to census tracts. Striking an accurate balance for processing the composite index amid these differing resolutions might lead to overestimation or underestimation of specific indicators' impact. Furthermore, applying census tract boundaries for socioeconomic data might foster artificial distinctions between closely located neighbors, potentially distorting the real-world complexities of environmental justice.

Indicators may also introduce uncertainty due to their subjective nature, as some important factors may not be included in the tool and require a multidisciplinary expert collaboration to evaluate its potential impact. The weighting processes are subject to assumptions and judgments. However, (August et al., 2012), with a restricted dataset, demonstrated that the model is reasonably resilient to weighting modifications, especially in terms of pinpointing areas of higher impact.

The model carries inherent uncertainties due to assumptions, temporal variability, and intrinsic complexities. The approximation of pollution's actual impact may not be entirely precise,

with assumptions concerning the accurate reflection of potential pollution areas by data locations or emissions. While significant strides were made to ensure data integrity and contemporaneity, potential discrepancies might still occur due to temporal environmental fluctuations or potential inconsistencies and lacunae in large-scale databases.

The model uses multiple indicators to identify areas with multiple pollution burdens and sensitive populations. A certain amount of uncertainty is unavoidable because indicators serve as stand-ins for the characteristics being modeled. While trade-offs are involved in combining various data sources, the results are thought to be most useful for identifying communities that might be disproportionately impacted.

How to interpret the Map

The map shows the potential cumulative impact on communities disproportionately affected by pollution. The indicators are assigned numerical values to represent how each census tract compares to all other census tracts in Connecticut with regard to the conditions that the data represents. Each census tract is assigned a rank from 0 to 10 that is used to measure the relative difference of potential impact factors between different census tracts. For composite indices, each indicator's rank averages are computed and then assigned the relative ranking. Each rank represents 10% of the total census tracts within the state. The ranking provides a common scale to compare various issues at the community level and to assess the cumulative impact of the indicators across all communities (Min et al., 2019b). The map displays the ranks from 0 (least impacted) to 10 (most impacted) (Figure 5). When a specific indicator is not present in a tract, or if the data for that indicator in that tract is, not available or not reported, the tract's ranking for that indicator is reported as Not Available Data. Rankings can help to highlight areas where certain hazards or impacts are more severe and can be used to identify patterns in the distribution of environmental risks. It is important to note that the ranks do not specify how much the numerical difference is between each tract, but rather where each tract falls on the overall distribution of tracts across the state.

Darker areas = Higher rankings = Higher potential impact

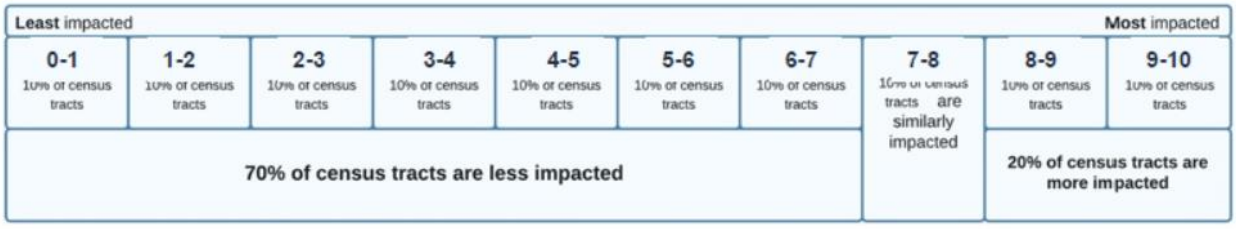

Figure 5: General Rank representation of the indicators and indices

For example, suppose a census tract has a rank of 8 for Pollution Burden. The diagram above displays how each of the ten ranking tiers corresponds to 10% of the census tracts in the state. In this case, ranks 1 –7 (representing 70% of the census tracts) are less impacted than the selected census tract, and ranks 9 – 10 (representing 20% of the census tracts) are more impacted than the selected census tract. The remaining 10% of the census tracts are comparable to the selected census tract, ranked 8. (Figure 5).

Not Available data is excluded from the ranking calculation when geographical areas do not have reliable indicators (e.g., data is uncertain). This way, ranking scores can be considered as comparisons between a state's census tracts only where affected areas are present.

The screening tool includes a color-coded map and can be used to create a standard report for a user-selected area. Users should remember that when looking at specific locations, some of the towns on the state border can have some uncertainties that deal with demographic and environmental data. This is due to the nature of boundary application to environmental data or census tract level socioeconomic data uncertainties at the boundaries. It is also important to note that, while the census tract scale of data provides a broad overview, it can obscure specific environmental justice issues occurring within smaller communities or sub-regions of a census tract. Consequently, a large census tract that appears to be less impacted overall may still have pockets of great vulnerability within it.

The Data

Indicators

i) Potential Pollution Sources

Potential Pollution Sources are a composite of multiple indicators designed to reflect the presence of certain types of pollution or potential sources of environmental harm in nearby communities. Indicators that fall under this category are given in Table 1. There are 13 indicators in this category.

Table 1: Potential Pollution Sources Indicators

Indicator Type	Dataset Time Frame	Resolution	Dataset Source
Brownfields	2022	Points	DEEP Brownfield Sites Inventory
EPCRA Tier II/ Facilities Managing Chemicals	2021	Points	EPCRA Tier II Locations, CT DEEP-CT SERC, 2021
Impervious Area	2021	Raster	2021 MRLC Impervious Land Cover
Incinerators/Resource Recovery Facilities	2020	Points	Connecticut Resource Recovery Facilities, 2020
Landfills	2020	Points	Active Landfills 2020, and Affecting Facilities 2021
Lead Paint Risk in Housing	2017 - 2021	Tract	2017-2021 American Community Survey 5-Year Estimates

Municipal Transfer Station	2020	Points	2020 CT DEEP Municipal Waste Disposal Data
Potentially Contaminated Sites	2021	Points	2021 CT DEEP Hazard Waste Inventory, Remediation Department
Recycling Processing Facilities / Materials Recovery Facilities	2018	Points	2018 CT DEEP Recycling Processing Facilities
Proximity to Superfund Site	2022	Tracts	2023 Significant Environmental Hazards, CT DEEP
Significant Environmental Hazards/Proximity to Facilities with Highly Toxic Substances	2023	Points	2023 Significant Environmental Hazards, CT DEEP
Underground Storage Tanks (USTs) - Active Facilities	2021	Points	2021 CT Gov active underground storage tanks (USTs) Facilities
Wastewater Discharge	2019	Tracts	2019 Risk-Screening Environmental Indicators (RSEI) modeled results from by EPA's Office of Pollution Prevention and Toxics (OPPT) on March 15, 2021.

The Potential Pollution Sources index is calculated by taking the average of all the ranks of Table 1 indicators for each census tract. These average ranks are called scores. The corresponding scores for each census tract are normalized into percentiles and impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. The value in the table below represents scores (average indicator ranks for Potential Pollution Sources) for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0.45	2.08	0	9.44	0	1
2.09	2.58	9.56	19.45	1	2
2.58	3.00	19.57	29.35	2	3
3.01	3.31	29.47	39.36	3	4
3.32	3.66	39.48	49.37	4	5
3.68	3.99	49.6	59.39	5	6
4.00	4.33	59.5	69.4	6	7

4.34	4.78	69.51	79.41	7	8
4.80	5.37	79.52	89.31	8	9
5.38	8.23	89.42	99.89	9	10

Brownfield Sites

The EPA defines a brownfield site as a location where the existence or probable presence of a hazardous material, pollutant, or contaminant makes expansion, redevelopment, or reuse difficult. The number of brownfields in the United States is estimated to be around 450,000 (E. Environmental Protection Agency, 2022a). The Connecticut Office of Brownfield Remediation and Development (OBRD), which is part of the Department of Economic and Community Development (DECD), offers financial and technical assistance for Brownfield cleaning and redevelopment. Brownfield redevelopment brings social and economic benefits, as well as advantages for human health and the environment (CT DEEP, 2022a)

Brownfield sites are accompanied by a variety of potential health risks. Physical health dangers may exist at these sites, such as open holes, unstable constructions, and sharp items. Furthermore, chemical pollution and/or remnants of chemical waste may be left behind from previous industrial activity. Trespassers risk being hurt or exposed to harmful substances (CT DPH, 2010).

Indicator This indicator represents the tracts ranked by their percentile proximity to brownfield sites. These sites are once used for industrial, manufacturing, or commercial uses, have been abandoned or underutilized due to known or suspected contamination from past uses.

Data Source CT DEEP Brownfields Site Inventory

Method A brownfield locations spreadsheet was provided by DEEP and geocoded. From each point, buffers of 250m, 500m, 750m, and 1000m were established, intersecting these buffers with the adjacent census tracts.

Buffer weights were determined based on their proximity to the brownfield site. Those within 250 meters were assigned a weight of 1, those within 250-500 meters received a weight of 0.5, tracts within 500-750 meters were assigned a weight of 0.25, and a weight of 0.1 was given for tracts within 750-1000 meters. Tracts beyond the 1000-meter radius were assigned a weight of 0, i.e., not close to the pollution source. The cumulative weight score was then computed by adding up the weights of each buffer located within each census tract.

The corresponding percentile for each census tract was designated based on these total weight scores. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. When there are a lot of census tracts with No Data (weight assigned 0, i.e. not close to the pollution source) is available, the rank range table do not

display ten equally sized rank ranges. The value in the table below represents the sum of site proximity weights for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0.1	0.2	0	9.36	0	5
0.1	0.5	61.09	68.94	6	7
0.6	1	72.13	73.38	7	8
1.1	2.9	82.82	89.31	8	9
3	191.5	89.42	99.89	9	10

Facilities Managing Hazardous Chemicals (EPCRA Tier II)

The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 assists communities in preparing for chemical emergencies. It requires businesses to report to federal, state, and local governments on the storage, usage, and release of hazardous chemicals (U.S. EPA, 2022a). According to the Connecticut State Emergency Response Commission, one section of the law ensures that facilities managing hazardous chemicals above certain levels share a detailed inventory of the amount of hazardous chemicals managed at a site over the preceding calendar year (Connecticut State Emergency Response Commission, 2022). This inventory, known as a "Tier II Report," helps communities better plan for preventing and responding to chemical emergencies. The inventory is not a list of chemicals that have been released or facilities that have had releases, but rather simply a record of what chemicals are present. This layer shows sites where hazardous chemicals are managed, and therefore pose a risk of release to the community if accidents or emergencies occur.

Indicator

This indicator represents the tracts ranked by their percentile proximity to Emergency Planning and Community Right-to-Know Act (EPCRA) Connecticut State Emergency Response Commission, Tier II chemical inventory data.

Data Source

EPCRA Tier II Locations, CT DEEP-CT SERC, 2021

Method

The EPCRA Tier II locations spreadsheet was provided by DEEP and geocoded. From each point, buffers of 250m, 500m, 750m, and 1000m were established, intersecting these buffers with the adjacent census tracts.

Buffer weights were determined based on their proximity to each pollution site. Those within 250 meters were assigned a weight of 1, those within 250-500 meters received a weight of 0.5, tracts within 500-750 meters were assigned a weight of 0.25, and a weight of 0.1 was given for tracts within 750-1000 meters. Tracts beyond the 1000-meter radius were assigned a weight of 0, i.e., not close to the pollution source. The cumulative weight score was then computed by adding up the weights of each buffer located within each census tract.
The corresponding percentile for each census tract was designated based on these total weight scores. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized

sections between the 0 and 10. The value in the table below represents the sum of site proximity weights for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Ra
0	1.85	0	7.28	0	1
1.9	3.7	9.56	18.66	1	2
3.75	5	20.25	29.24	2	3
5.1	6.45	29.81	39.02	3	4
6.5	7.85	39.59	48.58	4	5
7.9	9.65	49.72	59.39	5	6
9.75	11.75	59.84	69.4	6	7
11.8	14.9	69.62	79.41	7	8
14.95	19.55	79.86	89.31	8	9
19.6	63.9	89.42	99.89	9	10

Impervious Area

Impervious surfaces, such as roads, structures, and parking lots, are surfaces that prevent precipitation from penetrating the soil. The amount and density of impervious surfaces in metropolitan areas can impact water quality and the severity of flood and heat impact. For example, rainfall soaks into the soil and is held as groundwater in a wooded region, which slows water flow into streams. These areas get less severe flooding than cities, where impervious surfaces cause significant amounts of water to quickly enter streams, which raises the risk of catastrophic flooding (Konrad, 2003). Impervious surfaces also have a variety of negative effects on lakes and streams. This can seriously harm the stream environment and can alter the groundwater system's capacity to recharge (Frazer, 2006). Impervious surfaces absorb and retain heat throughout the day and overnight (Ziter et al., 2019).

Indicator This indicator represents the tracts ranked by their percentile of average impervious areas (streets, buildings and parking lots).

Data Source 2021 MRLC Impervious Land Cover

Method A raster file of impervious surfaces was downloaded and imported into ArcPro. "The NLCD imperviousness items depict urban impervious surfaces as a percentage covering each 30-meter pixel across the U.S. The 2021 NLCD release builds upon previous data, meaning the Impervious Surface data from 2019 remains consistent and can be integrated directly with the 2021 NLCD" (MRLC Impervious Land Cover). From there the file was clipped to Connecticut boundaries and transformed using Raster to Points tool. The average area of impervious surfaces per tract is calculated by dividing the sum of impervious percentage to the square mileage area of the tract, and used for percentile and rank calculation.

The corresponding percentile for each census tract was designated based on these percentage of land. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. The value in the table below represents average percent imperviousness per 30-meter pixel within census tracts by area-square mileage.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
2735	11173	0	9.44	0	1
11205	21679	9.56	19.45	1	2
21776	35369	19.57	29.35	2	3
35443	47872	29.47	39.36	3	4
47895	56658	39.48	49.37	4	5
56716	66419	49.49	59.39	5	6
66636	79767	59.5	69.4	6	7
79787	96746	69.51	79.41	7	8
96874	122609	79.52	89.31	8	9
122617	220477	89.42	99.89	9	10

Incinerator/Resource Recovery Facilities

An incinerator is a facility that burns household, hazardous, or medical waste at high temperatures. Connecticut has four municipal (household) solid waste incinerators. The largest incinerator in Bridgeport is in an environmental justice area. Incinerators emit harmful pollutants such as Particulate Matter (PM), Lead, Cadmium, Mercury, and dioxins/furans, which are known or suspected to cause adverse health and environmental effects (Committee on Health Effects of Waste Incineration, 2000; Environmental Protection Agency (EPA)., 2022). The State of Connecticut tracks incinerator activity as part of an effort to maintain an integrated waste management system (CT DEEP, 2022b).

An update to the Clean Air Act in 2000 was designed to substantially reduce incinerator emissions of air pollutants. EPA data shows that by the early 2000s, incinerators emitted 1% of the carcinogenic compounds that had been emitted in 1987 (Seltenrich, 2016). A systemic review of 31 research papers studying exposure to incinerators found that many older incinerators were linked with tumor growths, reproductive issues and other diseases in nearby populations (Tait et al., 2020). Although technology has improved, there is currently a lack of research and understanding of how living in close proximity to new-generation incinerators affects human health (Seltenrich, 2016; Tait et al., 2020; Vinti et al., 2021), therefore a cautionary approach to new incinerators is recommended.

Indicator This indicator represents the tracts ranked by their percentile proximity to incinerators

Data Source Connecticut Resource Recovery Facilities, 2020

Method Incinerator locations spreadsheet was provided by DEEP and geocoded. Double buffer weights were determined based on their proximity to each site. Those within 500 meters were assigned a weight of 1, those within 500-1000 meters received a weight of 0.5, tracts within 1000-1500 meters were assigned a weight of 0.25, and a weight of 0.1 was given for tracts within 1500-2000 meters. Tracts beyond the 1000-meter radius were assigned a weight of 0, i.e., not close to the pollution source. The cumulative weight score was then computed by adding up the weights of each buffer located within each census tract.

The corresponding percentile for each census tract was designated based on these total weight scores. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. When there are a lot of census tracts with No Data (weight assigned 0, i.e. not close to the pollution source) is available, the rank range table do not display ten equally sized rank ranges. The value in the table below represents the sum of site proximity weights for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0.1	0.1	0	0	0	2
0.25	0.25	26.79	26.79	2	3
0.5	0.5	44.64	44.64	4	5
1	1	64.29	64.29	6	7
	2		98.21	9	10

Solid Waste Disposal Area / Landfill Sites

A landfill, in its most basic form, is a discrete area of land or pit where municipal solid waste ("garbage") is buried under soil for decomposition. Landfill gas is emitted from the breakdown of organic waste in landfills. It is made up of around half methane, half carbon dioxide (CO2), and a minor quantity of non-methane compounds. Methane is a powerful greenhouse gas contributing to climate change that traps heat in the atmosphere 28 to 36 times more effectively than CO2 over a 100-year period (U.S. EPA, 2022.)

There are active landfills in Connecticut that are permitted to receive municipal solid waste, bulky waste, industrial waste, and special waste. Examples of special waste that may be suitable for disposal at a landfill include: water treatment, sewage treatment or industrial sludges and solids; fly-ash, casting sands or slag; contaminated dredge spoils; asbestos; and residue (e.g., ash from the combustion process at resource recovery facilities). Presently there are no landfills in Connecticut that are receiving/disposing of municipal solid waste or asbestos. The State of Connecticut tracks landfill activity to mitigate the number of landfills as part of an effort to utilize an integrated waste management hierarchy system (CT DEEP, 2022b).

Although there is limited investigation on the adverse health effects from exposure to properly managed landfill sites (Mattiello et al., 2013), some research has shown an increased potential health risk to individuals living near landfills, such as poor air quality in a disproportionately Black North Carolina community (Heaney et al., 2011). International studies have documented adverse health effects from living near landfills, such as lung cancer in Italy (Mataloni et al., 2016), birth defects in Wales (Palmer et al., 2005), and negative respiratory issues for children in China (Yu et al., 2018). Improperly managed landfills can potentially result in the contamination of groundwater that leads to drinking water sources (Vinti et al., 2021). In addition, residents living downwind of landfills may experience significant odor problems (Palmiotto et al., 2014).

Indicator This indicator represents the tracts ranked by their percentile proximity to solid waste disposal areas, including, but not limited to, a landfill that contains ash, construction and demolition debris or solid waste.

Data Source Active Landfills 2020, and Affecting Facilities 2021

Method

Landfill locations spreadsheet was provided by DEEP and geocoded. From each point, buffers of 250m, 500m, 750m, and 1000m were established, intersecting these buffers with the adjacent census tracts.

Buffer weights were determined based on their proximity to the each site. Those within 250 meters were assigned a weight of 1, those within 250-500 meters received a weight of 0.5, tracts within 500-750 meters were assigned a weight of 0.25, and a weight of 0.1 was given for tracts within 750-1000 meters. Tracts beyond the 1000-meter radius were assigned a weight of 0, i.e., not close to the pollution source. The cumulative weight score was then computed by adding up the weights of each buffer located within each census tract.

The corresponding percentile for each census tract was designated based on these total weight scores. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. When there are a lot of census tracts with No Data (weight assigned 0, i.e. not close to the pollution source) is available, the rank range table do not display ten equally sized rank ranges. The value in the table below represents the sum of site proximity weights for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0			0	0	1
0.1	2	93.29	99.77	9	10

Lead Paint Risk in Housing

The catastrophic consequences of lead poisoning on the human body make it a significant environmental problem. The toxicity of lead affects virtually every bodily function. Although the

United States banned the use and sale of lead-based paint for residential use in 1978 (Environmental Protection Agency, 2022a), it is still a frequent environmental contaminant and major health hazard in older homes (Wani et al., 2015). Compared to the projection of 64 million homes in 1990, lead-based paint was estimated to exist in 38 million housing units in 2002. Serious lead-based paint hazards were in 24 million housing units. An estimated 35% of all low-income households contained lead hazards (Jacobs et al., 2002). Lead poisoning is the number-one environmental health threat to children in the United States, especially poor children, children of color, and children living in older housing in inner cities. Black children are five times more likely than white children to have lead poisoning and one in seven black children living in older housing has elevated blood lead levels (Bullard et al., 2008).

Indicator This indicator represents the tracts ranked by their percentile of percentage of houses that are built before 1979.

Data Source 2017-2021 American Community Survey (ACS) 5-Year Estimates

Method The 2017-2021 ACS 5-year estimates "ACS DEMOGRAPHIC AND HOUSING ESTIMATES" from U.S. Census in tract resolution is processed to calculate the percentage of the houses. The total housing units on the tract level is found in Table DP04_0016E Estimate!!YEAR STRUCTURE BUILT!!Total housing units). The total houses built before 1979 is shown as the sum of the following tables: DP04_0022E (Estimate!!YEAR STRUCTURE BUILT!!Total housing units!!Built 1970 to 1979), DP04_0023E (Estimate!!YEAR STRUCTURE BUILT!!Total housing units!!Built 1960 to 1969), DP04_0024E (Estimate!!YEAR STRUCTURE BUILT!!Total housing units!!Built 1950 to 1959), DP04_0025E (Estimate!!YEAR STRUCTURE BUILT!!Total housing units!!Built 1940 to 1949), DP04_0026E (Estimate!!YEAR STRUCTURE BUILT!!Total housing units!!Built 1939 or earlier).

The sum of houses built before 1979 is divided by the total housing unit count to find the percentage of houses built before 1979. A percentile calculated for each census tract is determined by the percentage of houses dated pre-1979. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. The value in the table below represents the percentage of houses built before 1979 in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
7.85	47.58	0	9.4	0	1
47.7	55.23	9.52	19.38	1	2
55.28	61.84	19.5	29.36	2	3

61.89	66.67	29.47	39.45	3	4
66.68	71.44	39.56	49.43	4	5
71.55	76.39	49.66	59.4	5	6
76.42	80.83	59.52	69.38	6	7
80.93	85.02	69.5	79.36	7	8
85.12	90.79	79.47	89.33	8	9
90.81	98.49	89.45	99.89	9	10

Municipal Transfer Stations

A transfer station, in its most basic form, is a structure with a designated reception area where municipal solid waste ("garbage") collection vehicles unload their contents. The garbage is consolidated before being put onto bigger vehicles for long hauls, primarily via transfer trailers, although shipping containers, railcars, and barges are also used. The content is then transported to a final disposal location, which is commonly a landfill, waste-to-energy plant, or composting facility (U.S. EPA Solid Waste and Emergency Response, 2002). CT DEEP retains a record of municipal transfer stations that may collect and consolidate a variety of waste, including municipal solid waste (MSW), oversized MSW (e.g., furniture, carpets, mattresses, and rugs), land-clearing debris, construction and demolition materials, scrap tires, scrap metal, used oil, and recyclable commodities (CT DEEP, 2020a). According to the EPA, commercial trucks are a mobile source of air pollution while transferring garbage from and to the municipal transfer stations (U.S. EPA, 2023a). If improperly managed, there is a potential risk for transfer station truck traffic to contribute to road congestion, increased air emissions, increased noise on roads, and potential litter problems (U.S. EPA Solid Waste and Emergency Response, 2002; Wankhede and Wanjari, 2021).

Indicator This indicator represents the tracts ranked by their percentile proximity to municipal stations where garbage collection vehicles unload their contents.

Data Source 2020 CT DEEP Municipal Waste Disposal Data

Method

Municipal transfer station locations spreadsheet was provided by DEEP and geocoded. From each point, double buffers were established, intersecting these buffers with the adjacent census tracts.

Buffer weights were determined based on their proximity to each site. Those within 500 meters were assigned a weight of 1, those within 500-1000 meters received a weight of 0.5, tracts within 1000-1500 meters were assigned a weight of 0.25, and a weight of 0.1 was given for tracts within 1500-2000 meters. Tracts beyond the 1000-meter radius were assigned a weight of 0, i.e., not close to the pollution source. The cumulative weight score was then computed by adding up the weights of each buffer located within each census tract.

The corresponding percentile for each census tract was designated based on these total weight scores. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. When there are a lot of census tracts with No Data (weight assigned 0, i.e. not close to the pollution source) is available, the rank range table do not display ten equally sized rank ranges. The value in the table below represents the sum of site proximity weights for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	0	0	0	0	1
0.1	0.1	40.84	40.84	4	5
0.2	0.25	50.85	51.65	5	6
0.3	0.5	62.12	62.23	6	7
1	1	73.38	73.38	7	8
1.5	4	97.04	99.89	9	10

Potentially Contaminated/Cleanup Sites

Cleanup sites are areas polluted with hazardous substances that must be cleaned by the property owner or the government. Cleanup sites pose a potential health risk to humans and the environment. Humans can be harmed by contact with hazardous materials on a contaminated site via exposure to contaminated land, air, surface water, and ground water (Environmental Protection Agency, 2021). Potential cleanup sites include property transfer programs, federal remediation programs, state remediation programs, urban site remediation programs, and discharge authorization and enforcement programs. Cleanup sites include Resource Conservation & Recovery Act (RCRA) Corrective Action facilities and abandoned brownfield cleanup sites. RCRA requires facility owners and operators to clean up properties that have treated, stored, or disposed of hazardous waste at their facility. Voluntary remediation programs in Connecticut under Connecticut General Statutes (CGS) sections 22a-133x and 22a-133y.

People who live near these locations are more likely to experience pollution exposure than those who live further away. According to several assessments, cleanup locations are often in low-income communities and have a higher proportion of persons of color than other areas (California Office of Environmental Health Hazard Assessment (OEHHA), 2022). Research shows that residents living in areas near industrial contaminated sites have higher mortality and morbidity rates from a variety of conditions, including cancer, cardiovascular disease, and respiratory disease. These consistent findings from several epidemiological techniques support the need to identify and complete environmental cleaning efforts (Pirastu et al., 2013).

Indicator This indicator represents the tracts ranked by their percentile proximity to cleanup sites that can include property Transfer Program, federal remediation programs, state remediation program, urban site remediation program, general permit, discharge authorization and enforcement. Cleanup sites include Resource Conservation and Recovery Act (RCRA)

Closure and Corrective Action, Voluntary Remediation Connecticut General Statutes (CGS) sections 22a-133x and 22a-133y and abandoned brownfields cleanups.

Data Source 2021 CT DEEP Hazard Waste Inventory, Remediation Department

Method Potentially contaminated sites were selected from the Hazard Waste Inventory spreadsheet was provided by DEEP and geocoded. From each point, buffers were established, intersecting these buffers with the adjacent census tracts. Buffer weights were determined based on their proximity to each site. Those within 250 meters were assigned a weight of 1, those within 250-500 meters received a weight of 0.5, tracts within 500-750 meters were assigned a weight of 0.25, and a weight of 0.1 was given for tracts within 750-1000 meters. Tracts beyond the 1000-meter radius were assigned a weight of 0, i.e., not close to the pollution source. The cumulative weight score was then computed by adding up the weights of each buffer located within each census tract.

The corresponding percentile for each census tract was designated based on these total weight scores. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. When there are a lot of census tracts with No Data (weight assigned 0, i.e. not close to the pollution source) is available, the rank range table do not display ten equally sized rank ranges. The value in the table below represents the sum of site proximity weights for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	0	0	0	0	1
0.1	0.1	38.57	38.57	3	4
0.2	0.25	43.57	44.82	4	5
0.3	1	50.17	57.79	5	6
1.25	1.5	79.07	79.41	7	8
2	2	81.8	81.8	8	9
2.5	10	91.58	99.89	9	10

Proximity to Superfund Sites

Superfund sites, also known as National Priorities List (NPL) sites, are unregulated, abandoned hazardous waste sites that the federal government is given jurisdiction over for remediation efforts. The Comprehensive Environmental Response Compensation and Liability Act (CERCLA) was passed by Congress in 1980 to address these contaminated areas. Improperly managed hazardous commercial and industrial wastes cause intolerable dangers to both human health and the environment (Environmental Protection Agency, 2011). Communities near Superfund sites, who are often low-income or communities of color, are at increased risk of being exposed to environmental contaminants from these sites. Studies have found that living in proximity to Superfund sites is associated with

potential adverse health effects, such as low birth weight and higher blood pesticide levels, compared to those living further away (University of Washington Department of Environmental & Occupational Health Sciences and Washington State Department of Health., 2022).

In accordance with CERCLA, the EPA's response to Superfund sites may include long term cleaning measures or prompt removal measures. The Superfund process is exceedingly time-consuming and does not result in the rapid eradication of public health threats. The entire process involves site identification, cleanup, removal from the NPL following successful remediation, and reuse of the site (Lioy and Burkeb, 2010).

Indicator This indicator represents the tracts ranked by their percentile proximity to sites proposed and listed on the National Priorities List (NPL). National Priorities List (NPL) sites, are unregulated, abandoned hazardous waste sites that the federal government is given jurisdiction over for remediation efforts.

Data Source 2022 EPA CERCLIS database,

Method The information is obtained through EPA EJSCREEN 2022 database. The census tract based PNPL dataset is used to compute the percentiles. PNPL describes the superfund proximity: Count of proposed and listed NPL sites within 5 km (or nearest one beyond 5 km), each divided by distance in km. Count excludes deleted sites.

The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. The table below represents the sum of site proximity weights for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0.033	0.047	0	9.47	0	1
0.047	0.054	9.59	19.41	1	2
0.054	0.062	19.52	29.45	2	3
0.062	0.070	29.57	39.38	3	4
0.070	0.080	39.5	49.43	4	5
0.081	0.092	49.54	59.36	5	6
0.092	0.111	59.47	69.41	6	7
0.111	0.145	69.52	79.34	7	8
0.145	0.230	79.45	89.38	8	9
0.231	2.502	89.5	99.89	9	10

Recycling Processing/Materials Recovery Facilities

A materials recovery facility (MRF), also known as a recycling processing facility, is a plant that specializes in receiving and sorting single-stream recycling to sell to buyers for reuse in products.

As of 2018, Connecticut's MRFs received recyclable items as single stream (mix of bottles, cans, plastic & paper); paper mix; individual paper grades; dual stream (bottles and cans separately from paper); aluminum or steel cans; and glass bottles (CT DEEP, 2018). Similarly, to transfer stations, improperly managed recycling processing facilities may create nuisances to nearby communities from litter, noise, odor, heavy truck traffic and equipment noise (U.S. EPA Solid Waste and Emergency Response, 2002).

Indicator This indicator represents the tracts ranked by their percentile proximity to materials recovery facilities (MRF), also known as a recycling processing facility, is a plant that specializes in receiving and sorting single-stream recycling to sell to buyers for reuse in product.

Data Source 2018 CT DEEP Recycling Processing Facilities

Method

Recycling facility locations spreadsheet was provided by DEEP and geocoded. From each point, buffers were established, intersecting these buffers with the adjacent census tracts. Buffer weights were determined based on their proximity to each site. Those within 250 meters were assigned a weight of 1, those within 250-500 meters received a weight of 0.5, tracts within 500-750 meters were assigned a weight of 0.25, and a weight of 0.1 was given for tracts within 750-1000 meters. Tracts beyond the 1000-meter radius were assigned a weight of 0, i.e., not close to the pollution source. The cumulative weight score was then computed by adding up the weights of each buffer located within each census tract.

The corresponding percentile for each census tract was designated based on these total weight scores. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. When there are a lot of census tracts with No Data (weight assigned 0, i.e. not close to the pollution source) is available, the rank range table do not display ten equally sized rank ranges. The value in the table below represents the sum of site proximity weights for each census tract.

Max Value	Min Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	0	0	0	0	1
0.1	0.5	81.91	86.58	8	9
1	3	89.31	99.54	9	10

Significant Environmental Hazards/Proximity to Facilities with Highly Toxic Substances

Significant environmental hazards (SEHs) must be reported to CT DEEP as soon as a property owner becomes aware of conditions that may cause imminent threat to human health and the environment, according to Section 22a-6u of the Connecticut General Statutes (CGS). The list of conditions that must be reported to CT DEEP include: contaminated wells; polluted groundwater close to a drinking water well; polluted groundwater impacting a waterbody and causing issues to the

aquatic life; polluted groundwater close to an occupied building causing issues to indoor air quality; exposed polluted soil posing risk to direct contact to humans; and vapors from pollution that may cause explosion (CT DEEP, 2022c).

Indicator This indicator represents the tracts ranked by their percentile proximity to active, resolved and controlled cases of significant hazards because they pose a potential short-term health risk to exposed individuals or the environment defined by Connecticut General Statues Section 22a-6u.

Data Source 2023 Significant Environmental Hazards, CT DEEP

Method The locations spreadsheet was provided by DEEP and geocoded. From each point, buffers were established, intersecting these buffers with the adjacent census tracts. Buffer weights were determined based on their proximity to each site. Those within 250 meters were assigned a weight of 1, those within 250-500 meters received a weight of 0.5, tracts within 500-750 meters were assigned a weight of 0.25, and a weight of 0.1 was given for tracts within 750-1000 meters. Tracts beyond the 1000-meter radius were assigned a weight of 0, i.e., not close to the pollution source. The cumulative weight score was then computed by adding up the weights of each buffer located within each census tract.

The corresponding percentile for each census tract was designated based on these total weight scores. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. When there are a lot of census tracts with No Data (weight assigned 0, i.e. not close to the pollution source) is available, the rank range table do not display ten equally sized rank ranges. The value in the table below represents the sum of site proximity weights for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	0.1	0	8.65	0	1
0.2	0.5	10.58	16.5	1	2
0.7	1	24.12	25.82	2	3
1.25	1.25	48.46	48.46	4	5
1.5	2	50.06	52.45	5	6
2.25	2.5	68.6	68.83	6	7
3	4	69.97	79.41	7	8
5	5	85.55	85.55	8	9
5.5	21	90.56	99.89	9	10

Underground Storage Tanks (UST)s – Active Facilities

Around 542,000 underground storage tanks (USTs) contain petroleum or hazardous chemicals across the country. Contamination of groundwater, which is the source of drinking water for over half

of all Americans, is the most serious concern posed by a leaky UST (Environmental Protection Agency, 2022b). While there is no funding for regulating residential units, CT DEEP regulates non-residential underground storage tanks, such as those for oil, petroleum, and chemical liquids. DEEP must be notified of any releases from these tanks, and cleanup must be carried out (CT DEEP, 2016).

Gas stations, businesses, and other organizations use USTs to store hazardous materials like gasoline and oil that contain harmful chemicals like benzene, toluene, and heavy metals that can harm developing children and cause cancer (Sierra Club, 2004). Proximity to living close to the leaking USTs, has close a environmental injustice relationship with poverty and neighborhoods with higher percentages of black residents. (Wilson et al., 2013).

Indicator This indicator represents the tracts ranked by their percentile proximity to non-residential tanks that stores oil, petroleum, and chemical liquids.

Data Source 2021 CT Gov active underground storage tanks (USTs) Facilities

Method UST locations spreadsheet was provided by DEEP and geocoded. Buffer weights were determined based on their proximity to each site. Those within 250 meters were assigned a weight of 1, those within 250-500 meters received a weight of 0.5, tracts within 500-750 meters were assigned a weight of 0.25, and a weight of 0.1 was given for tracts within 750-1000 meters. Tracts beyond the 1000-meter radius were assigned a weight of 0, i.e., not close to the pollution source. The cumulative weight score was then computed by adding up the weights of each buffer located within each census tract.

The corresponding percentile for each census tract was designated based on these total weight scores. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. The value in the table below represents the sum of site proximity weights for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0.5	7	0	8.53	0	1
7.5	9	11.15	15.81	1	2
9.25	12	20.25	28.21	2	3
12.5	14	32.88	36.52	3	4
14.25	17	40.73	47.78	4	5
17.5	20	51.76	58.02	5	6
20.5	22	62.91	66.33	6	7
22.5	26	69.51	77.7	7	8
26.5	32	79.64	88.62	8	9
33	94	89.87	99.89	9	10

Wastewater Discharge

Wastewater is water that has been used in a home or business and may contain pollutants. The National Pollutant Discharge Elimination System (NPDES) can grant permits to industries to allow for the discharge of wastewater to waterways. The NPDES permit enforces limits on the amount of pollutants being released to prevent harm to the environment and human health (Environmental Protection Agency, 2022c). Effluent Guidelines are national regulatory criteria that apply to wastewater released to surface waterways from treatment facilities in municipalities. Based on the effectiveness of treatment and control technologies, EPA publishes these standards for various industrial categories. The most effective level of control also varies based on the technology available in each industry (Environmental Protection Agency, 1988). Under the Clean Water Act (CWA) section 304(a)(4), effluent guidelines regulate biochemical oxygen demand (BOD5), total suspended solids (TSS), fecal coliform, pH, and any other pollutants the EPA deems as conventional (U.S. EPA, 2023b). With economic development and the intensification of urbanization, the amount of urban wastewater discharge increases annually. This causes concern for an increase of health risks that are associated with various pollutants being released through wastewater (An et al., 2018).

Indicator This indicator represents the tracts ranked by their percentile level of wastewater discharge Risk-Screening Environmental Indicators (RSEI) Model modeled Toxic Concentrations at stream segments within 500 meters, divided by distance in kilometers (km) calculated to stream segments.

Data Source 2019 Risk-Screening Environmental Indicators (RSEI) modeled results from by EPA's Office of Pollution Prevention and Toxics (OPPT) on March 15, 2021.

Method The information is obtained through EPA EJSCREEN 2022 database. The census tract based PWDIS dataset is used to compute the percentiles. PWDIS is wastewater discharge: 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.

The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. The value in the table below represents the toxicity-weighted concentration/km distance).

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	1.77E-07	0	9.44	0	1
1.82E-07	6.30E-06	9.56	19.45	1	2
6.41E-06	3.43E-05	19.57	29.35	2	3
3.52E-05	0.000167	29.47	39.36	3	4
0.00017	0.000525	39.48	49.37	4	5

0.000536	0.001295	49.49	59.39	5	6
0.00131	0.003617	59.5	69.4	6	7
0.003633	0.012612	69.51	79.41	7	8
0.012615	0.050665	79.52	89.31	8	9
0.050758	3.296275	89.42	99.89	9	10

ii) Potential Pollution Exposure

Potential Pollution Exposure is a composite of multiple indicators designed to reflect the estimated level of exposure to environmental pollutants within census tracts. The indicators illustrate measured environmental concentrations and releases of contaminants from pollution sources. Indicators that fall under this category are given in Table 2. There are 12 indicators in this category.

Table 2: Potential Pollution Exposure Indicators

Indicator Type	Dataset Time Frame	Resolution	Dataset Source
Diesel PM Emissions	2017	Tracts	EPA EJSCREEN 2022, National Emissions Inventory, EPA Hazardous Air Pollutants 2017
Noise	2018	Road Segment	U.S. Department of Transportation, Bureau of Transportation Statistics, National Transportation Noise Map, 2018
Ozone	2016	1 km x 1 km grid	NASA Socioeconomic Data and Applications Center, (Requia et al., 2020)
Particulate Matter 2.5	2019	1 km x 1 km grid	Atmospheric Composition Analysis, Washington University in St. Louis. (Van Donkelaar et al., 2021)
Facilities Releasing Toxins	2020	Points	TRI Form R and A 2021 DEEP and U.S. Environmental Protection Agency and CT Department of Energy and Environmental Protection
Traffic Density	2020	Road Segment	2020 Traffic Monitoring Annual Average Daily Traffic Report, CT Department of Transportation
Permitted Major Air Pollution Sources	2021	Points	2021 Title V permits - CT DEEP Bureau of Air ManagementTitle V permits - CT DEEP Bureau of Air Management
Permitted Minor Air Pollution Source	2021	Points	2021 New Source Review Permits - CT DEEP Bureau of Air Management
Minor Facilities with Permit-limited Emissions Potential	2023	Points	2023 Section 22a-174 33a and 33b facilities CT DEEP Bureau of Air Management Title V permits - CT DEEP Bureau of Air Management

Urban Heat Index	2003-2018	Raster	2003-2018 UHI Earth Engine Data Catalog, (Chakraborty and Lee, 2019)
EPA Respiratory Hazard Index	2017	Block group averaged over tract	Air Toxics data Update, EPA EJSCREEN 2022
EPA Cancer Risk	2017	Block group averaged over tract	Air Toxics data Update, EPA EJSCREEN 2022

The Potential Pollution Exposure index is calculated by taking the average of all the ranks of Table 2 indicators for each census tract. These average ranks are called scores. The corresponding scores for each census tract are normalized into percentiles and impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. The value in the table below represents scores (average indicator ranks for Potential Pollution Exposure) for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0.67	2.53	0	9.44	0	1
2.53	3.25	9.56	19.34	1	2
3.26	3.75	19.57	29.35	2	3
3.75	4.26	29.47	39.36	3	4
4.27	4.75	39.48	49.26	4	5
4.76	5.24	49.6	59.39	5	6
5.24	5.72	59.5	69.4	6	7
5.72	6.20	69.51	79.41	7	8
6.20	6.85	79.52	89.31	8	9
6.87	9.29	89.42	99.89	9	10

Diesel PM Emissions

Diesel is the primary fuel source used to run machines and transport goods. Diesel engines emit a combination of pollutants including Volatile Organic Compounds such as benzene and formaldehyde; Nitrogen dioxide (NO2), and Particulate Matter (PM). Short-term exposure can cause oxidative stress, increased airway inflammation and acute cardiovascular events, while long-term exposure has been shown to cause higher rates of lung cancer and mortality (Mckenzie et al., 2022; Min et al., 2019a). Polycyclic aromatic hydrocarbon (PAH), a known carcinogenic compound, is also found in diesel emissions (American Cancer Society, 2015). Several studies have observed elevated levels of cancer in miners and truck drivers with chronic exposure to diesel exhaust (Silverman, 2017). There is evidence that particulate matter in diesel truck emissions from commercial truck traffic may potentially impact air quality and public health (U.S. EPA, 2003., 2023.). Other research has indicated that diesel exhaust exposure increases the risk of developing bladder cancer (Koutros et al., 2020).

Indicator This indicator represents the tracts ranked by their percentile level of diesel particulate matter emissions from on-road and non-road sources.

Data Source EPA EJSCREEN 2022, National Emissions Inventory, EPA Hazardous Air Pollutants 2017

Method The information is obtained through EPA EJSCREEN 2022 database. The census tract based gridded diesel PM concentrations are used to calculate the percentiles. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. The value in the table below represents the Diesel particulate matter level in air in micrograms per cubic meter (µg/m3).

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0.074	0.114	0	9.4	0	1
0.114	0.141	9.52	19.38	1	2
0.141	0.162	19.5	29.36	2	3
0.162	0.179	29.47	39.45	3	4
0.180	0.196	39.56	49.43	4	5
0.196	0.215	49.54	59.4	5	6
0.215	0.229	59.52	69.38	6	7
0.230	0.263	69.5	79.36	7	8
0.264	0.307	79.47	89.33	8	9
0.307	0.412	89.45	99.89	9	10

Noise

Noise exposure has been linked to hearing loss, hypertension, coronary artery disease, irritation, sleep disruption, and poor academic performance (Passchier-Vermeer1 and Passchier2, 2000). Noise pollution from transportation is associated with significant increases in community stress and may lead to an elevated risk of cardiovascular disease, adverse mental health outcomes, and sleep disturbances leading to poorer quality of life ("Environmental Justice Index Indicators.," 2022; Stansfeld and Matheson, 2003; University of Washington Department of Environmental & Occupational Health Sciences and Washington State Department of Health., 2022). Recent studies show an association between the effects of road traffic noise and susceptibility to anxiety, depression, and psychological distress (Stansfeld et al., 2021). Several studies indicate that chronic environmental noise exposure in children from airplanes, railroads, or roads decreases capabilities in auditory and reading comprehension and long-term memory (Stansfeld and Matheson, 2003).

Indicator This indicator represents the tracts ranked by their percentile level of equivalent average noise energy due to transportation noise sources over a 24-hour period from aviation, rail and Interstate Road noise.

Data Source U.S. Department of Transportation, Bureau of Transportation Statistics, National Transportation Noise Map, 2018

Method The information is obtained as a shape file and intersected with the census tracts. The census tract-based average of A-weighted noise levels (approximate average noise energy due to transportation noise sources over the 24-hour period at the defined receptors), for each tract, are used to calculate the percentiles. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. The value in the table below represents noise level of 24-hr equivalent A-weighted sound level in decibel.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
32.22	162.33	0	9.45	0	1
164.46	293.43	9.57	19.36	1	2
295.29	484.31	19.48	29.38	2	3
487.61	692.51	29.5	39.41	3	4
695.67	932.36	39.52	49.43	4	5
932.36	1305.83	49.54	59.34	5	6
1313.62	1825.90	59.45	69.36	6	7
1826.69	2948.93	69.48	79.38	7	8
2951.05	5389.74	79.5	89.29	8	9
5455.89	11087.83	89.41	99.89	9	10

Ozone

Ozone (O_3) is a gas made up of three bonded oxygen atoms. There are two types of ozone: Ozone that occurs naturally in the upper atmosphere and forms a protective layer on the earth by blocking out ultraviolet radiation from the sun; and ozone on ground-level which is a harmful air pollutant that must be monitored to track air quality. Ground-level ozone is not an emission. Rather, ground-level ozone is formed when nitrogen oxides (NOx) and volatile organic compounds (VOCs) react together in the presence of heat and sunlight. It is the main ingredient of "smog." The health effects of ozone pollution can include respiratory inflammation and damage, difficulty breathing deeply and vigorously during exercise, and aggravation of respiratory diseases such as asthma, emphysema, and chronic bronchitis (U.S. EPA, 2022b).

In order to limit the concentration of air pollutants, the EPA sets national ambient air quality standards (NAAQS) for the six major criteria air pollutants, which includes ozone. Major sources of the ozone-forming compounds NOx and VOCs are emitted from car exhaust, gasoline vapor, power

plants, industrial boilers, refineries, and other industrial sources (U.S. EPA, 2022c). In Connecticut, sources of ozone-forming compounds include local emissions from transportation, commercial, and industrial sources, as well as pollutants carried on high-altitude winds from western regions and on southwest winds from the New York metropolitan region (CT DEEP, 2023a). CT DEEP is working with the U.S. EPA and neighboring states to reduce local and regional emissions that cause ozone (CT DEEP, 2022d).

Indicator This indicator represents the tracts ranked by their percentile level of daily 8-hour annual average surface-level O3 concentrations modeled over 1km x 1km plots in 2016.

Data Source NASA Socioeconomic Data and Applications Center, (Requia et al., 2020)

Method The census tract based gridded ozone concentrations are used to calculate the percentiles. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. The value in the table below represents Ozone summer seasonal avg. of daily maximum 8-hour concentration in air in parts per billion, units of ppbv.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
38.29	39.58	0	9.44	0	1
39.59	39.85	9.56	19.45	1	2
39.86	39.97	19.57	29.12	2	3
39.97	40.05	29.58	39.36	3	4
40.05	40.15	39.48	49.37	4	5
40.16	40.29	49.49	59.39	5	6
40.29	40.42	59.5	69.4	6	7
40.42	40.55	69.51	79.41	7	8
40.55	40.70	79.52	89.31	8	9
40.70	42.14	89.42	99.89	9	10

Particulate Matter 2.5

Particulate matter 2.5 (PM2.5) is the term for inhalable solid particles and liquid droplets in the air that are 2.5 micrometers in diameter or smaller. It is the fine particles that are found in smoke and haze. PM2.5 is one of the six air pollutants criteria that is monitored under EPA's national ambient air quality standards (NAAQS). Primary PM2.5 is particulate matter that is directly emitted into the air as solid or liquid particles. Primary PM2.5 sources are emitted from cars and trucks, diesel engines, dust from roads and construction, agricultural operations, coal and oil-burning boilers, wildfires and other sources of fire and burning. Secondary PM2.5 is formed in the atmosphere by chemical reactions of gases. Secondary PM2.5 sources are power plants, oil refineries, pulp and paper production, and industrial activities that emit gases such as sulfur dioxide (SO2), nitrogen oxides (NOx), volatile

organic compounds (VOCs), and ammonia (NH3) (U.S. EPA, 2023c). Health studies have shown a link between particulate matter and harmful health effects such as respiratory disease, cardiovascular disease, and premature death (U.S. EPA, 2023d).

Indicator This indicator represents the tracts ranked tracts ranked by their percentile level of daily 8-hour annual average surface-level PM2.5 concentrations modeled over by 1km x 1km plots in 2019.

Data Source Atmospheric Composition Analysis, Washington University in St. Louis, (Van Donkelaar et al., 2021)

Method The census tract based gridded ozone concentrations are used to calculate the percentiles. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. The value in the table below represents Particulate matter (PM2.5) levels in air, micrograms per cubic meter (µg/m3) annual average.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
5.13	5.71	0	8.99	0	1
5.72	5.92	9.56	18.77	1	2
5.93	6.1	19.45	29.35	2	3
6.1	6.23	29.35	39.14	3	4
6.24	6.34	39.93	48.12	4	5
6.35	6.45	49.49	57.91	5	6
6.46	6.56	59.5	69.17	6	7
6.57	6.69	69.62	79.18	7	8
6.7	6.9	79.41	89.08	8	9
6.9	7.6	89.08	99.66	9	10

Facilities Releasing Toxics (TRI Facilities)

The Toxics Release Inventory (TRI) from the U.S. EPA gathers data annually about environmental releases of toxic chemicals from industrial facilities. A "release" of a chemical means it moved into the air or water or was transferred to a recycling facility or out-of-state disposal facility (since there are no active disposal facilities in Connecticut). The purpose of collecting this information is to share it with local communities. The quantity of the releases does not predict or estimate the level of health risk posed by the chemicals (U.S. EPA, 2022d). Communities burdened by multiple TRI facilities and other harmful land uses may experience noise and odor pollution and an increased level of community stress ("Environmental Justice Index Indicators.," 2022). Studies have shown that TRI sites are more prevalent in or near low-income communities or communities of color and may be associated with an increased risk of infant mortality, childhood cancers and cardiovascular mortality

(Min et al., 2019a). This layer is intended to show the potential risks to the environment and communities living near TRI facilities.

Indicator This indicator represents the tracts ranked by their percentile of proximity to the facilities that are releasing toxic chemicals into the air and off-site incineration. The Toxics Release Inventory (TRI) from the U.S. EPA gathers data annually about environmental releases of toxic chemicals from industrial facilities.

Data Source TRI Form R and A 2021 U.S. Environmental Protection Agency and CT Department of Energy and Environmental Protection

Method The locations spreadsheet was provided by DEEP and geocoded. From each point, buffers were established, intersecting these buffers with the adjacent census tracts. Buffer weights were determined based on their proximity to each site. Those within 250 meters were assigned a weight of 1, those within 250-500 meters received a weight of 0.5, tracts within 500-750 meters were assigned a weight of 0.25, and a weight of 0.1 was given for tracts within 750-1000 meters. Tracts beyond the 1000-meter radius were assigned a weight of 0, i.e., not close to the pollution source. The cumulative weight score was then computed by adding up the weights of each buffer located within each census tract.

The corresponding percentile for each census tract was designated based on these total weight scores. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. When there are a lot of census tracts with No Data (weight assigned 0, i.e. not close to the pollution source) is available, the rank range table do not display ten equally sized rank ranges. The value in the table below represents the sum of site proximity weights for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	0	0	0	0	1
0.1	0.2	25.37	29.01	2	3
0.25	0.5	29.81	34.13	3	4
0.6	1	39.59	41.64	4	5
1.1	1.25	58.59	59.27	5	6
1.3	2.5	59.73	69.28	6	7
2.6	5	70.42	79.29	7	8
5.2	9.4	81	89.31	8	9
9.5	318.75	89.42	99.89	9	10

Traffic Density

Air pollutants from vehicle emissions include carbon monoxide (CO), nitrogen oxides (NOx), and black carbon (BC). Particulate matter (PM), another emission from vehicles, contains some BC, benzene, and other harmful compounds such as polycyclic aromatic hydrocarbons (PAHs) (Karner et al., 2010). Traffic congestion concentrates these pollutants and has led to an increase in the amount of the population exposed to these compounds, including those who live beyond metropolitan areas (Insaf et al., 2022). The cumulative impact of these compounds may increase the risk for developing respiratory illness such as asthma, rheumatoid arthritis (a long-term autoimmune disorder), cardiovascular complications including coronary heart disease, and other adverse health effects (Insaf et al., 2022; Kajbafzadeh et al., 2015; University of Washington Department of Environmental & Occupational Health Sciences and Washington State Department of Health., 2022). An increase of carbon monoxide and particulate matter in the air due to high traffic levels was even found to correlate to higher levels of infant mortality (Knittel et al., 2011).

Indicator This indicator represents the tracts ranked by their percentile sum of traffic volumes adjusted by road segment length (vehicle-kilometers per hour) divided by total road length (kilometers) within 150 meters of the census tract boundary.

Data Source 2020 Traffic Monitoring Annual Average Daily Traffic Report, CT Department of Transportation

Method A 150-meter buffer was placed around each of the 2020 census tracts in Connecticut. The selected buffer distance of 150 meters, or about 500 feet, is taken from the California Air Resources Board Air Quality and Land Use Handbook recommendations, which states that most particulate air pollution from traffic drops off after approximately 500 feet. The buffered census tracts were intersected with the AADT shapefile, the data file containing traffic information. For each road within the buffer, a length-adjusted volume was calculated and summed for all roads in the buffer. Calculate Geometry tool is used to calculate the road miles (rd_miles) per Census Tract to calculate the total amount of road length within the buffered census tract. Due to differences in the length of road segments across the state, a length-adjusted traffic volume metric was selected. This metric multiplies traffic volumes (AADT) by the length of the road segment. To calculate AADT adjusted (AADT_adj) calculate the field by using AADT x road_miles.

Traffic density was then calculated by dividing the sum of all length-adjusted traffic volumes within the buffered census tract (vehicle-Miles/day) by the sum of the length of all road segments within the buffered census tract (Miles). Traffic density prepares a field called AADT_tract which is (AADT_adj x length).

Traffic density (vehicles-Miles/day/Miles) is represented as the number of vehicles (adjusted by road segment lengths in kilometers) per hour per kilometer of roadways within the buffered census tract.

A percentile calculated for each census tract is determined by the sum of traffic volumes adjusted by road segment length divided by the total road length within the 150-meter buffer. The map is divided into 10 equal specific thresholds ranging between the 0 and 99th percentile. The specific threshold used for this layer is the sum of weighted traffic volumes. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. The value in the table below represents traffic volumes adjusted by road segment length divided by the total road length within the 150-meter buffer, (vehicle-km/hr).

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
705.3	3692.9	0	9.44	0	1
3693.0	5035.2	9.56	19.45	1	2
5038.3	6798.0	19.57	29.35	2	3
6800.9	8384.0	29.47	39.36	3	4
8468.4	10295.2	39.48	49.37	4	5
10353.7	14089.3	49.49	59.39	5	6
14202.7	18042.1	59.5	69.4	6	7
18073.8	22762.6	69.51	79.41	7	8
22834.5	28941.6	79.52	89.31	8	9
28964.2	60891.7	89.42	99.89	9	10

Permitted Major Air Pollution Sources

Major sources of air pollution in this mapping tool are designated by facilities with active Title V permits that are regulated by CT DEEP. Major sources of air pollution tend to be facilities that emit large quantities of air pollution and are subject to the most rigorous air pollution control requirements. Generally speaking, these are Title V permitted facilities that:

1) Are subject to air pollution control regulations from federal Clean Air Act requirements (CT DEEP, 2023b)

2) Have the potential to emit Criteria Air Pollutants in amounts that exceed the threshold of 100 tons per year (U.S. EPA, 2023e)

3) Have the potential to emit any one or more of 186 Federal Hazardous Air Pollutants (HAP) in amounts that exceed thresholds of 10 tons per year for a single HAP or 25 tons per year for any combination of HAP (U.S. EPA, 2023e)

Title V operating permits regulate the facility emissions for the following Criteria Air Pollutants: carbon monoxide, nitrogen oxides and volatile organic compounds (which are each a component in the formation of ozone pollution), sulfur dioxide, lead, and particulate matter. The permits also regulate emissions of the 186 federal Hazardous Air Pollutants. The permits contain monitoring, record keeping, and reporting requirements designed to show whether or not a facility is complying with requirements applicable to these Criteria Air Pollutants and Hazardous Air Pollutants. This data layer shows the geographic location of facilities with active Title V permits operating in Connecticut.

Indicator This indicator represents the tracts ranked by their percentile of proximity to the facilities with active Title V permits to regulate the facility emissions for the following Criteria Air Pollutants: carbon monoxide, nitrogen oxides and volatile organic compounds, sulfur dioxide, lead, and particulate matter.

Data Source 2021 Title V permits - CT DEEP Bureau of Air Management

Method Title V permit locations spreadsheet was provided by DEEP and geocoded. From each point, double buffers were established, intersecting these buffers with the adjacent census tracts. Buffer weights were determined based on their proximity to each site. Those within 500 meters were assigned a weight of 1, those within 500-1000 meters received a weight of 0.5, tracts within 1000-1500 meters were assigned a weight of 0.25, and a weight of 0.1 was given for tracts within 1500-2000 meters. Tracts beyond the 2000-meter radius were assigned a weight of 0, i.e., not close to the pollution source. The cumulative weight score was then computed by adding up the weights of each buffer located within each census tract.

The corresponding percentile for each census tract was designated based on these total weight scores. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. When there are a lot of census tracts with No Data (weight assigned 0, i.e. not close to the pollution source) is available, the rank range table do not display ten equally sized rank ranges. The value in the table below represents the sum of site proximity weights for each census tract.

Max Value	Max Percentile	Min Rank	Max Rank
0	0	0	1
0.1	0.1	65.07	65.07
0.2	0.5	71.79	78.16
0.6	1	84.64	85.55
1.25	51.5	93.74	99.89

Permitted Minor Air Pollution Sources/Equipment/Processes

This map layer shows the geographic distribution of minor air-polluting equipment throughout Connecticut at facilities that are not considered to be major air pollution emitters. This is intended to show which communities throughout Connecticut are the most and least burdened with minor air pollution processes or industrial activities. This layer displays the concentration of minor air-polluting equipment at facilities; it does not display the concentration of actual air pollution emissions. The sources in this mapping tool were issued permits under the New Source Review (NSR) program. The NSR permit program is administered by the Engineering and Enforcement Division of the Bureau of Air Management to ensure that new and modified pollution emitting equipment meets air standards and regulations at the State and Federal level. The NSR permits are issued for individual sources of air pollution such as boilers; stationary internal combustion engines such as diesels and turbines; incinerators; rock crushing operations; chemical reactors and mixers; paint spray booths; metal degreasers; metal plating and surface treatment operations; printing operations; volatile liquid storage tanks; and other manufacturing or processing operations (CT DEEP, 2013). The NSR list used in this mapping tool was modified to exclude Title V permits of major sources of air pollution to ensure that this list only represents minor air pollution sources. It should also be noted that other registered sources of pollution, such as those that existed before the implementation of the NSR program, are not included in this map.

Indicator This indicator represents the tracts ranked by their percentile of proximity to the facilities permitted minor air pollution sources (equipment) with New Source Review permit locations. Registered equipment permitting minor air pollution can include school boilers, turbines, engines, etc.

Data Source 2021 New Source Review Permits - CT DEEP Bureau of Air Management

Method NSR permit locations spreadsheet was provided by DEEP and geocoded. From each point, double buffers were established, intersecting these buffers with the adjacent census tracts.

Buffer weights were determined based on their proximity to each site. Those within 500 meters were assigned a weight of 1, those within 500-1000 meters received a weight of 0.5, tracts within 1000-1500 meters were assigned a weight of 0.25, and a weight of 0.1 was given for tracts within 1500-2000 meters. Tracts beyond the 2000-meter radius were assigned a weight of 0, i.e., not close to the pollution source. The cumulative weight score was then computed by adding up the weights of each buffer located within each census tract.

The corresponding percentile for each census tract was designated based on these total weight scores. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. When there are a lot of census tracts with No Data (weight assigned 0, i.e. not close to the pollution source) is available, the rank range

table do not display ten equally sized rank ranges. The value in the table below represents the sum of site proximity weights for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	0.75	0	9.33	0	1
0.8	2	10.01	17.63	1	2
2	3	23.09	29.35	2	3
3.2	5.1	29.47	39.36	3	4
5.25	8.75	39.48	49.37	4	5
9	15	49.49	59.39	5	6
15	27.8	59.5	69.4	6	7
28	50.75	69.51	79.41	7	8
50.9	149.4	79.52	89.31	8	9
149.75	1188.5	89.42	99.89	9	10

Minor Facilities with Permit-limited Emissions Potential

This data layer shows the geographic distribution throughout Connecticut of facilities that are minor air pollution emitters. These facilities are regulated under a Permit by Rule under Section 22a-174 33a or Section 22a-174 33b of the Regulations of Connecticut State Agencies, which is overseen by the Engineering and Enforcement Division of the Bureau of Air Management with CT DEEP. Facilities subject to Section 22a-174 33a and 33b have the potential capacity to emit pollutants at the same level as a major source of air pollution but are only allowed up to 50% or 80% of emission levels that are allowed by facilities with Title V permits. Title V permits are considered to be major sources of air pollution. Facilities emitting minor sources of air pollution under these regulations can include: a chemical manufacturing process, an environmental testing laboratory, a source of volatile organic compounds (VOC) or hazardous air pollutants (HAP), a fuel burning combustion unit, a non-metallic mineral processing plant, a concrete plant, or an asphalt plant (Office of the Secretary of the State, 2023). This layer is a measure of the number of facilities rather than the quantity of pollution emissions.

Indicator This indicator represents the tracts ranked by their percentile of proximity to the facilities that are minor air pollution emitters. Minor facilities are regulated under the Permit-by-Rule program known as Section 22a-174 33a and Section 22a-174 33b of the Regulations of Connecticut State Agencies, which limits their pollution emission potential to a level below that of major air pollution facilities, also known as Title-V permit.

Data Source 2023 Section 22a-174 33a and 33b facilities CT DEEP Bureau of Air Management

Method The facility locations spreadsheet was provided by DEEP and geocoded. From each point, double buffers were established, intersecting these buffers with the adjacent census tracts.

Buffer weights were determined based on their proximity to each site. Those within 500 meters were assigned a weight of 1, those within 500-1000 meters received a weight of 0.5, tracts within 1000-1500 meters were assigned a weight of 0.25, and a weight of 0.1 was given for tracts within 1500-2000 meters. Tracts beyond the 2000-meter radius were assigned a weight of 0, i.e., not close to the pollution source. The cumulative weight score was then computed by adding up the weights of each buffer located within each census tract.

The corresponding percentile for each census tract was designated based on these total weight scores. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. When there are a lot of census tracts with No Data (weight assigned 0, i.e. not close to the pollution source) is available, the rank range table do not display ten equally sized rank ranges. The value in the table below represents the sum of site proximity weights for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	0	0	0	0	1
0.1	0.25	21.84	29.12	2	3
0.3	0.5	35.95	38.34	3	4
0.6	1	45.62	48.46	4	5
1.1	1.25	67.92	68.94	6	7
1.3	2.3	69.51	79.41	7	8
2.4	5	79.75	89.19	8	9
5.1	77.5	89.87	99.89	9	10

Urban Heat Index

The urban heat island (UHI) effect refers to where urban areas experience higher temperatures than their rural surroundings due to human activities (U.S. Environmental Protection Agency (EPA), 2023). It is primarily attributed to the modification of land surfaces — paved streets and buildings absorb sunlight and retain heat more than natural vegetation does — and waste heat generated from energy use. Interestingly, environmental justice concerns are intertwined with UHI. Historically marginalized and economically disadvantaged communities often reside in neighborhoods with fewer green spaces, more impervious surfaces, and less access to cooling amenities, making them more vulnerable to the adverse effects of UHIs. Urban heat islands can intensify extreme heat events and be a health hazard (Madrigano et al., 2022). In New York City, higher incidences of heat-related deaths occur in neighborhoods with high poverty and in historical neighborhoods of color (NASA, 2022.) Additionally, these populations frequently lack the resources to mitigate or adapt to extreme heat events, increasing health risks such as heat exhaustion and heat stroke. This uneven distribution of environmental benefits and burdens emphasizes the necessity of integrating equity considerations into urban planning and climate resiliency efforts. Studies have shown that increasing tree canopy, creating

green roofs, and improving urban design can not only mitigate UHI effects but also address environmental justice challenges in cities (Stone et al., 2010).

The interrelation between the urban heat island (UHI) effect and inequity reflect the broader systemic disparities present in urban planning and resource allocation. Historically, many marginalized communities, especially communities of color, have been pushed to live in areas with degraded environments due to policies like redlining and discriminatory housing practices. Such areas, now termed "heat islands," typically have fewer trees, parks, or green spaces, which are essential for providing shade and reducing ambient temperatures (Hoffman et al., 2020). As a result, residents in these neighborhoods face elevated temperatures, leading to increased energy costs, health risks, and even mortality during heatwaves. Furthermore, these communities often lack adequate infrastructure, like cooling centers, to combat these higher temperatures. The people in socioeconomically disadvantaged neighborhoods and those with higher percentages of people of color experience more significant heat-related health risks due to UHIs (Harlan et al., 2006). Addressing UHI through an environmental justice lens involves not just combating rising temperatures but also rectifying the deeply entrenched disparities in our urban environments.

Indicator — This indicator represents the tracts ranked by their percentile level of percentage of observations of Urban Heat Islands intensities, which refer to the phenomenon where cities experience higher temperatures than the surrounding rural areas.

Data Source — 2003-2018 UHI Earth Engine Data Catalog. (Chakraborty and Lee, 2019)

Method — The raster file is converted to points. Average urban heat island intensities are taken for each census tract. Th average intensities for each tract is used for percentile calculation. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. When there are a lot of census tracts with No Data (weight assigned 0, i.e. not close to the source) is available, the rank range table do not display ten equally sized rank ranges. The value in the table below represents the percent urban heat intensity average over 30-m pixel within the tract.

Max Value	Min Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0.57	1.29	0	2.2	0	1
1.32	1.32	77.26	77.26	7	8
1.35	2.19	91.93	97.31	9	10

EPA Air Toxics Screening Assessment Cancer Risk

Air Toxics are hazardous pollutants in the air that are known to cause cancer and other major health issues. Sources of exposure to air toxics can include breathing contaminated air, drinking water contaminated by air toxics, or ingesting contaminated food products that were exposed to air pollutants. Benzene from gasoline, methylene chloride from paint stripper, asbestos, and lead are a few of the air toxics identified by the EPA. The sources of emissions registered under AirToxScreen include point sources, nonpoint sources, mobile sources, fires, and biogenic emissions that occur naturally (E. Environmental Protection Agency, 2022b).

The U.S. EPA Air Toxics Screening Assessment (AirToxScreen), formerly known as the National Air Toxics Assessment (NATA,) has calculated the national cancer risk from these contaminants. The information on air contaminants provided by AirToxScreen can be utilized to estimate the overall chance of a population in an area getting diagnosed with cancer. The projected cancer risk is higher overall for urban areas compared to rural sites, with the risk exceeding 75 cases per million at seven urban sites out of 21 (Weitekamp et al., 2021). The EPA considers cancer risk to be 'concerning' if there are 100 cases per 1 million people in an area (Graham et al., 2021).

Indicator — This indicator represents the tracts ranked by their percentile level of lifetime cancer risk from inhalation of air toxics, persons per million lifetime.

Data Source — 2017 Air Toxics data Update, EPA EJSCREEN 2022

Method — The information is obtained through EPA EJSCREEN 2022 database. The census tract-based estimates are used to calculate the percentiles. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. When there are a lot of census tracts with No Data (weight assigned 0, i.e. not close to the pollution source) is available, the rank range table do not display ten equally sized rank ranges. The value in the table below represents the lifetime cancer risk from inhalation of air toxics, persons per million lifetime.

Max Value	Max Percentile	Min Rank	Max Rank
20	0	0	1
30	65.83	9	10

EPA Air Toxics Screening Assessment Respiratory Hazard Risk

Respiratory conditions and illnesses, such as sinusitis, bronchitis, pneumonia, allergic rhinitis, and asthma, can seriously impair one's ability to function. Chest discomfort, congestion, wheezing, and coughing are signs of mild or more serious illnesses. In the worst cases, chronic respiratory distress or death are potential outcomes (Environmental Protection Agency -EPA, 2015). There are several causes of respiratory health issues, but CIRCA is focused on environmental implications.

Environmental causes of respiratory disease include smoking and second-hand smoke, Particulate Matter (PM), Ozone, Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2), burning coal, and biomass fuel usage (Cortes-Ramirez et al., 2021). The results of the Respiratory Hazard Risk of the Air Toxics Screening Assessment (AirToxScreen), formally known as the National Air Toxics Assessment (NATA), serve as a good starting point when examining air toxics. AirToxScreen assists EPA and its partner air agencies in determining potential sources of these respiratory hazards (E. Environmental Protection Agency, 2022b).

Indicator — This indicator represents the tracts ranked by their percentile level of the air toxics respiratory hazard index (ratio of exposure concentration to health-based reference concentration)

Data Source — 2017 Air Toxics data Update, EPA EJSCREEN 2022

Method — The information is obtained through PLACES 2020 database. The census tract based depression estimates are used to calculate the percentiles. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. When there are a lot of census tracts with No Data (weight assigned 0, i.e. not close to the pollution source) is available, the rank range table do not display ten equally sized rank ranges. The value in the table below represents air toxics respiratory hazard index.

Max Value	Max Percentile	Min Rank	Max Rank
0.2	0	0	1
0.3	22.02	9	10

iii) Socioeconomic Factors

Socioeconomic Factor is a composite index that assesses social and economic conditions within a census tract. These indicators identify the conditions that communities face, which amplify their stress or complicate their living situations. While these social vulnerabilities don't intensify the pollution itself, they do make it more challenging for these communities to seek relief from pollution, move away from affected areas, or effectively cope with its consequences. Indicators that fall under this category are given in Table 3. There are 18 indicators in this category.

Table 3: Socioeconomic Factors Indicators

Indicator Type	Dataset Time Frame	Resolution	Dataset Source
Housing Burden	2017-2021	Tract	2017-2021 American Community Survey 5-Year Estimates

Linguistic Isolation	2017-2021	Tract	2017-2021 American Community Survey 5-Year Estimates
Poverty/Low Income	2017-2021	Tract	2017-2021 American Community Survey 5-Year Estimates
Unemployment	June 2023	Town	Connecticut Department of Labor Current Monthly Data
Race/People of Color	2017-2021	Tract	2017-2021 American Community Survey 5-Year Estimates
Educational Attainment	2017-2021	Tract	2017-2021 American Community Survey 5-Year Estimates
Median Income	2017-2021	Tract	2017-2021 American Community Survey 5-Year Estimates
Young Population	2017-2021	Tract	2017-2021 American Community Survey 5-Year Estimates
Elderly Population	2017-2021	Tract	2017-2021 American Community Survey 5-Year Estimates
Health Insurance	2017-2021	Tract	2017-2021 American Community Survey 5-Year Estimates
Mobile Home	2017-2021	Tract	2017-2021 American Community Survey 5-Year Estimates
Multi-Unit Home	2017-2021	Tract	2017-2021 American Community Survey 5-Year Estimates
Rent-Ownership Ratio	2017-2021	Tract	2017-2021 American Community Survey 5-Year Estimates
Single Parent	2017-2021	Tract	2017-2021 American Community Survey 5-Year Estimates
Food Security	2017-2021	Tract	2017-2021 American Community Survey 5-Year Estimates
Energy Burden	2020	Tract	2020 Low-Income Energy Affordability Data (LEAD)
Disability	2017-2021	Tract	2017-2021 American Community Survey 5-Year Estimates
Tree Canopy	2021	Raster	2021 MRLC Tree Canopy Cover

The Socioeconomic Factor index is calculated by taking the average of all the ranks of Table 2 indicators for each census tract. These average ranks are called scores. The corresponding scores for each census tract are normalized into percentiles and impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. The value in the table below represents scores (average indicator ranks for Socioeconomic Factor) for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
1.23	2.48	0	9.44	0	1
2.49	3.09	9.56	19.45	1	2
3.10	3.59	19.57	29.35	2	3
3.61	4.07	29.47	39.25	3	4
4.08	4.67	39.48	49.37	4	5
4.68	5.30	49.49	59.39	5	6
5.31	5.93	59.5	69.4	6	7
5.94	6.80	69.51	79.41	7	8
6.81	7.54	79.64	89.31	8	9
7.54	8.81	89.42	99.89	9	10

Educational Attainment

According to several studies, adults with higher levels of education tend to be healthier than adults with less education due to factors such as income level, health habits, social support, and access to health care. 30% of this correlation is because education leads to higher income and more stable jobs. Adults with less education tend to display a larger prevalence of smoking, unhealthy diets, and a lack of exercise. Greater economic stability showed a correlation with successful long-term relationships and social support, as well as access to health care – all of which support positive health outcomes (Zajacova and Lawrence, 2018).

Statistics available from the U.S. Census Bureau demonstrate the proportion of the population that has completed various levels of schooling. People 25 years of age and older served as the baseline for comparison. Connecticut is working toward increasing education attainment levels for residents. A report released by Miguel Cardona, commissioner of education, states that Connecticut's four-year graduation rate increased to 88.5% for the class of 2018–19 from 88.3% for the class of 2017–18 (Cardona, 2022). As of 2021, 8.9% of the United States population ages 25 and older did not have a high school diploma or equivalent (US Census Bureau, 2022).

Indicator This indicator represents the tracts ranked by their percentile level of percentage of people 25 years and older who do not have high school diplomas. Rank is calculated by the percentage of the population in each census tract aged 25 and older without a high school diploma.

Data Source 2017-2021 American Community Survey 5-Year Estimates

Method The 2015-2019 ACS 5-year estimates "EDUCATIONAL ATTAINMENT" from U.S. Census in tract resolution is geocoded.

The total number of adults is found in Table S1501_C01_006E (Estimate!!Total!!Population 25 years and over). The number of adults with no high school diploma is found by taking the sum of Table S1501_C01_007E 2 (Estimate!!Total!!Population 25 years and over!!Less than 9th grade). The percentage is calculated by the number of adults having degree less than 9th grade over total number of adults over 25 to find the percent of adults age 25 and older without a high school diploma or equivalent.

A percentile calculated for each census tract is determined by the percentage of the population aged 25 and older without a high school diploma. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data was not available or the total population is given as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max
0	0.3	0	9.47	0	1
0.31	0.68	9.7	19.29	1	2
0.7	1.14	19.75	29.45	2	3
1.15	1.7	29.79	39.38	3	4
1.71	2.44	39.5	49.43	4	5
2.47	3.37	49.89	59.36	5	6
3.38	4.45	59.59	69.41	6	7
4.48	6.43	69.63	79.34	7	8
6.47	11.03	79.45	89.38	8	9
11.28	32.07	89.61	99.89	9	10

Elderly Population

Over 575,000 people in Connecticut were 65 years of age or older in 2016, making up an estimated 16% of the state's 3.6 million citizens overall, according to the U.S. Census (Proto, 2017). Connecticut is already the seventh-oldest state in the US and is aging. One in five CT residents will be 65 or older by 2025. In response, the State Department on Aging is realigning its goals and offering crucial leadership to areas that are undergoing fast demographic change (Department of Aging & Disability Services, 2020). According to the CDC, adults aged 65 and older face higher rates of social isolation than the general population, which can potentially hinder their ability to participate in

environmental decision-making in their communities. Older populations may be more susceptible to environmental pollution due to lowered immune function. A lifetime of pollution exposures can result in accumulated oxidative stress, which can limit the body's ability to fight off disease (Mckenzie et al., 2022). Ageism, discrimination of individuals based on age, is another factor that puts older populations at risk. Ageism is prevalent in adults between age 50 to 80 (Allen et al., 2022). The CDC cites several reports indicating that ageism impairs the physical and mental health of older populations (Petery, 2021).

Indicator This indicator represents the tracts ranked by their percentile level of percentage of people 65 years and older. The percentile is determined from the percentage of people 65 years and older within each census tract.

Data Source 2017-2021 American Community Survey 5-Year Estimates

Method The 2015-2019 ACS 5-year estimates "ACS DEMOGRAPHIC AND HOUSING ESTIMATES" from U.S. Census in tract resolution is geocoded.

The total population on the tract level is found in Table DP05_0001E (Estimate!!SEX AND AGE!!Total population). The population aged 65 and older is found in Table DP05_0024E (Estimate!!SEX AND AGE!!Total population!!65 years and over). The population of 65 and older is divided by the total population to find the percentage of residents aged 65 and older.

A percentile calculated for each census tract is determined by the percentage of the population aged 65 and older. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data was not available or the total population is given as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	8.43	0	9.47	0	1
8.46	11.4	9.59	19.41	1	2
11.45	13.88	19.52	29.45	2	3
13.93	15.49	29.57	39.38	3	4
15.52	16.79	39.61	49.43	4	5
16.8	18.36	49.54	59.36	5	6
18.39	20.06	59.47	69.29	6	7
20.07	22.39	69.63	79.34	7	8
22.48	25.22	79.45	89.38	8	9
25.24	63.29	89.5	99.89	9	10

Energy Burden

Energy burden, defined as the proportion of household income spent on energy costs, disproportionately affects marginalized and low-income communities. A report from the American Council for an Energy-Efficient Economy (ACEEE) and Energy Efficiency for All (EEFA) found that low-income households, particularly those of color, spend a significantly larger fraction of their income on energy bills compared to the median (Drehobl and Ross, 2016). Factors such as energy-inefficient housing, economic disparities, and systemic inequities contribute to this elevated energy burden, further exacerbating the financial strain on these households. High energy costs can compel families to make tough choices between paying utility bills and other necessities, like food or medical care. From an environmental justice perspective, these communities often reside in areas with higher environmental risks like pollution, yet they have less capacity to invest in energy-efficient upgrades that could mitigate some of these challenges (Reames, 2016). Thus, addressing energy burden is not only an economic imperative but also a critical component of achieving environmental justice and ensuring equitable access to safe, sustainable living conditions for all.

Indicator This indicator represents tracts ranked by their percentile level of percentage of household income spent on energy costs.

Data Source 2020 Low-Income Energy Affordability Data (LEAD)

Method Energy Burden was calculated using the building energy burden percent field and that field was directly used to calculate percentile and rank. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. When there are a lot of census tracts with No Data (weight assigned 0, i.e. not close to the source) is available, the rank range table do not display ten equally sized rank ranges. In addition, an 11th category was established for instances where data was not available or the total population is given as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Ma
1	2	0	1.72	0	1
3	3	35.17	35.17	3	4
4	4	73.31	73.31	7	8
5	5	87.63	87.63	8	9
6	907	94.5	99.89	9	10

Food Insecurity

According to the USDA, food insecurity is a household-level economic and social condition of having limited or uncertain access to adequate, healthy food (United States Department of Agriculture, 2022). Food insecurity is a main social determinant of health and is associated with various adverse physical and mental health outcomes, such as type 2 diabetes, hypertension, depression, and anxiety (Hazzard et al., 2022). An emerging body of evidence suggests that food insecurity may be associated with eating disorders, which are highly concurrent with mood and anxiety disorders (Hazzard et al., 2022). The Supplemental Nutrition Assistance Program (SNAP) in the U.S. is a leader in reducing food insecurity. SNAP offers benefits to eligible low-income people and families. Compared to eligible non-participants, SNAP participants are 45% less likely to experience food insecurity (Gundersen, 2022).

The USDA reported the following groups throughout the U.S. as having higher percentages of food insecurity than the national average (10.5%): households with children; household with children with a single parent; individuals living alone; Black, non-Hispanic households; Hispanic households; and low-income households living below 185% of the federal poverty level (Proto, 2020). A survey of Connecticut residents by DataHaven and Siena College Research Institute in 2022 showed that the food insecurity rate of 17% throughout the state as a whole masks large differences by race, gender, age, income, disability, and other factors. For example, approximately 11% of white, 25% of Black, and 34% of Latino adults reported food insecurity in the past year (Abraham, 2022). Rates varied from 13% among men to 20% among women, and from 14% among adults living without children to 23% among adults living with children. More than a quarter of young adults aged 18 to 34 reported food insecurity. DataHaven's analysis indicates that food insecurity in the state has nearly doubled in 2022 (Abraham et al., 2022).

Indicator This indicator represents the tracts ranked by their percentile level of percentage of households that use Supplemental Nutrition Assistance Program (SNAP).

Data Source 2017-2021 American Community Survey 5-Year Estimates

Method The 2015-2019 ACS 5-year estimates "ACS DEMOGRAPHIC AND HOUSING ESTIMATES" from U.S. Census in tract resolution is geocoded. The total number of households on the tract level is found in S2201_C01_001E (Estimate!!Total!!Households). The households on SNAP is found in Table S2201_C03_001E (Estimate!!Households receiving food stamps/ SNAP!!Households). The household population on SNAP is divided by the total household population to find the percentage of people on SNAP.

A percentile calculated for each census tract is determined by the percentage of the households with SNAP. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data was not available or the total population is given

as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max
0	0.86	0	9.4	0	1
0.87	1.87	9.52	19.38	1	2
1.89	3.14	19.5	29.36	2	3
3.15	4.62	29.47	39.45	3	4
4.64	6.56	39.56	49.43	4	5
6.57	8.94	49.77	59.4	5	6
8.99	13.02	59.52	69.38	6	7
13.05	20.11	69.5	79.36	7	8
20.12	32.65	79.47	89.33	8	9
32.88	80.87	89.45	99.89	9	10

Housing Burden

If a household spends 30% or more of their yearly household income on housing costs, it is considered cost burdened. Housing cost burden is defined by the percentage of a household's gross monthly income spent on housing. According to the Department of Housing and Urban Development's (HUD) Worst Case Housing Needs report, households that spend 30 to 50% of their income on housing are considered cost burdened and households that spend more than half of their income on housing are severely cost burdened (Alvarez and Steffen, 2021). The 30 percent cutoff for affordability matches what assisted households are required to pay in HUD's Section 8 rental assistance programs—public housing and the housing choice voucher program (Leopold et al., 2016). Cost burdened households are more likely than other renters to sacrifice other necessities like healthy food, utilities and healthcare to pay rent, and to experience unstable housing situations like evictions. Utility, tax, mortgage, insurance, and other relevant fees for the home are all included in housing costs for homeowners. Gross rental and associated payments make up a renter's housing expenditures (CT Data Collaborative, 2019). White households represent most households in the state, and 24% of them rent their homes. In contrast, Black households and Latino households make up 10 and 12% of households, respectively, while 61% of Black households and 66% of Latino households rent (Walker et al., 2021). The unequal distribution of housing is not surprising when historical processes of discriminatory restrictions on housing availability, such as redlining, and involuntary displacement from urban renewal and gentrification, are considered (Commission on Human Rights and Opportunities, 2021; Rohstein, 2017; Woods et al., 2014).

Indicator This indicator represents the tracts ranked by their percentile level of percentage of households who spend 30% or more of their yearly household income on housing costs.

Data Source 2017-2021 American Community Survey 5-Year Estimates

Method

The 2017-2021 ACS 5-year estimates ACS SELECTED HOUSING CHARACTERISTICS. To find the target variable, expenses on housing above 30% of monthly household income, CIRCA found the sum of five categories:
Table DP04_0115E: Estimate!!SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME (SMOCAPI)!!Housing units with a mortgage (excluding units where SMOCAPI cannot be computed)!!35.0 percent or more
Table DP04_0123E: Estimate!!SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME (SMOCAPI)!!Housing unit without a mortgage (excluding units where SMOCAPI cannot be computed)!!30.0 to 34.9 percent,
Table DP04_0124E: Estimate!!SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME (SMOCAPI)!!Housing unit without a mortgage (excluding units where SMOCAPI cannot be computed)!!35.0 percent or more
Table DP04_0141E: Estimate!!GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME (GRAPI)!!Occupied units paying rent (excluding units where GRAPI cannot be computed)!!30.0 to 34.9 percent
Table DP04_0142E: Estimate!!GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME (GRAPI)!!Occupied units paying rent (excluding units where GRAPI cannot be computed)!! 35.0 percent or more. The sum of these categories were divided to DP04_0002E(Estimate!!HOUSING OCCUPANCY!!Total housing units!!Occupied housing units) to find the housing percentage.

Percentile is calculated for each census tract by determining the percentage of households who spend 30% or more of their yearly household income on housing costs. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data was not available or the total population is given as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max
0	16.67	0	9.4	0	1
16.68	20.45	9.52	19.38	1	2
20.48	23.46	19.5	29.36	2	3
23.56	26.11	29.47	39.45	3	4
26.16	29.27	39.56	49.31	4	5
29.4	32.36	49.66	59.4	5	6
32.38	36.15	59.52	69.38	6	7
36.29	41.53	69.5	79.36	7	8
41.55	48.76	79.47	89.33	8	9
48.85	71.73	89.45	99.89	9	10

Linguistic Isolation

Individuals with linguistic isolation represent a vulnerable population in society. According to the American Community Survey conducted by the U.S. Census Bureau, more than 25 million Americans (or 9% of the country's population aged five and older) had low English proficiency (LEP) in 2015. Additionally, over 20% of those LEP people lived in homes with yearly incomes that were low-income. Most American communities have seen increases in the number of immigrants and languages spoken during the past ten years (CT Department of Health, 2022). According to the Center for Disease Control, the ability to communicate in English can be an important factor in determining a community's ability to publicly participate in environmental decision-making and policies. Documents and news sources covering environmental issues are often not available in languages other than English. This hinders non-English speakers' ability to inform themselves and engage in environmental issues (Mckenzie et al., 2022), which may lead to environmental health disparities in predominantly LEP communities (Min et al., 2019a). Research shows that individuals with limited English proficiency often have poorer health than those who are English proficient (Sentell and Braun, 2012). LEP individuals have a higher percentage of social needs than those who are proficient in English and often face barriers to fulfilling these needs, such as employment, medical-legal assistance, health insurance, public benefits, health literacy, transportation, medical care, utilities, housing quality and security, and food security (Fischer et al., 2021).

Indicator This indicator represents the tracts ranked by their percentile level of percentage of limited English-speaking population over five years of age.

Data Source 2017-2021 American Community Survey 5-Year Estimates

Method The 2017-2021 ACS 5-year estimates "LANGUAGE SPOKEN AT HOME" from U.S. Census in tract resolution is geocoded. The total population is found in Table S1601_C01_001E (Estimate!!Total!!Population 5 years and over). The population that speaks English less than "very well" is found in Table S1601_C05_001E (Estimate!!Speak English less than very well"!!Percent of specified language speakers!!Population 5 years and over").

The total population over 5 years is divided by the population who cannot speak English "at least very well" to find the percent of residents who cannot speak English "very well."

A percentile calculated for each census tract is determined by the percentage of residents who cannot speak English "very well." The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data was not available or the total population is given as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	0.9	0	9.36	0	1
0.91	1.89	9.59	19.41	1	2

1.91	2.78	19.52	29.45	2	3
2.79	3.96	29.57	39.38	3	4
3.98	5.19	39.61	49.32	4	5
5.21	6.68	49.54	59.25	5	6
6.69	9.88	59.47	69.41	6	7
9.93	14.38	69.52	79.34	7	8
14.44	22.07	79.45	89.38	8	9
22.19	49.64	89.5	99.89	9	10

Median Income

Median income accounts for the income distribution within a geographic area of all households, including those with no income (Guzman, 2022). The median household income in Connecticut is $83,572. Median income varies by census tract due to socioeconomic differences. Several studies reveal an increase in income inequality between affluent and low-income populations within the past several decades in the United States (Avanceña et al., 2021; DiPasquale et al., 2021; Gastwirth, 2014). There are also links between race and ethnicity and income inequality, as well as income inequality and health. U.S. Census Bureau data from 2016-2020 indicates that the median annual earnings for those identifying as white non-Hispanic or as Asian were much higher than the median annual earnings for Connecticut residents of all other racial and ethnic identities (Wilner, 2022). Health disparities due to income inequality are made clear through several studies and show that adults with higher individual or household incomes face lower rates of all-cause mortality and have longer life expectancy than adults with lower incomes (Avanceña et al., 2021; DiPasquale et al., 2021).

Indicator This indicator represents the tracts ranked by their percentile level of median household incomes per census tract, per capita income.

Data Source 2017-2021 American Community Survey 5-Year Estimates

Method The 2017-2021 ACS 5-year estimates "ACS INCOME IN THE PAST 12 MONTHS (IN 2019 INFLATION-ADJUSTED DOLLARS)" from U.S. Census in tract resolution is geocoded. Median household income for each tract was geocoded using Table DP03_0062E (Estimate!!INCOME AND BENEFITS (IN 2021 INFLATION-ADJUSTED DOLLARS)!!Total households!!Median household income (dollars))).
The percentile is determined from the lowest to highest median household income for each census tract. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data was not available or the total population is given as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max R
250000+	156625	0	9.44	0	1
145536	125435	9.55	19.45	1	2

122063	108897	19.56	29.46	2	3
106902	96543	29.57	39.36	3	4
95278	89286	39.47	49.37	4	5
86773	78946	49.48	59.38	5	6
76420	68470	59.49	69.39	6	7
67184	56935	69.51	79.4	7	8
54502	44109	79.52	89.3	8	9
42500	19032	89.41	99.88	9	10

Mobile Homes

Mobile homes are single-family homes manufactured in a regulated factory, adhering to federal Manufactured Home Construction and Safety Standards. Single or multi-section manufactured homes are only transported to the site after construction. A key difference regarding mobile homes is that the residents rent the land while typically owning the home (Castonguay, 2022). Mobile homes are often excluded from certain neighborhoods based on zoning laws (Maantay, 2002).

Mobile homes are considered precarious housing for several reasons. They are more vulnerable to environmental damage than single-family owned houses (Cutter et al., 2003). Because mobile homeowners rent the land, they are more susceptible to displacement from landowners selling the land for more profitable land use (Hernández and Swope, 2019; Pendall et al., 2012). In addition to economic vulnerabilities, there are several potential health factors of mobile homeowners that may designate them as a vulnerable population. Studies have found that compared to older persons living in other types of housing, older people who live in mobile homes have lower levels of education, income, and health insurance. They may also have higher smoking rates, lung and heart disease, and good to poor health status (Al-Rousan et al., 2015). Mobile home residents are often more susceptible to the negative health effects of indoor air pollution, extreme heat, and unreliable access to drinking water due to inadequate construction and energy inefficiency of the home structure (Min et al., 2019b).

Indicator This indicator represents the tracts ranked by their percentile level of percentage of mobile home housing units.

Data Source 2017-2021 American Community Survey 5-Year Estimates

Method The 2017-2021 ACS 5-year estimates "SELECTED HOUSING CHARACTERISTICS" from U.S. Census in tract resolution is geocoded. The total number of housing units is found in Table DP04_0006E (Estimate!!UNITS IN STRUCTURE!!Total housing units), and the number of mobile homes is found in Table DP04_0014E (Estimate!!UNITS IN STRUCTURE!!Total housing units!!Mobile home). The number of mobile homes is divided by the total number of housing units to find the percentage of housing units considered mobile homes.

A percentile calculated for each census tract is determined by the percentage of housing units below a particular threshold within all census tracts. The percentiles are normalized

into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. The map was segmented into ten equally sized sections between the 0 and 10. When there are a lot of census tracts with No Data (weight assigned 0, i.e. not close to the pollution source) is available, the rank range table do not display ten equally sized rank ranges. In addition, an 11th category was established for instances where data was not available or the total population is given as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	0	0	0	0	1
0.53	0.53	79.36	79.36	7	8
0.54	1.75	79.59	89.33	8	9
1.8	23.85	89.45	99.89	9	10

Multi-Unit Housing

Multi-unit housing, which is considered more than two units per structure, is often created as a more affordable housing option than a single-family home. The greater economic accessibility of multi-unit housing is important for lower-income families, who are disproportionately Latinos, Black, Indigenous, and People of Color (BIPOC) in Connecticut (Open Communities Alliance, 2021). Affordable housing opportunities may ensure that families and individuals have enough income for a good quality of life, including investment in higher education, retirement, or the purchasing of a permanent home.

Planning and zoning practices often limit the development of multi-family housing in some towns, which excludes families from social services and educational resources that higher-income communities benefit from and also contributes to the affordable housing crisis in (Open Communities Alliance, 2021). These planning and zoning practices often encourage few bedrooms and enforce age-limits for multi-unit homes, both of which exclude families with children (Giffin et al., 2022). Research by the Open Communities Alliance shows there is a hyper-focus of "large-lot single-family homes" in non-Hispanic, white, high-income neighborhoods in Connecticut, where multi-unit housing is banned because it is considered out of character within residential communities.

Individuals living in multi-unit housing have a potential risk for poorer health and improperly managed environmental conditions than those living in single-family homes. The risk of eviction and the potential lack of maintenance from absentee landlords may create unstable living conditions in rental units (Pendall et al., 2012). The lack of control of the maintenance of shared spaces in multi-unit dwellings may contribute to higher rates of asthma in humans and a higher prevalence of pests than in single-family homes (Adamkiewicz et al., 2014; Mehta et al., 2018; Northridge et al., 2010).

Indicator This indicator represents the tracts ranked by their percentile level of percentage of multi-unit housing units.

Data Source 2017-2021 American Community Survey 5-Year Estimates

Method The 2017-2021 ACS 5-year estimates ACS SELECTED HOUSING CHARACTERISTICS. To compute the percentage of multi-unit homes, CIRCA used Table DP04_0006E (Estimate!!UNITS IN STRUCTURE!!Total housing units) as the total number of housing units while multi-use units are included in the following tables: DP04_0009E (Estimate!!UNITS IN STRUCTURE!!Total housing units!!2 units), DP04_0010E (Estimate!!UNITS IN STRUCTURE!!Total housing units!!3 or 4 units), DP04_0011E (Estimate!!UNITS IN STRUCTURE!!Total housing units!!5 to 9 units), DP04_0012E (Estimate!!UNITS IN STRUCTURE!!Total housing units!!10 to 19 units), DP04_0013E (Estimate!!UNITS IN STRUCTURE!!Total housing units!!20 or more units)).

The sum of values in multi-unit tables is divided by the total number of housing units to find the percent of multi-unit housing units. This same process was repeated for each census tract. The value in the table below represents the percentage of the indicator in each census tract.

The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data was not available or the total population is given as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	2.53	0	9.4	0	1
2.64	6.69	9.52	19.38	1	2
6.73	11.06	19.5	29.36	2	3
11.08	17.68	29.47	39.33	3	4
17.7	24.46	39.45	49.31	4	5
24.5	34.97	49.43	59.29	5	6
35.33	47.74	59.4	69.15	6	7
47.82	62.58	69.27	79.13	7	8
62.64	81.08	79.24	89.11	8	9
81.73	100	89.22	99.66	9	10

Population with Disability

Disability status represents an individual's physical, medical, cognitive, intellectual, or psychiatric challenges that affect their everyday life. In Connecticut, the poverty rate for people with disabilities was much higher than for people without disabilities in 2015 (Erickson et al., 2016). Working-age persons (ages 21 to 64) with disabilities had a poverty rate of 24.5%. This equates to a 16.5 percentage point difference in poverty rates between working-age people with and without impairments. In 2015, people with disabilities who worked full-time made $7,000 less than full-time workers without a disability. Individuals with disabilities face barriers to care and everyday life, which

exacerbates disparities. The WHO makes the distinction between health and disability in its International Classification of Functioning (ICF). Accordingly, individuals with disabilities are not destined for a life of poor health status by virtue of their disability; rather it is the lack of institutional support for this underserved population that contributes to their poor health outcomes, a phenomenon seen among all historically underserved populations (World Health Organization (WHO), 2022a).

Indicator This indicator represents the tracts ranked by their percentile level of percentage of the population with disability.

Data Source 2017-2021 American Community Survey 5-Year Estimates

Method The 2017-2021 ACS 5-year estimates "ACS DEMOGRAPHIC AND HOUSING ESTIMATES" from U.S. Census in tract resolution is geocoded. The total population on the tract level is found in Table S1810_C01_001E (Estimate!!Total!!Subject!!Total civilian noninstitutionalized population). The population with a disability is found in Table S1810_C03_001E (Estimate!!Percent with a disability!!Subject!!Total civilian noninstitutionalized population). The population with a disability is divided by the total population to find the percentage of people with a disability. The percentage of people with disabilities determines a percentile for each census tract.

The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data was not available or the total population is given as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	6.22	0	9.39	0	1
6.26	7.64	9.51	19.47	1	2
7.65	8.98	19.59	29.44	2	3
8.99	9.83	29.55	39.4	3	4
9.84	10.69	39.52	49.03	4	5
10.7	11.86	49.48	59.11	5	6
11.87	13.33	59.45	69.42	6	7
13.35	15.01	69.53	79.27	7	8
15.02	17.47	79.5	89.35	8	9
17.48	53.11	89.46	99.89	9	10

Populations without Health Insurance

Although Connecticut has one of the lowest rates of uninsured people in the United States, 5.9 percent of Connecticut's residents, or around 204,500 people, lacked health insurance in 2019 (Connecticut Health Foundation, 2022). In Connecticut, the highest percentage of residents without

health insurance are Latinos, people of color, and people with incomes just above the poverty level (Connecticut Health Foundation, 2022). The inherent high expense of health insurance is a barrier to health care access for low income individuals (Davila et al., 2020).

Individuals without health insurance are less likely than adults with health coverage to receive preventive and screening treatments, due to expensive appointment costs (Davila et al., 2020), making them more vulnerable to poor health outcomes (Institute of Medicine (US), 2002). According to the Institute of Medicine, "uninsured patients who are hospitalized for a range of conditions are more likely to die in the hospital, to receive fewer services, and, when admitted, are more likely to experience substandard care and resultant injury than are insured patients." (Institute of Medicine (US), 2002).

Indicator This indicator represents the tracts ranked by their percentile level of percentage of the population without health insurance.

Data Source 2017-2021 American Community Survey 5-Year Estimates

Method The 2017-2021 ACS 5-year estimates "ACS SELECTED ECONOMIC CHARACTERISTICS" from U.S. Census in tract resolution is geocoded. The total population on the tract level is found in DP03_0095E (Estimate!!HEALTH INSURANCE COVERAGE!!Civilian noninstitutionalized population). The total insured population is found in Table DP03_0099E (Estimate!!INCOME AND BENEFITS (Estimate!!HEALTH INSURANCE COVERAGE!!Civilian noninstitutionalized population!!No health insurance coverage).

The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data was not available or the total population is given as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	0.94	0	9.28	0	1
0.95	1.59	9.74	19.47	1	2
1.6	2.24	19.7	29.44	2	3
2.25	2.79	29.78	39.4	3	4
2.8	3.54	39.52	49.14	4	5
3.55	4.54	49.48	59.11	5	6
4.55	5.97	59.45	69.3	6	7
5.99	7.66	69.53	79.38	7	8
7.68	11.93	79.5	89.35	8	9
12.01	33.94	89.46	99.89	9	10

Poverty

Poverty is one of the main determinants of physical and mental health (Compton and Shim, 2015). Research shows that financially insecure individuals have higher rates of acute and chronic disease, chronic stress, depression and anxiety, food insecurity (i.e. lack of access to healthy food), nutritional deficits, and poor reproductive outcomes. The effects of poverty on people can also result in limited opportunities for housing, education, and employment (Beech et al., 2021; Davila et al., 2020).

Connecticut has one of the highest concentrations in the country of affluent, racially segregated neighborhoods and low-income, racially segregated neighborhoods (Buchanan and Abraham, 2015). According to DataHaven, "in 2018, about 10 percent of the population, or roughly 361,000 people in Connecticut, lived in poverty—the equivalent of a family of four earning less than $25,100 per year. An additional 449,000 people lived in households earning between one and two times the federal poverty limit. By race, 19 percent of Black, 23 percent of Latino, and just 6 percent of white residents lived in poverty" (Davila et al., 2020). The World Health Organization's Commission on Social Determinants of Health attributes the poor health status of individuals and communities living in poverty with an unequal distribution of power, income, products, and services throughout society (Beech et al., 2021).

Indicator This indicator represents the tracts ranked by their percentile level of percentage of the population living below 150% of the federal poverty level.

Data Source 2017-2021 American Community Survey 5-Year Estimates

Method The 2017-2021 ACS 5-year estimates "POVERTY STATUS IN THE PAST 12 MONTHS" from U.S. Census in tract resolution is geocoded. The total population is found in Table S1701_C01_001E (Estimate!!Total!!Population for whom poverty status is determined).The impoverished population is found in Table S1701_C01_040E (Estimate!!Total!!Population for whom poverty status is determined!!ALL INDIVIDUALS WITH INCOME BELOW THE FOLLOWING POVERTY RATIOS!!150 percent of poverty level). The total population considered is divided by the total impoverished population to find the percent of people in poverty.

The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data was not available or the total population is given as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	3.77	0	9.4	0	1
3.8	5.64	9.52	19.38	1	2
5.65	7.58	19.5	29.36	2	3
7.59	9.49	29.47	39.45	3	4
9.5	11.73	39.56	49.43	4	5

11.82	15.17	49.54	59.4	5	6
15.19	20.08	59.52	69.38	6	7
20.15	26.42	69.5	79.36	7	8
26.61	39.59	79.47	89.33	8	9
39.68	90.33	89.45	99.89	9	10

Race/Ethnicity

People of color and ethnic minoritized groups experience greater exposure to environmental hazards than white populations due to the location of pollution sources in historically racially and ethnically segregated communities throughout the United States (Bullard et al., 2008; Mohai et al., 2009; Mohai and Saha, 2015; University of Washington Department of Environmental & Occupational Health Sciences and Washington State Department of Health., 2022). Redlining was a practice of the 1930s for designating communities as "hazardous" for home mortgage-lending based on the prevalence of industrial exposures, low-income levels, and racial and ethnic diversity. This racist policy encouraged racial residential segregation and continues to drive environmental inequality today (Kaufman and Hajat, 2021). Research and surveys conducted on social and economic wellbeing show that 81 percent of metropolitan regions in the United States were more segregated as of 2019 than they were in 1990 (Madrigano et al., 2022). The neighborhoods that were red-lined in the past have reduced green space in present day, which several studies show is associated with racial residential segregation, urban heat islands, more noise pollution, and poorer air quality (Nardone et al., 2021).

The CDC has labeled systemic racism as a serious public health threat ("Environmental Justice Index Indicators.," 2022). Systemic racism affects the health of residents in Connecticut today. For example, a survey conducted by DataHaven found that in Connecticut 11% of white, 13% of Black, and 21% of Latino adults have asthma, a disease that is triggered by air pollution (Ofgang, 2020). As of 2020, people of color and ethnic minorities in the state had higher rates of diabetes, food insecurity, healthcare discrimination, no health insurance, obesity, opioid overdoses, and poverty than Connecticut's white populations (Davila et al., 2020). According to the U.S. Census, Connecticut has a white-alone population of 66.4%. This value has been steadily decreasing, meaning the state of Connecticut is becoming more diverse in racial demographics (Connecticut by the Numbers, 2021).

Indicator This indicator represents the tracts ranked by their percentile level of percentage of sum of all race/ethnicity categories except White/Non-Hispanics.

Data Source 2017-2021 American Community Survey 5-Year Estimates

Method The 2017-2021 ACS 5-year estimates "ACS SELECTED ECONOMIC CHARACTERISTICS" from U.S. Census in tract resolution is geocoded.
The total population on the tract level is found in Table DP05_0033E (Estimate!!RACE!!Total population). The total Non-Hispanic/white DP05_0077E Estimate!!HISPANIC OR LATINO AND RACE!!Total population!!Not Hispanic or Latino!!White alone was subtracted from the total population to find all the race groups

that are not characterized as single white race. All race except non-Hispanic/white is divided by the total population to find the sum of all racial categories.

The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data was not available or the total population is given as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
55	648	0	9.38	0	1
86	702	9.61	19.45	1	2
174	695	19.57	29.41	2	3
265	1048	29.52	39.36	3	4
282	1854	39.59	49.43	4	5
606	1877	49.54	59.38	5	6
1110	2324	59.5	69.34	6	7
1070	3487	69.45	79.41	7	8
243	5606	79.52	89.36	8	9
1146	3313	89.47	99.89	9	10

Rent Ownership Ratio

Housing security through rental units or homeownership can be affected by economic status, public policy, and/or race (Desmond, 2018). Rental units are often more vulnerable housing situations than owner-occupied units due to the potential lack of maintenance from absentee landlords and the potential for landlords to evict renters and sell the property (Pendall et al., 2012). Throughout the U.S., homeownership is a source of wealth accumulation, but homeownership is one of the biggest drivers of the racial wealth gap. Decades of redlining, discriminatory mortgage-lending practices, lack of access to credit, and lower incomes have blocked the homeownership path for African Americans while creating and reinforcing racially segregated communities (Shapiro et al., 2013).

Nearly 1.3 million of Connecticut's nearly 1.5 million housing units are inhabited. Homeowners occupy approximately two-thirds of these housing units (Reger, 2016). As of May 2022, the median home price in Connecticut was $380,500, while the average monthly cost of a rental unit was $1,582 (Van Buren, 2022). The high cost of renting and buying a home has increased economic strain for low income families by reducing the ability to save for a down payment and obtain home-ownership and therefore limiting financial resources in other areas, such as food and education costs.

Indicator This indicator represents the tracts ranked by their percentile level of percentage of number of tenants to homeowners, out of all housing units in the area.

Data Source 2017-2021 American Community Survey 5-Year Estimates

Method

The 2017-2021 ACS 5-year estimates "ACS SELECTED HOUSING CHARACTERISTICS" from U.S. Census in tract resolution is geocoded. Table DP04_0047E (Estimate!!HOUSING TENURE!!Occupied housing units!!Renter-occupied) is divided into (Estimate!!HOUSING OCCUPANCY!!Total housing units!!Occupied housing units). The number of owner-occupied units is found in Table DP04_0046E (Estimate!!HOUSING TENURE!!Occupied housing units!!Owner-occupied).

The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data was not available or the total population is given as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	6.78	0	9.44	0	1
6.88	11.18	9.55	19.45	1	2
11.22	16.92	19.56	29.46	2	3
17	25.48	29.57	39.36	3	4
25.49	35.51	39.47	49.37	4	5
35.9	52.26	49.48	59.38	5	6
52.41	83.48	59.49	69.39	6	7
84.1	142.16	69.51	79.4	7	8
144.38	317.01	79.52	89.3	8	9
321.25	5656.25	89.41	99.88	9	10

Single Parent Households

A "single-parent family" is one in which only one parent is living in the house, who is either unmarried, widowed, divorced, or married with partner not present, as classified by the U.S. Census. Single-parent households represent a vulnerable population due to greater economic strain than two-parent families (Casey and Maldonado, 2012). In the U.S., 31% of single-parent households report struggling to afford food at times, compared with 19% of two-parent households (Stutzman and Mendes, 2013).

Single parents' disadvantaged economic position has shown to correlate with a lack of wellbeing. Compared to parents living as couples, single parents report poorer health, and single parent women report worse health overall than single parent men (Benzeval, 1998). Single parent homes often have a lack of financial resources, parental involvement, and social resources, which may impair children's academic performance at school (de Lange et al., 2014). Children from single parent households have shown poorer physical and mental health than those from coupled parents, potentially due to the stress of financial insecurity or living near harmful environmental conditions (Scharte and Bolte, 2013).

Indicator This indicator represents the tracts ranked by their percentile level of percentage of the population in single parent homes.

Data Source 2017-2021 American Community Survey 5-Year Estimates

Method The 2017-2021 ACS 5-year estimates "ACS SELECTED HOUS ING CHARACTERISTICS" from U.S. Census in tract resolution is geocoded.
The sum of S1101_C03_001E (Estimate!!Male householder, no spouse present, family household!!HOUSEHOLDS!!Total households) and S1101_C04_001E (Estimate!!Female householder, no spouse present, family household!!HOUSEHOLDS!!Total households) is divided into S1101_C01_001E (Estimate!!Total!!HOUSEHOLDS!!Total households).

The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data was not available or the total population is given as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max
0	6.78	0	9.29	0	1
6.8	8.93	9.52	19.38	1	2
8.94	10.96	19.61	29.36	2	3
10.98	12.9	29.59	39.33	3	4
12.91	14.91	39.56	49.43	4	5
14.93	17.06	49.54	59.4	5	6
17.08	20.1	59.52	69.38	6	7
20.16	24.93	69.5	79.36	7	8
24.99	33.82	79.47	89.33	8	9
33.86	93.99	89.45	99.89	9	10

Unemployment Rates

Unemployed individuals are a vulnerable population due to several factors. According to America's Health Ranking from the United Health Foundation and the Center for Disease Control, there is a strong relationship between unemployment and poor physical and mental health (Athar et al., 2013). Unemployment is associated with a higher risk of all-cause mortality (Roelfs et al., 2011), especially among adults ages 18-24 (Davila et al., 2010). The United States has experienced an alarming increase in suicide rates, opioid/other drug abuse, alcohol abuse, and poorer physical and mental health (Case and Deaton, 2015), which can be traced in part to unemployment, underemployment, and the quality of working lives (McGee and Thompson, 2015).

Census Bureau data shows that young people (age 20-29), workers with fewer years of education, and workers of color are more likely to apply for unemployment benefits than other groups (CT Data Collaborative, 2020). The lack of skills and opportunities and an increase in hopelessness

and despair have led to a drastic increase in mortality arising in middle-age, white Americans (Case, 2015) and increased depression in young adults (McGee and Thompson, 2015). The Covid-19 Pandemic has had an impact on many socioeconomic factors, including loss of employment leading to poor health outcomes, food insecurity and housing instability (Davila et al., 2020). In 2019, the unemployment rate was 3.7% (CT Department of Labor Communications, 2021).The number of unemployed residents in Connecticut collectively was 8.1% for the year 2020, which was heavily influenced by the coronavirus pandemic (CT Department of Labor Communications, 2021).

Indicator This indicator represents the towns ranked by their percentile level of unemployment rate of people eligible for the labor force excluding retirees, students, homemakers, institutionalized persons except for prisoners, those not looking for work, and military personnel on active duty.

Data Source Connecticut Department of Labor Data, 2022 average

Method The average unemployment rate for 2022 is considered for percentile and rank calculations. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data was not available or the total population is given as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
2.5	3.1	0	5.92	0	1
3.2	3.3	11.24	15.38	1	2
3.4	3.5	20.12	28.99	2	3
3.6	3.6	33.73	33.73	3	4
3.7	3.7	44.97	44.97	4	5
3.8	3.8	56.8	56.8	5	6
3.9	4	62.72	68.05	6	7
4.1	4.3	71.6	78.11	7	8
4.4	4.7	82.25	88.76	8	9
4.8	6.5	91.12	99.41	9	10

Lack of Tree Canopy

The lack of tree canopy in urban areas presents a crucial environmental justice issue, with profound implications for historically marginalized communities. neighborhoods with lower socioeconomic status and higher percentages of minority residents were less likely to have urban tree canopy cover, thereby being more exposed to heat and air pollution (Pham et al., 2020). This lack of tree canopy becomes not just an environmental disparity but also a pressing public health concern. Tree canopy act as natural air filters, reducing harmful pollutants in the air; offer shade, helping to combat the urban heat island effect; and provide critical green spaces that are instrumental for both

mental and physical health. tree canopies play an essential role in reducing air pollution by absorbing pollutants, which means areas with fewer trees might have worse air quality (Nowak et al., 2014).

Indicator This indicator represents the tracts ranked by their percentile level of average percentage of tree canopy estimates.

Data Source 2021 MRLC Tree Canopy Cover

Method The raster file is converted to points. Average tree canopy coverage are taken for each census tract. Th average tree canopy coverage for each tract is used for percentile calculation. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. The value in the table below represents average tree canopy per 30m pixel within the census tracts..

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
74.43	67.67	0	9.44	0	1
66.81	62.55	9.56	19.45	1	2
61.99	56.07	19.57	29.35	2	3
54.91	50.05	29.47	39.36	3	4
48.89	43.96	39.48	49.37	4	5
43.18	39.28	49.49	59.39	5	6
38.43	33.58	59.5	69.4	6	7
32.12	26.07	69.51	79.41	7	8
24.57	17.44	79.52	89.31	8	9
15.33	3.30	89.42	99.89	9	10

Young Population

Children and newborns are particularly susceptible to pollution and other environmental variables that could have a major negative impact on their health. The EPA estimates that air pollution contributes to 600,000 deaths worldwide in children under 5 years old. Children are more at risk because they consume more food, liquids, and air per pound than adults do for their size. Additionally, children's protective biological systems are still developing, such as those that process chemicals in the body and filter contaminants from the air we breathe. Environmental pollutants may interfere with normal biological processes during periods of rapid growth and development in children (United States Environmental Protection Agency, 2017)

Indicator This indicator represents the tracts ranked by their percentile level of percentage of people 5 years and younger.

Data Source 2017-2021 American Community Survey 5-Year Estimates

Method The 2017-2021 ACS 5-year estimates "ACS DEMOGRAPHIC AND HOUSING ESTIMATES" from U.S. Census in tract resolution is geocoded.

The total population on the tract level is found in Table DP05_0001E (Estimate!!SEX AND AGE!!Total population) The population under age five is found in Table DP05_0005E (Estimate!!SEX AND AGE!!Total population!!Under 5 years). The population of residents under age five is divided by the total population to find the percentage of residents under age five.

The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data was not available or the total population is given as zero. The value in the table below represents the percentage of the indicator in each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	2.15	0	9.47	0	1
2.17	2.83	9.59	19.29	1	2
2.84	3.4	19.52	29.45	2	3
3.42	3.99	29.57	39.38	3	4
4	4.54	39.61	49.43	4	5
4.55	5.19	49.66	59.25	5	6
5.2	6.1	59.47	69.18	6	7
6.12	6.91	69.52	79.34	7	8
6.92	8.39	79.45	89.38	8	9
8.43	20.33	89.5	99.89	9	10

iv) Health Sensitivity

Health Sensitivity is a component index representing the people with weakened physical conditions who are therefore more susceptible to pollutants due to their biological susceptibility. Unequal distribution of environmental hazards can have serious consequences, including higher disease rates, disparities in certain medical conditions or disabilities, and premature death. Indicators that fall under this category are given in Table 4. There are eight indicators in this category.

Table 4: Health Sensitivity Indicators

Indicator Type	Data updated	Resolution	Dataset Source
Asthma ED Visits	2015-2019	Town	DPH - Connecticut Inpatient Hospitalization and Emergency Department Visit Dataset
Coronary Heart Disease	2021	Tract	PLACES – Center for Disease Control and Prevention

Chronic Lung Disease (COPD) ED visits	2013-2017	Town	Connecticut State Department of Public Health COPD Health Viewer
Childhood Elevated Lead Levels	2020	Town	DPH
Depression	2020	Tract	PLACES – Center for Disease Control and Prevention
Diabetes	2021	Tract	PLACES – Center for Disease Control and Prevention
Mental Health	2021	Tract	PLACES – Center for Disease Control and Prevention
Low Birth Weight Rate Infants	2016-2020	Town	CT DPH Health Statistics and Surveillance Section, Births Dataset

The Health Sensitivity index is calculated by taking the average of all the ranks of Table 2 indicators for each census tract. These average ranks are called scores. The corresponding scores for each census tract are normalized into percentiles and impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. The value in the table below represents scores (average indicator ranks for Health Sensitivity) for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0.57	2.20	0	9.44	0	1
2.23	3.40	9.56	19.34	1	2
3.43	4.00	19.68	29.12	2	3
4.00	4.68	29.47	39.36	3	4
4.69	5.36	39.48	49.26	4	5
5.36	6.05	49.49	59.39	5	6
6.05	6.84	59.73	69.4	6	7
6.86	7.60	69.51	79.41	7	8
7.60	8.39	79.52	89.19	8	9
8.39	9.51	89.42	99.89	9	10

Asthma Emergency Dept. Visit Rate

The data in this layer summarizes the average age-adjusted rates of asthma as the primary diagnosis for emergency department visits by the town of residence in Connecticut. Asthma is a

serious, chronic disease that causes inflammation and constriction of the airways and makes breathing difficult. Irritants like cigarette smoke, air pollution, infections, and stress can trigger asthma. People with asthma can experience wheezing, coughing, shortness of breath, chest tightness, and airway inflammation, and even though the symptoms can be managed, there is no cure for acute conditions. Research also shows that children exposed to outdoor ozone and coarse particulate matter (PM10-2.5) were more likely to develop asthma (Hernandez et al., 2019; Keet et al., 2018). Asthma makes people susceptible by increasing their vulnerability to pollutants. Connecticut was among the top 12 states with the highest percentage of adults with asthma in 2019 (see adult asthma data across states). The Connecticut Asthma Program includes recent information and statistics related to the state.

The data presented here is age-adjusted asthma as the primary diagnosis for emergency department visits during 2015-2019, sorted by town. Any rate lower than 20 is considered unstable.

Indicator The decile rank of age-adjusted asthma as the primary diagnosis for emergency department visits during 2015-2019, sorted by town. Rate estimates per 10,000 population.

Data Source Connecticut State Department of Public Health Asthma Program Statistics.

Method The input data has a town resolution and was provided by the Connecticut DPH as a .csv file. The mortality rate information was geocoded to compute the 1-10 Decile rank scale. The map is divided into ten specific thresholds ranging between the 1 and 10. In addition, an 11th category was established for instances where data not available or unreliable. The value in the table below represents the age adjusted rate.

Decile	Value	Rate Range
1	11.1	5.5-11.0
2	16.1	11.1-15.9
3	19.1	16.0-18.9
4	21.7	19.0-21.6
5	25.9	21.7-25.5
6	31.3	25.6-30.9
7	41.0	31.0-40.1
8	54.4	40.2-53.2
9	69.7	53.3-69.6
10	200.7	69.7-200.7

Coronary Heart Disease

EPA-funded MESA Air Study indicates a clear relationship between air pollution and atherosclerosis, an accumulation of plaque in the coronary artery that can compromise heart health, which makes it an important component for environmental justice screening. Research consistently indicates that marginalized communities, particularly those of lower socioeconomic status and racial or ethnic minorities, face higher exposure to environmental pollutants known to exacerbate or contribute to Coronary Heart Disease (CHD), such as fine particulate matter (PM2.5) (Brook et al.,

2010). These communities often reside closer to sources of pollution, such as highways, factories, or industrial zones, and are therefore subjected to higher levels of harmful pollutants (Morello-Frosch et al., 110AD). Furthermore, they may have limited access to healthcare, healthy food options, and opportunities for physical activity, compounding their risk (Brulle and Pellow, 2006). The cumulative burden of these social determinants, coupled with environmental exposures, escalates their vulnerability to diseases like CHD. Addressing the intertwined challenges of environmental pollution and CHD within the lens of environmental justice is essential to ensure equitable health outcomes for all communities.

Indicator This indicator represents the tracts ranked by their percentile level of annual prevalence (percentage) age-adjusted rate of adults aged 18 and older who report having been told by a doctor, nurse, or other health professional that they had coronary heart disease.

Data Source 2020 PLACES – Center for Disease Control and Prevention, Behavioral Risk Factor Surveillance System (BRFSS).

Method The information is obtained through PLACES 2020 database. The data is a shape file based on 2010 census tracts. The shape file is spatial joined with 2020 census tracts, assigning the same value for the new 2020 tracts that share the same geographical areas. The census tract-based percent estimates are used to calculate the percentiles. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data not available or unreliable. The value in the table below represents the age adjusted rate.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	4.1	0	8.2	0	1
4.2	4.5	10.13	18.46	1	2
4.6	4.7	21.83	25.81	2	3
4.8	5	30.16	38.12	3	4
5.1	5.2	41.86	47.41	4	5
5.3	5.5	51.51	57.78	5	6
5.6	5.7	62.36	66.47	6	7
5.8	6.1	69.6	78.05	7	8
6.2	6.5	81.54	88.78	8	9
6.6	13.1	90.23	99.88	9	10

Emergency Department Visits for Chronic Lung Disease

Chronic Obstructive Pulmonary Disease (COPD) is a lung disease that includes two main conditions: emphysema and chronic bronchitis. In 2014, one in twenty Connecticut adults had been told they had COPD (*Chronic obstructive pulmonary disease (COPD)*, 2014). Long-term exposure to air

pollution was associated with an increased risk of COPD, especially in those with high genetic risk and unfavorable lifestyle (Wang et al., 2022). The most common non-occupational outdoor exposures are particulate matter (PM10 & PM2.5), ozone, and sulfur dioxide from automobiles and industrial sources (see CT DPH COPD). Communities characterized by lower socioeconomic statuses, particularly racial and ethnic minorities, are disproportionately located near industrial sites, highways, and other sources of air pollution (Gwynn and Thurston, 2019). Exposure to pollutants like particulate matter (PM2.5), ozone, and nitrogen dioxide has been linked to both the onset and exacerbation of lung conditions (Rice et al., 2019). Moreover, these communities often lack adequate healthcare resources, leading to delayed diagnoses and limited treatment options (Hardy et al., 2017). The compounding of these environmental and health disparities exemplifies the intertwined challenges faced by marginalized communities and underscores the need for inclusive policy interventions.

Indicator The percentile range for each census tract for average age-adjusted Chronic Obstructive Pulmonary Disease as the primary diagnosis for emergency department visits per 10,000 people over the age of 25 during 2013-2017.

Data Source Connecticut State Department of Public Health COPD Health Viewer

Method The input data has a town resolution and was provided by the Connecticut DPH as a .csv file. The COPD emergency department rate information was geocoded and used to present deciles. 1-10 Decile rank scale. The map is divided into ten specific thresholds ranging between the 1 and 10. In addition, an 11th category was established for instances where data not available or unreliable. The value in the table below represents the age adjusted rate.

Decile	Value	Range
1	8.1	3.9-8.0
2	9.4	8.1-9.3
3	10.3	9.4-10.2
4	11.3	10.3-11.2
5	12.5	11.3-12.4
6	13.5	12.5-13.4
7	14.2	13.5-14.1
8	15.3	14.2-15.2
9	20.9	15.3-20.8
10	22.2	20.9-22.2

Childhood Elevated Blood Lead Levels

Childhood lead poisoning is the most common pediatric public health problem, yet it is entirely preventable. Once a child has been poisoned, the impairment it may cause is irreversible. Lead can harm a child's nervous system and is associated with reduced IQ, behavioral problems and learning disabilities. No amount of lead is safe for the body.

Marginalized communities, particularly low-income and minority populations, are more frequently housed in older, poorly-maintained residences which are more likely to contain lead-based paint, a primary source of childhood lead poisoning (Jacobs et al., 2002). In addition to housing

disparities, these neighborhoods often overlap with areas that once had a high concentration of industries releasing lead into the environment, leading to contaminated soil (Mielke and Reagan, 1998).

Connecticut Statute mandates that all children be screened for lead poisoning annually between the ages of 9 and 35 months. Laboratories and health care providers are required to report all blood lead tests of children to the CT Department of Public Health. Children with a blood lead level equal to or greater than 3.5 micrograms per deciliter (µg/dL) of blood are considered to have an elevated blood lead level. Children are primarily exposed to lead by ingesting lead paint chips or breathing in lead dust. Children younger than 6 years are more likely to be exposed to lead dust due to their frequent hand to mouth behavior. Children may ingest lead dust by putting objects such as toys and dirt in their mouth. Because of their developing nervous system, children are vulnerable to the effects of lead exposure since lead is easily absorbed in their nervous system.

In 2020, 61,723 children under the age of 6 were tested for lead poisoning. Of these children, 1,024 had an elevated blood lead level of 5 µg/dL and higher.

In October 2021, the CDC reduced the recommended blood lead reference value (BLRV) to ≥ 3.5 µg/dL (see CDC Childhood Lead Poisoning Prevention). Connecticut adopted the reduced BLRV of 3.5 µg/dL in January 2023.

The data represented shows the total number of children tested for lead poisoning by town between 2016 and 2020. Rates are then calculated based on the total number of individual children that had an elevated blood lead level 5 µg/dL and higher greater out of the total number of children tested for lead poisoning. Towns were ranked with a decile from 1 to 10. The towns with a higher decile have a larger volume percent of lead poisoned children based on the reported data. Towns that had fewer than 11 children with elevated blood lead levels were omitted due to confidentiality concerns.

Indicator The decile of rate children tested for lead poisoning by town between 2016 and 2020 blood lead levels ≥5mcg/dL and above under six years old.

Data Source Connecticut State Department of Public Health Childhood Lead Poisoning Surveillance Report

Method

The input data has a town resolution and was provided by the Connecticut DPH as a .csv file. The total number of children's blood levels higher than 5 mcg/dL that gives prevalence rate percentages, and its corresponding deciles are presented in1-10 rank scale. The map is divided into ten equal specific thresholds ranging between the 1 and 10. In addition, an 11th category was established for instances where data not available or unreliable.

Decile	Value	Range
1	0.71	0.0-0.70
2	0.87	0.71-0.86
3	1.35	0.87-1.34
4	1.48	1.35-1.47
5	1.92	1.48-1.91

6	2.4	1.92-2.39
7	2.83	2.40-2.82
8	3.59	2.83-3.58
9	4.64	3.59-4.63
10	6.7	4.64-6.70

Depression Rates

Depression, also known as depressive disorder, is a common mental disorder that involves a depressed mood (feeling sad, irritable, empty) or a loss of interest in activities for long periods of time. Depression is characterized by a depressive episode where these feelings last every day for at least two weeks. According to the CDC, depression is a major cause of disability. People who have lived through abuse, chronic disease, major medical conditions, severe losses, or other stressful events are more likely to develop depression (Centers for Disease Control and Prevention (CDC)., 2021a; World Health Organization (WHO), 2023). Depression can lead to problems with self-care, relationships, school, and work, as well as more stress and dysfunction, which can worsen depression itself (World Health Organization (WHO), 2023). Depression is also linked to unconventional and mass oil and gas production, which creates a neighborhood scale stressor and contribute to environmental injustice (Malin, 2020). Harmful environmental exposures such as pollutants, inadequate housing, and limited access to green spaces have been associated with increased rates of depressive symptoms (Triguero-Mas et al., 2015). Marginalized communities often face systemic disparities in access to mental health care, exacerbating the severity and duration of depressive episodes (Chow et al., 2003).

This indicator maps the geographic distribution of adults aged 18 and older who reported having been told by a doctor, nurse, or other health professional that they had depressive disorder (including depression, major depression, dysthymia, or minor depression). This data is from a survey conducted by the Behavioral Risk Factor Surveillance System (BRFSS) (Centers for Disease Control and Prevention (CDC)., 2021a). The BRFSS is the United States' system of health-related telephone surveys that collect state data about U.S. residents regarding their health-related risk behaviors, chronic health conditions, and use of preventive services (Center for Disease Control and Prevention, 2023).

Indicator This indicator represents the tracts ranked by their percentile level of annual prevalence (percentage) age-adjusted rate of adults aged 18 and older who report having been told by a doctor, nurse, or other health professional that they had depressive disorder.

Data Source 2020 PLACES – Center for Disease Control and Prevention, Behavioral Risk Factor Surveillance System (BRFSS).

Method The information is obtained through PLACES 2020 database. The data is a shape file based on 2010 census tracts. The shape file is spatial joined with 2020 census tracts, assigning the same value for the new 2020 tracts that share the same geographical areas. The census tract-based percent estimates are used to calculate the percentiles. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the

0 and 10. In addition, an 11th category was established for instances where data not available or unreliable. The value in the table below represents the age adjusted rate.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	17.2	0	8.93	0	1
17.3	18.1	9.77	17.97	1	2
18.2	19.3	19.78	28.95	2	3
19.4	20.3	30.52	39.45	3	4
20.4	21	40.53	49.1	4	5
21.1	21.7	50.78	58.99	5	6
21.8	22.3	60.68	67.91	6	7
22.4	23	69.84	78.17	7	8
23.1	24.2	79.73	89.02	8	9
24.3	39.5	89.51	99.88	9	10

Diabetes

Diabetes, particularly type 2 diabetes, is a multifaceted health issue that intersects with environmental justice concerns. Studies have highlighted that marginalized communities, especially those of lower socioeconomic backgrounds and racial or ethnic minorities, are more susceptible to environments that promote diabetes. Such communities frequently encounter "food deserts," areas where access to affordable and nutritious food is limited, increasing their reliance on unhealthy food options (Walker et al., 2010). Furthermore, these communities often reside in areas with limited safe spaces for physical activity, amplifying sedentary behaviors. Moreover, there's emerging evidence linking environmental pollutants, often concentrated in disadvantaged neighborhoods, with heightened diabetes risk. For instance, exposure to fine particulate matter (PM2.5) and other pollutants can induce inflammation, insulin resistance, and other metabolic dysfunctions leading to diabetes (Rajagopalan and Brook, 2012). This confluence of unfavorable environmental conditions and exposure, compounded by limited healthcare access, places disadvantaged groups at a heightened risk of diabetes, underlining the environmental justice implications.

Indicator This indicator represents the tracts ranked by their percentile level of annual prevalence (percentage) age-adjusted rate of adults aged 18 and older who report having been told by a doctor, nurse, or other health professional that they had diabetes.

Data Source 2020 PLACES – Center for Disease Control and Prevention, Behavioral Risk Factor Surveillance System (BRFSS).

Method The information is obtained through PLACES 2020 database. The data is a shape file based on 2010 census tracts. The shape file is spatial joined with 2020 census tracts, assigning the same value for the new 2020 tracts that share the same geographical areas. The census tract-based percent estimates are used to calculate the percentiles. The percentiles are normalized into impact rank scores between 0

(least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data not available or unreliable. The value in the table below represents the age adjusted rate.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	6.9	0	8.81	0	1
7	7.6	9.89	19.06	1	2
7.7	8.1	21.47	28.71	2	3
8.2	8.6	31	39.45	3	4
8.7	9	40.89	47.17	4	5
9.1	9.5	49.94	59.23	5	6
9.6	10	61.64	68.52	6	7
10.1	11.1	70.21	79.13	7	8
11.2	13.3	79.73	89.14	8	9
13.4	26.9	89.51	99.88	9	10

Low Birthweight Rate of Infants

Infants who weigh less than 2,500 grams at delivery are classified as low birthweight (LBW). LBW results from the abnormally slow growth of the fetus during pregnancy or from preterm delivery (before 37 weeks), depriving the infant of additional time for growth. Most LBW births in Connecticut are due to preterm birth.

Singleton LBW refers to the percentage of LBW births among single-infant deliveries only. Higher-order pregnancies (twins, triplets, etc.) have a higher risk of LBW due to the shared fetal environment (Martin et al., 2019). The Singleton LBW rate, instead of the overall LBW rate, allows for surveillance of LBW rates over time or across populations without the need to adjust for varying levels of higher-order pregnancies (Martin et al., 2019).

For 2016-2020, the Connecticut LBW rate was 7.8% and the singleton LBW rate was 6.0%. Connecticut's singleton LBW rate remained lower than the national rate from 2005-2020; however, within Connecticut, non-Hispanic Black and Puerto Rican singletons are twice as likely to be born LBW than non-Hispanic white singletons in 2010-2014 (Backus et al., 2022; Hayes et al., 2021) . Towns with rates based on 1-10 LBW births less than 10 are not shown for rate instability and data confidentiality.

Indicator The data presented in this indicator is decile ranks of 2016-2020 rates of singleton low birthweight (<2,500g), by town

Data Source CT DPH Health Statistics and Surveillance Section, Births Dataset

Method

The input data has a town resolution and was provided by the Connecticut DPH as a .csv file. The mortality rate information was geocoded to compute the 1-10 Decile rank scale. The map is divided into ten specific thresholds ranging between the 1 and 10. In addition, an 11th category was established for instances where data not available or unreliable. The value in the table below represents the age adjusted rate. The value in the table below represents the percent LBW.

The state of Connecticut values are

% Rate	5.99
Standard Error	0.06
95% of lower Confidence interval	5.87
95% of upper Confidence interval	6.10

Decile of Percent LBW	Minimum Percent LBW	Maximum Percent LBW
1	2.59	3.54
2	3.58	4.17
3	4.19	4.39
4	4.41	4.7
5	4.72	5.06
6	5.1	5.4
7	5.49	5.94
8	6	6.62
9	6.78	7.55
10	7.78	9.18

Poor Mental Health

Mental health is defined as a person's emotional, psychological, and social well-being. A person's state of mental health affects how they think, feel, act, and respond to stress (Center for Disease Control and Prevention, 2021). Mental health is essential for overall health. Poor mental health can impact people's ability to care for themselves, make decisions, build relationships, learn well, work well, and contribute to their community. Exposure to adverse social, economic, and environmental circumstances – including poverty, violence, inequality, and environmental deprivation – increases people's risk of experiencing mental health conditions (World Health Organization (WHO), 2022b). Although the terms are often used interchangeably, poor mental health and mental illness are not the same. A person can experience poor mental health and not be diagnosed with a mental illness. Likewise, a person diagnosed with a mental illness can experience periods of physical,

mental, and social well-being (Centers for Disease Control and Prevention (CDC)., 2021b). Using time-series data on individuals' exposure to air pollution lowers hedonic happiness and raises the prevalence of depressive symptoms (Zhang et al., 2017). Communities also often confront systemic socio-economic challenges, including inadequate access to healthcare, unemployment, and housing instability, which further strain mental well-being (Downey and Van Willigen, 2005).

This indicator maps the geographic distribution of adults aged 18 and older who self-reported 14 or more days during the past 30 days during which their mental health was not good. This data is from a survey conducted by the Behavioral Risk Factor Surveillance System (BRFSS) (Center for Disease Control and Prevention, 2023). The BRFSS is the United States' system of health-related telephone surveys that collect state data about U.S. residents regarding their health-related risk behaviors, chronic health conditions, and use of preventive services (Center for Disease Control and Prevention, 2023).

Indicator

This indicator represents the tracts ranked by their percentile level of annual prevalence (percentage) age-adjusted rate of adults aged 18 and older who report having been told by a doctor, nurse, or other health professional that they had poor mental health over 14 days or more days during the past 30 days during which their mental health was not good.

Data Source

2020 PLACES – Center for Disease Control and Prevention, Behavioral Risk Factor Surveillance System (BRFSS).

Method

The information is obtained through PLACES 2020 database. The data is a shape file based on 2010 census tracts. The shape file is spatial joined with 2020 census tracts, assigning the same value for the new 2020 tracts that share the same geographical areas. The census tract-based percent estimates are used to calculate the percentiles. The percentiles are normalized into impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally-sized sections between the 0 and 10. In addition, an 11th category was established for instances where data not available or unreliable. The value in the table below represents the age adjusted rate.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	11	0	9.05	0	1
11.1	12	9.65	18.58	1	2
12.1	12.7	19.66	28.11	2	3
12.8	13.4	29.67	37.88	3	4
13.5	14.1	39.81	49.34	4	5
14.2	14.7	51.51	58.38	5	6
14.8	15.7	59.95	69.24	6	7
15.8	17	70.81	79.01	7	8
17.1	19.4	79.73	89.38	8	9
19.5	39.5	89.75	99.88	9	10

Cumulative Indices

i) Pollution Burden

The Pollution Burden represents the potential cumulative exposure to pollutants and adverse environmental conditions. Marginalized communities may be disproportionately affected by pollution for a variety of reasons. These communities are often more likely to be located near sources of pollution, such as vehicular sources of air pollution, waste, and industrial facilities. They may have less ability to advocate for changes to reduce these risks. Addressing the pollution burden experienced by communities is an essential part of environmental justice. It entails working to lessen the unequal distribution of pollution and enhance the health and well-being of these communities. The Pollution Burden index is a combination of the Potential Pollution Sources and Potential Pollution Exposures indices.

The Pollution Burden index is calculated by taking the weighted average of the ranks of Potential Pollution Sources and Potential Pollution Exposures component indices for each census tract (Equation 3). These average ranks are called scores. The corresponding scores for each census tract are normalized into percentiles and impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. The value in the table below represents scores (average ranks for Pollution Burden) for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0.77	2.38	0	9.44	0	1
2.38	2.94	9.56	19.45	1	2
2.95	3.40	19.57	29.35	2	3
3.40	3.89	29.47	39.36	3	4
3.90	4.32	39.48	49.37	4	5
4.33	4.76	49.49	59.39	5	6
4.77	5.21	59.5	69.4	6	7
5.22	5.71	69.51	79.41	7	8
5.71	6.18	79.52	89.31	8	9
6.19	8.67	89.42	99.89	9	10

ii) Sensitive Populations

This composite index refers to a community's demographic, health, and socio-economic characteristics that may affect its vulnerability to environmental hazards. This index reflects biological and societal elements that can increase the susceptibility of a community to environmental conditions. pre-existing health conditions prevalent in these communities, often resulting from socioeconomic adversities, can be exacerbated by environmental stressors, thereby making them more sensitive to pollutants and other environmental threats. Consequently, the intricate relationship between socioeconomic factors, health susceptibilities, and environmental exposures magnifies the need for

environmental justice, ensuring that all communities, regardless of their economic or social status, have the right to a healthy living environment. The Sensitive Populations index is a combination of the Socioeconomic Factors and Health Sensitivity indices.

The Sensitive Populations index is calculated by taking the weighted average of the ranks of Socioeconomic Factors and Health Sensitivity component indices for each census tract (Equation 4). These average ranks are called scores. The corresponding scores for each census tract are normalized into percentiles and impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. The value in the table below represents scores (average ranks for Sensitive Populations) for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0.05	1.2	0	9.1	0	1
1.2	2.2	9.56	19.34	1	2
2.25	3.25	19.8	29.24	2	3
3.3	4.15	30.15	39.36	3	4
4.15	4.95	39.48	49.37	4	5
5	5.65	49.83	59.39	5	6
5.7	6.6	59.95	69.28	6	7
6.65	7.75	70.31	79.29	7	8
7.8	8.85	79.52	89.31	8	9
8.85	9.95	89.53	99.89	9	10

iii) Environmental Justice Index

The Environmental Justice (EJ) Index is a cumulative index developed to identify possible environmental justice problem areas. This index is a combination of the Pollution Burden and Sensitive Population composite indices, and considers a variety of information to present an all-encompassing picture of the environmental justice issues that may arise in a particular census tract. This index serves as a tool for identifying places that, depending on the combined effects of pollution burden and sensitive populations, may experience higher degrees of environmental injustice. However, it should not be seen as a conclusive measurement of environmental justice; rather, it should be regarded as a tool to lead future inquiry and action.

The Environmental Justice index is calculated by multiplying Pollution Burden and Sensitive Populations composite indices for each census tract (Equation 5). These multiplied ranks are called scores. The corresponding scores for each census tract are normalized into percentiles and impact rank scores between 0 (least impacted) to 10 (most impacted). The map was segmented into ten equally sized sections between the 0 and 10. The value in the table below represents scores for each census tract.

Min Value	Max Value	Min Percentile	Max Percentile	Min Rank	Max Rank
0	1.26	0	9.44	0	1
1.3	3.69	9.67	19.45	1	2
3.72	7.31	19.57	29.35	2	3
7.36	12.95	29.47	39.36	3	4
12.96	21.06	39.48	49.37	4	5
21.08	29.68	49.49	59.39	5	6
29.76	39.95	59.5	69.4	6	7
39.99	52.5	69.51	79.41	7	8
52.8	67.76	79.52	89.31	8	9
68.06	97.02	89.42	99.89	9	10

Context Layers

Context layers refers to a data layer that provides background or supplementary information to help interpret or understand the primary data of interest. Context layers do not contribute directly to the EJ analysis but give the user a broader understanding of the surrounding environment, factors, or conditions related to the main data.

Context layers are divided into subcategories called: Boundaries, Flood/Water Impairments, Other Tool Indices and Other CT EJScreen layers that are not used in composite index calculations. The list of the content layers in version 2.0 are given in Table 5.

Table 5: Content Layers

i) Boundaries

Content Layer	Year	Resolution	Description	Dataset Source
Town Boundary	2023	Town	The CT Town Boundary layer consists of individual polygons representing each of the 169 towns that make up the state of Connecticut.	CT Data
2020 Census Tract Boundary	2020	Tract	The 2020 Census Tract Boundary layer consists of individual polygons representing each of the 879 Census Tracts (excludes ocean tracts) that make up the state of Connecticut.	US Census Bureau
EJ block groups	2022	Block	The Environmental Justice Block Groups consists of individual polygons that use poverty data to determine which block groups qualify as	CT DEEP EJ

			EJ communities (see CT State statute 22a-20a). Environmental Justice Communities include distressed municipalities and environmental justice block groups, as defined by Section 22a-20a of the Connecticut State Statute. The Environmental Justice Block Groups are census block groups that, although not located in Distressed Municipalities, have 30% of their population living below 200% of the federal poverty level	
EJ Distressed Municipalities	2022	Town	The Distressed Municipalities' layer consists of individual polygons that identify the state's most fiscally and economically distressed municipalities and are used by state agencies to target funds for needs which may include housing, insurance, open space, brownfield remediation and economic development programs, among others. The Connecticut Department of Economic and Community Development (DECD) list of distressed municipalities and defined census blocks (see new map link below) indicate areas considered under section 22a-20a of the General Statutes and the Environmental Justice Policy. According to C.G.S. Section 32-9p, a distressed municipality should be based on "high unemployment and poverty, aging housing stock and low or declining rates of growth in job creation, population, and per capita income." DECD additionally included 1) Level of Per Capita Income, 2) % of the population with high school degree and higher, and 3) Per Capita Adjusted Equalized Net Grand	CT DEEP EJ

			List (AENGL) to arrive at its ranking. For more information, visit CT DEEP Environmental Justice Communities.	
Tribal Boundaries	2020	Polygon	The Tribal Boundaries layer consists of individual polygons representing 2 federally recognized tribes and 3 state recognized tribe.	US Census Bureau
Health District	2023	Town	The Health Districts layer are identify a towns local Departments of Health.	Local Health Administration - Site Map (ct.gov)

ii) Flood/Water Impairments

Content Layer	Year	Resolution	Description	Dataset Source
CIRCA Flood Layer	1950-2020	Polygon	The CIRCA Flood Layer shows individual polygons representing flood maps with 100-year storm surge (1% Annual Exceedance Probability) with 20 inches of sea-level rise projections along Connecticut's coastline.	CIRCA Sea Level Rise
ESRI FEMA Flood Layer	2022	Polygon	The ESRI FEMA Flood Layer displays polygons representing Flood Hazard Areas from the Flood Insurance Rate Map created by the Federal Emergency Management Agency.	ESRI Living Atlas
Impaired Rivers	2022	Polyline	The Impaired Rivers layer consists of polyline representing rivers that have been identified as "Not Supporting" one or more of the following: Habitat for wildlife, recreation, fish consumption and drinking water.	Impaired 2022 River, Lake, Estuary Set | CT Geodata Portal
Impaired Lakes	2022	Polygon	The Impaired Lakes layer consists of polygons representing lakes that have been identified as "Not Supporting" one or more of	Impaired 2022 River, Lake, Estuary Set | CT Geodata Portal

			the following: Habitat for wildlife, recreation, fish consumption and drinking water.	
Impaired Estuaries	2022	Polygon	The Impaired Estuaries layer consists of polygons representing Estuaries that have been identified as "Not Supporting" one or more of the following: Habitat for wildlife, recreation, fish consumption, commercial shellfish harvesting and drinking water.	Impaired 2022 River, Lake, Estuary Set | CT Geodata Portal

iii) Other Tool Indices

Content Layer	Year	Resolution	Description	Dataset Source
Food Deserts	2019	Tract	The Food Deserts layer displays individual polygons that identify census tracts having low food access at 1 mile for urban areas and 10 miles for rural areas.	USDA ERS - Download the Data
Climate Justice Index	2010	Tract	The Climate Justice Index layer consists of individual polygons that identify communities as disadvantaged if they are in a Census Tract that are at or above the 90th percentile for expected agriculture loss rate OR expected building loss rate OR expected population loss rate OR projected flood risk OR projected wildfire risk and are at or above the 65th percentile for low income.	Downloads - Climate & Economic Justice Screening Tool (geoplatform.gov)

Social Vulnerability Index (SVI)	2020	Tract	The Social Vulnerability Index layer consists of polygons that assesses census tracts for community vulnerability to health hazards based on socioeconomic factors.	CDC/ATSDR Social Vulnerability Index
Location Affordability Index - Housing	2012-2016	Tract	The Location Affordability Index layer consists of individual polygons that report a census tracts monthly average housing cost.	Location Affordability Index V.3
EJScreen Demographic Index	2023	Tract	The Demographic Index layer consists of individual polygons that defines census tracts from EPA EJScreen and based on the average of % low-income and % people of color.	Download EJScreen Data | US EPA

iv) Other CT EJScreen Layers

Content Layer	Year	Resolution	Description	Dataset Source
CT Demographics	2023	Tract	The CT Demographics layer consists of individual polygons that represent a census tract's demographics.	2017-2021 American Community Survey

Advisory Committees

State Data Advisory Committee (SDAC)

The primary role of the State Data Advisory Committee (SDAC) is to provide advice on available and missing datasets as identified in (del Fierro et al., 2021) report and to obtain feedback on the indicators that were deemed necessary and acceptable, shared documentation to solicit feedback regarding consistent terminology, the indicator inclusion, and how to frame environmental burdens and health impacts. This group met five times during the project timeline. CT DEEP Commissioner Katie Dykes invited several state agencies and data partners to nominate representatives to serve on the State Data Advisory Committee. The nominated representative who serve on the SDAC are:

- Office of Policy & Management: Scott Gaul, Eric Lindquist, Alfredo Herrera
- Yale Center on Climate Change & Public Health: Dr. Laura Bozzi, Dr. Kai Chen
- DataHaven: Mark Abraham
- Department of Economic and Community Development: Maya Loewenberg
- Department of Transportation: Jennifer Petrario, Adam Cohen, and Tiffany Garcia
- Department of Public Health: Lori Mathieu, Christine Hahn
- Department of Emergency Services and Public Protection: Kenneth Dumais, Daniel Czaja
- Clean Air Association of the Northeast States (NESCAUM): Barbara Morin, Russell Pildes
- Connecticut Data Collaborative: Sarah Eisele-Dyrli

Over the past two years, CIRCA has actively collaborated with multiple state agencies to enhance the EJScreen tool. The state data advisory committee, along with various other agencies, provided invaluable feedback that directly influenced the tool's iterations and improvements. A detailed account of these feedback points, as well as CIRCA's corresponding responses and enhancements, can be found in the Appendix **Error! Reference source not found.**.

Mapping Tool Advisory Committee (MTAC)

The MTAC committee and associated grant aimed to increase access and enable participation from community-based organizations and individuals with lived experience who represent different interests contributing to environmental justice. These intersecting interests may include health, transportation, food systems, racial justice, education, city planning, and more. While the public workshops and public comment opportunities allowed a wide range of people to review and engage with the mapping tool briefly, the MTAC allowed for repeated in-depth engagement from a selected group of community representatives as the mapping tool is developed. The MTAC application process was developed by CIRCA staff in collaboration with an external grant advisory committee of experts from universities, state and federal agencies, and community foundations.

In order to increase access to the input process and compensate participants for their time and expertise, a budget was allocated for MTAC participants to fund six MTAC members. Eligible applicants included both community-based organizations as well as individuals with lived experience.

Community-based organizations were defined as "a private, non-profit (incorporated or unincorporated) or for-profit organization that is aimed at making desired improvements to a community's social health, well-being, and overall functioning; that is representative of a community or significant segments of a community; and that provides services to individuals in the community based on input from community members." This includes 501(c)3 organizations, religious organizations, neighborhood groups, and other non-governmental organizations. All community-based organizations interested in applying were asked to nominate a single representative from the organization to participate in the MTAC in order to ensure consistency across meetings.

Individuals with lived experience were defined as "individuals who have lived/are living with the issues the community is focusing on and who may have the insight to offer about the system as consumers experience it. These individuals will have expertise that doesn't come from training or formal education; knowledge from experience with an issue or challenge; and/or direct experience with a system, process, or issue, or trying to engage with a resource and awareness of what works, what doesn't work, and what resources (formal or informal) are available in the community."

A Request for Applications was published on CIRCA's website in both English and Spanish in September 2022. An announcement of the funding opportunity was shared through CIRCA's website, the EJ Mapping tool website, the GC3 Environmental Justice and Equity working group, the Connecticut Equity and Environmental Justice Advisory Council, and a compiled list of thirty non-profit organizations working in fields related to environmental justice within Connecticut. A webinar about the MTAC was held on September 26th, 2022, and the slides and recording were made available on the CIRCA website afterward.

The Request for Applications outlined each MTAC member's work scope and was explained in the webinar. The MTAC member duties were listed as follows:

- Watch an introductory webinar on EJ mapping tool project.
- Attend five virtual meetings (about 2 hours each) between January – June 2023.
- Review meeting materials (draft forum agendas, latest EJ Map Viewer version), to be distributed in advance of meetings).
- Attend a regional forum in early 2023 (choose from multiple dates/locations; mileage reimbursed).
- Attend public meeting/launch and offer comments in August 2023.
- Short project/participation evaluation mid-way through (April 2023) and at the end of the project (August 2023).

Organization applicants were asked to provide the following information:

- A short letter of support from your organization's leadership clearly states who would represent the organization and that they would be available for the scope of work.
- Description or screenshot of your organization's mission or activities that demonstrate your commitment to environmental justice (1 paragraph)
- Description of why the proposed person is the best representative for your organization (1 paragraph)
- Description of how your organization can inform the EJ Map (1-3 paragraphs)
- Description of how your organization's participation could benefit your organization, either during or after the project period (1-3 paragraphs)

Individual applicants were asked to provide the following information:

- Short statement of commitment that you would be available for the scope of work
- Description of your lived experience and/or expertise in environmental justice or related advocacy efforts (housing, transportation, health) (1-2 paragraph)
- Description of how your experience and/or expertise can inform the EJ Map (1-3 paragraphs)
- Description of how your participation could benefit your efforts towards environmental justice, either during or after the project period (1-3 paragraphs)

Fourteen applicants submitted applications to join the MTAC and receive an MTAC grant.

The application evaluation process involved two stages. First, CIRCA staff reviewed every application received and evaluated each according to an established scoring rubric (see below). After this review, CIRCA referred eleven applicants for review by the external grants advisory committee. This committee selected the final six participants, who were then awarded grants to serve on the MTAC.

All applicants were notified of funding decisions in early November 2022 and received a brief survey to assess their experiences with the application process. MTAC meetings took places between January and August of 2023, with the final launch of the EJ Mapping tool expected in August 2023. The evaluation criteria for the candidates are given below Table 6.

Table 6: Evaluation Criteria for MTAC members

Evaluation Criteria	**Points Available**
Eligibility • Applicant has a commitment to environmental justice in their mission and/or activities • Applicant organization (if applicable) has uploaded a letter demonstrating support from the organization's leadership • Individual applicant (if applicable) has demonstrated lived experience	**Pass/Fail**
Demonstrated Potential for Success • Application includes a clear explanation of how the applicant's expertise and/or experience will effectively inform the creation and use of an EJ map for Connecticut **(20 points)** • Applicant has a proven track record of projects related to EJ planning and/or action **(10 points)** • Applicant demonstrates readiness and capacity to participate in the effort described in Attachment A: Scope of Work **(10 points)**	**40 points**
Qualifications of Applicant • Applicant can commit to the effort described in Attachment A: Scope of Work **(20 points)** • Applicant has a demonstrated commitment to environmental justice work **(10 points)**	**40 points**

• Applicant has a record of involvement in environmental justice or related advocacy of at least 6 months **(10 points)**	
Benefit to Applicant • Application includes a clear explanation of how the applicant might benefit from participation in this project, either during the project period or after the project is completed **(20 points)**	**20 points**
Total Points	**100 points**

The selected MTAC members consist of two organizations and four individuals.

- Operation Fuel
- Groundwork Bridgeport
- Cathy Fletcher, Bridgeport
- Tayarisha Batchelor, Windsor
- Alexis Torres, New Haven
- Reginald Saint Fortcolin, Bridgeport

Over the last eight months of the project, CIRCA has actively collaborated with MTAC members to enhance the EJScreen tool and improve public forum applications. A detailed account of these feedback points, as well as CIRCA's corresponding responses and enhancements, can be found in the Appendix Responses to Feedback

Grant Advisory Committee

The grants advisory committee is an external group assembled to provide input on multiple CIRCA initiatives related to environmental justice, including the statewide EJ Mapping Tool, the Mapping Tool Advisory Committee Grant, and the Climate and Equity Grant Program. The committee comprises seven members, all of whom have expertise in environmental justice advocacy, scholarship, or policy, including representatives from state and federal agencies, universities, and community foundations. The grants advisory committee met multiple times to review the progress of CIRCA's environmental justice work and evaluate grant applications.
Grant advisory committee members and their affiliations:

- Mark Mitchell, MD, MPH, Associate Professor of Climate Change, Energy & Environmental Health Equity at George Mason University and Co-chair of the Connecticut Equity and Environmental Justice Advisory Council (CEEJAC)
- Hermia Delaire, MS, Sandy Recovery Program Manager for the CT Department of Housing
- David Embrick, PhD, Associate Professor of Sociology and Africana Studies at UConn and Director of the CT Center for Research on Resilient Cities, Racism, and Equity
- Edith Pestana, MS, MPH, Administrator for CT DEEP's Environmental Justice Program
- Bessie Wright, EPA Region 1 Program Coordinator for Long Island Sound Study
- Jennifer O'Brien, Program Director for Community Foundation of Eastern Connecticut
- Ellen Carter, MPA, Vice President of Program, for the Community Health Foundation

Public Feedback and Engagement

Tool Evaluation Forums

In the evaluation phase of the Environmental Justice (EJ) Screening tool, CIRCA collaborated with community-based, non-profit hosting organizations to hold evaluation forums. The process began with selecting hosting partners with strong connections with their local communities. Five communities were chosen based on EJ characteristics and geographic spread around the state (Table 7). CIRCA offered financial compensation to these organizations for their involvement in the project, with the exception of the City of Groton and Waterbury Health Department.

These hosting organizations curated groups with a rich mix of backgrounds and perspectives, ensuring the diversity of the participants. Each forum began with a presentation introducing the EJ tool, explaining its purpose, functionality, and underlying data. This served to familiarize participants with the tool and equip them with a baseline understanding needed for effective evaluation. CIRCA also provided the Community Forum Information Sheet, Draft Factsheet, and Exit Survey as handouts.

Table 7: Tool Evaluation Forum locations and hosting organizations

Hosting Organization	Location	Forum Date
East End NRZ	Bridgeport	March 21st, 2023
Bridge to Success & Waterbury Health Department	Waterbury	April 26th, 2023
Center for Latino Progress	Hartford	May 17th, 2023
City of Groton	City of Groton	May 24th, 2023
Junta for Progressive Action	New Haven	May 30th, 2023

The Community Forum Information Sheet offers details about the community forum, an event to evaluate the beta version of the Connecticut Environmental Justice Screening Tool. The Information Sheet included information about the forum's objective, the forum's agenda, and how feedback gathered during the forum would be used by the research team. It also included the guidelines for the group discussion, emphasizing respectful and active listening, focusing on understanding others' perspectives, not interrupting, and encouraging others to voice their opinions. The guidelines encouraged learning rather than debating, criticizing ideas instead of individuals, and avoiding assumptions about others.

Once the introduction was complete, participants could experience the tool hands-on using iPads. This allowed them to personally navigate the tool's features and functionalities, offering them insights into its usability and potential areas for improvement. During this section of the forum, the project team collected verbal feedback from the participants, providing immediate assistance when necessary and taking notes to inform the future development of the tool. Each forum concluded with a group discussion in which participants shared their feedback in response to guiding questions and were offered an open-ended chance to provide insights and suggestions about the tool.

Upon completion of the hands-on session, participants provided written feedback through a short exit survey, giving them a chance to reflect on their experience and offer more considered opinions and suggestions. Participants were compensated with a meal during the forum and gift cards to appreciate their contribution and time. Hosting organizations advised the project team on the most appropriate choice of food and gift card for each forum's audience. The funding for the gift cards and food was provided by *SeaGrant NOAA Award NA22OAR4170093, Project A/E-69, Reaching underserved communities: a two-step pilot in Connecticut.*

This participatory approach to the tool's evaluation helped us gather invaluable user feedback from diverse perspectives, ensuring that the EJ tool remains user-centered, accessible, and effective in serving its purpose. The handouts distributed during the forums are given in Appendix Public Forum Handouts.

Feedback From the Forums

During the evaluation forums for the Connecticut Environmental Justice Mapping Tool, participants from a wide range of backgrounds, professions, and ages provided useful feedback and made insightful suggestions for additional map layers and tool features.

Additional map layer suggestions encompassed a variety of topics, including substance abuse, energy burden, specific diseases such as HIV/AIDS and breast cancer, noise pollution from gunshots and sirens, and real-time pollution emergency notifications. Suggestions for tool features ranged from allowing users to input personal data, language accessibility, and providing resources and contact lists for aid and reporting. There were also suggestions for improving visual clarity and making it more user-friendly, such as larger print, color-coding, and clear instructions on how to turn layers on and off. Clarifying that not all data suggestions can be feasibly implemented as indicators due to several practical considerations is important. These constraints primarily include a lack of statewide data availability, resolution limitations, and the relevance of certain data to the tool's primary focus on environmental justice. That said, several suggested layers align with the tool's objectives and are feasible to implement. CIRCA has integrated these layers as context layers in the 2.0 version of the tool. CIRCA has also improved the visualization of the web application in response to feedback gathered at the evaluation forums. The suggestion to add user-generated layers will not be implemented within the online public version of the tool but can be accomplished on desktop applications.

Participants also expressed confusion and raised questions about certain terminologies, the source and frequency of data updates, and the tool's capabilities. These areas were marked as needing further clarification. Participants showed keen interest in the tool's application, including viewing pollution layers, exploring correlations between contamination and health, and understanding how the tool can influence decision-making. CIRCA prepared a detailed data page that will be linked to the application to clarify these topics further.

Potential uses for the tool suggested by youth participants included informing personal relocation decisions, serving as a resource for academic projects, and sharing the tool's findings with their network. Participants with professions related to municipal planning, nonprofit work, and community organizing also suggested the tool could be used for grant applications and overlaid with other data sources.

Feedback from participants indicated an overall positive reception of the tool, although some concerns were raised about the potential misuse of the data for financial redlining or that the tool could negatively affect property values. Additionally, concerns were noted about the data underestimating health issues due to uninsured and undocumented individuals (who may not seek medical attention and thus may not be reflected in medical data) not being represented. CIRCA recognizes that transparency about how data are used is paramount, and we want to ensure that the tool's core purpose is to aid in identifying and mitigating environmental justice disparities in communities across Connecticut. In response to these concerns, CIRCA prepared an additional resource page highlighting how the data can be utilized to attract investment into communities that need it most.

The feedback collected during the forums was constructive and varied, offering valuable insights for refining and enhancing the mapping tool to serve Connecticut's communities better. The diverse experiences and backgrounds of the participants contributed to a rich feedback process, highlighting the need for more accessible instructions and acknowledging the importance of a diverse team in tool development, as different perspectives might notice varying factors related to safety and well-being. A list of comments and suggestions made by forum participants and CIRCA's responses will be added to this report as an Appendix **Error! Reference source not found.** and **Error! Reference source not found.**.

Public Comment Period

In an effort to ensure comprehensive feedback and inclusivity, the beta version of the Connecticut Environmental Justice Screening Tool was open for a public comment period for 15 days. This crucial phase of the project allowed community members, policy makers, academic researchers, and others to engage with the tool and provide their feedback. The comments, questions, and suggestions received during this period have proven invaluable in refining the tool further and making it more responsive to the needs of our communities. The response from the public comment period was integrated into the final version of the tool.

A list of comments and suggestions submitted during the public comment period and CIRCA's responses will be added to this report as an Appendix **Error! Reference source not found.**.

Webinars and Engagement Materials

The launch of the public comment period for the Connecticut Environmental Justice Screening Tool was accompanied by a comprehensive set of engagement materials aimed at maximizing accessibility, understanding, and ease of use. This initiative kicked off with an informative

webinar, providing participants with an overview of the project, the purpose and functionality of the tool, and guidelines on how to use it effectively.

In addition to the webinar, CIRCA created a detailed factsheet and user guides in both short and extended formats (Appendix Factsheet and User Guides). These PDF guides offered step-by-step instructions and visual representations to facilitate user interaction with the tool, making it an easier and more intuitive process.

Moreover, to further simplify the user experience, CIRCA developed an instructional video that visually demonstrated how to navigate the tool. This audiovisual resource was designed to answer common questions, clarify any potential areas of confusion, and provide practical tips for users.

Recognizing the linguistic diversity of our community, we ensured that all these engagement materials, including the factsheet, user guides, and the how-to video, were translated into Spanish. This not only widened the tool's reach but also encouraged inclusivity and participation from a broader section of the community.

All these measures reinforced our commitment to making the tool accessible and comprehensible to everyone interested in environmental justice in Connecticut. CIRCA's aim has always been to empower the community with this tool, and these materials played a significant role in achieving that goal.

Conclusion

In conclusion, developing and testing the Connecticut Environmental Justice (EJ) Screening Tool has been an intensive, inclusive, and engaging process. Its objective was to offer a powerful resource to begin to identify and address the high pollution burden, health sensitivities, social stressors, and environmental health impacts communities in Connecticut face.

The methodology involved hosting tool evaluation forums in collaboration with community-based organizations, ensuring a diverse group of participants to provide comprehensive feedback. Participants had an opportunity to experience the tool firsthand and were encouraged to share their thoughts, comments, and suggestions for improvements. In addition to that, having advisory boards with State experts, community organizations, and individuals with diverse backgrounds allowed CIRCA to represent the data and the tool more effectively.

Feedback from the forums revealed valuable insights that helped shape the tool's development, indicating areas of clarification and suggesting additional map layers and tool features. Some of these suggestions were integrated into the tool, while others were considered but ultimately not incorporated due to factors such as lack of statewide data availability and resolution.

We also engaged with the public through a 15-day public comment period, during which we provided a range of materials to help users understand and navigate the tool. These materials included a factsheet, user guides, and a how-to video, all available in both English and Spanish.

Participants responded positively to the tool overall, recognizing its potential to inform and empower communities about environmental justice. While concerns about the potential misuse of data and potential effects on property values were raised, these were addressed by highlighting the tool's ultimate purpose, to target resources and investments to areas that need them the most, and the ways that other states have used similar tools.

As we move forward, the tool should be updated to keep up with the State's need for user feedback and ongoing analysis. The focus remains on ensuring this tool is an effective and accessible resource for communities, policymakers, and advocates working toward environmental justice in Connecticut.

Future recommendations

By implementing these recommendations, the EJ Mapping Tool can continue to evolve as an increasingly powerful resource for understanding and addressing environmental justice issues in Connecticut.

Improving the Model: The data layers should be utilized in forming indicators to reduce redundancy and enhance clarity. By conducting a thorough statistical analysis for the current layers and identifying overlaps or repetitive information, the indicator list can be improved to form independent variables. Consolidating and refining these layers will not only improve the efficiency of data processing but also provide users with a clearer, more concise view of the indicators, thus aiding in better decision-making. The incorporation of American Community Survey (ACS) error estimates is advised as a constraining measure to filter out potentially unreliable data. This measure will bolster the tool's reliability and enhance the credibility of its outputs. Exploring avenues for customized indexing is also advocated, enabling users to obtain analyses that align with particular needs or stipulated parameters. Additionally, the tool would benefit from features that allow communities to engage in self-identification processes, accommodating burdens identifiable at scales finer than the census tract. This addition promises a more nuanced and contextually relevant understanding of localized adversities, rendering the tool indispensable for community-centric initiatives and interventions.

Enhance User Interface: A permanent info box could remind users to turn layers on/off to prevent confusion. A back button could also help improve navigation within the tool. The tool is designed on ArcGIS Online platform and cannot currently handle these suggestions.

Increase Accessibility: The tool should be made available in multiple languages in accordance with the languages most commonly spoken in Connecticut. Additionally, voice control

features could be added to aid users who may struggle to navigate a touchscreen (this feature is not currently possible on the ArcGIS online platform).

Monitoring and Updating Data: The tool should regularly be updated with the most recent available data to ensure accuracy and relevance. Implementing a standardized protocol for periodic reviews will ensure that the layers remain relevant and updated.

Ongoing Engagement and Feedback: Future forums should continue to be held periodically to introduce the tool to new users and to gather feedback for continued refinement. This iterative feedback process ensures the tool remains responsive to community needs and concerns.

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Appendices

A. Factsheet

UCONN Connecticut Institute for Resilience and Climate Adaptation

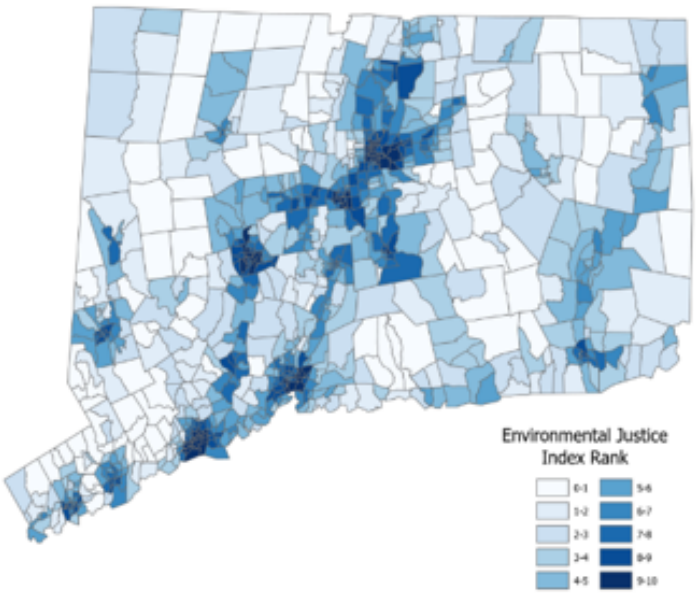
Connecticut Environmental Justice Screening Tool 2.0

This tool helps identify communities with high potential pollution burdens, health sensitivities, and/or social stressors, as well as potential opportunities for addressing environmental health impacts. The tool is based on various datasets (called **indicators**) that each represent a type of pollution, health impact, or social vulnerability. Indicators are mapped across Connecticut census tracts and then combined into an overall Environmental Justice Index Score for each community.

How to Read the Map

Each indicator has a 0–10 ranking for each census tract, reflecting relative placement compared to all Connecticut tracts rather than an absolute value. Some public health indicators are ranked by town instead of tract. All the indicators are combined into an overall EJ Index Score.

Darker areas
=
Higher potential cumulative impact of pollution, health sensitivity, and vulnerable populations



Disclaimer

This Screening Tool DOES:	This Screening Tool DOES NOT:
✓ Identify potential sources of pollution.	X Does not reflect actual exposures to pollution.
✓ Identify areas that that may be more vulnerable to impacts from accidents or emergencies involving the release of environmental contamination.	X Does not indicate the exact pollution burden nor reflect the number of individuals that may be affected by pollution.
✓ Identify census tracts near potential pollution sources.	X Does not establish causal associations between environmental risks and health.
✓ Identify the degree to which a community, by census tract, is burdened by environmental harms and impacts.	X Does not provide information about an individual's health status or environment.
	X Does not release private addresses, information, or names.

CIRCA

For more information on the Environmental Justice Screening Tool or CIRCA, contact circa@uconn.edu or use the QR code to the right. This tool was funded by the Regional Greenhouse Gas Initiative.

UCONN Connecticut Institute for Resilience and Climate Adaptation

How are the Scores on the EJ Screening Tool Calculated?

- Each dataset (**indicator**) represents a type of pollution, health impact, or social vulnerability.
- Indicators are organized into **4** categories, which are used to calculate **2** composite (combined) categories (**Pollution Burden & Sensitive Populations** in the table below). These are then multiplied to get the final ***Environmental Justice Index Score,*** which represents the cumulative impact for each census tract in Connecticut.

Overall Score	**Environmental Justice Index Score = Pollution Burden x Sensitive Populations**			
Composite Category	**Pollution Burden** $\frac{0.5 \times average(PPS) + average(PPE)}{1.5}$		**Sensitive Populations** $\frac{average(SF) + average(HS)}{2}$	
Category	*Potential Pollution Sources (PPS)*	*Potential Pollution Exposure (PPE)*	*Socioeconomic Factors (SF)*	*Health Sensitivity (HS)*
Indicator	• Brownfield sites • Proximity to Superfund Sites • Impervious Surfaces • Incinerators • Landfills • Housing Lead Risk • Municipal Transfer Stations • Potentially Contaminated/Clean-Up Sites • Recycling Processing Facilities • Significant Environmental Hazards • Underground Storage Tanks • Facilities Managing Hazardous Chemicals • Wastewater Discharges	• Diesel PM Emissions • Noise • Ozone • Particulate Matter 2.5 • Facilities Releasing Toxics • Major Sources of Air Pollution • Minor Sources of Air Pollution • Minor Air Pollution Facilities • Traffic Density • EPA Cancer Risk Index • EPA Respiratory Hazard Risk Index	• Housing Burden • Linguistic Isolation • Poverty levels • Unemployment • Race/Ethnicity • Educational Attainment • Energy Burden • Median Income • Population Age < 5 • Population Age > 65 • No Health Insurance • Mobile Homes • Multi-unit Housing • Rent-ownership Ratio • Disability • Single Parent Households • Food Insecurity	• Asthma Emergency Dept. Visit Rate • Coronary Heart Disease • Emergency Dept. Visits for Chronic Lung Disease • Diabetes • Low Birthweight Rate of Infants • Declined Mental Health • Depression Rates

Who Can Use The Tool?	Why Use The Tool?	Access The Tool
✓ Community groups ✓ Advocacy organizations ✓ Government agencies ✓ Teachers and students ✓ Everyone!	✓ Address environmental justice issues ✓ Inform government decisions ✓ Facilitate dialogue and collaboration between policymakers and community members	Freely accessible online via ✓ Phone ✓ Tablet ✓ Computer

CIRCA

For more information on the Environmental Justice Screening Tool or CIRCA, contact circa@uconn.edu or use the QR code to the right. This tool was funded by the Regional Greenhouse Gas Initiative.

B. Public Forum Handouts

a) Public Forum Format

Community Forum Information Sheet

Thank you for participating in this community forum to evaluate the beta version of the Connecticut Environmental Justice Mapping Tool by testing it out and providing feedback about the user experience!

Participating in this forum is completely voluntary and you may choose to withdraw from the session at any time. Those who complete the forum will be offered a gift card for personal use. CIRCA staff will take notes on your questions, comments, and suggested improvements throughout the forum and will store these notes at the UConn Avery Point campus. Once all forums are completed, CIRCA will update the tool and open it up for public use and comment.

Our goal is to create a mapping tool that helps Connecticut identify and address the high pollution burden, health sensitivities, social stressors, and environmental health risks that communities face; then use your feedback from these forums to improve the tool, making it more useful for communities and policymakers!

Over the course of 1.5 hours, this community forum will include:

- Opening remarks: The host organization and DEEP explain the purpose and process of the forum
- Mapping Tool Presentation: CIRCA provides a basic demonstration of how-to-use the tool
- Tool Testing: Community members spend time experimenting with the tool
- Group Discussion: Community members provide feedback, insights, and suggestions for the tool
- Exit Survey: Community members will complete a short survey then retrieve their gift-cards

The gift cards are funded by CT SeaGrant NOAA Award: Reaching underserved communities: a two-step pilot in Connecticut

Group Discussion Guidelines

Listen respectfully, without interrupting. (One Mic)	Listen actively to understand others' views.
Only have one conversation at a time.	Avoid off-topic conversations.
Be mindful to give others the opportunity to speak.	Give each other grace.
Commit to learning, not debating.	Criticize ideas, not people.
Avoid blame, speculation and inflammatory language.	Avoid assumptions about any member of the group.

b) Exit Survey

Community Forum Exit Survey

Thank you for your participation in the community forum! Your feedback will be used to update Connecticut's Environmental Justice Mapping Tool to ensure that it's effective and user friendly!

Before you go, please take a moment to complete the exit survey below then grab your gift card.
The gift cards are funded by CT SeaGrant NOAA Award: Reaching underserved communities: a two-step pilot in Connecticut

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Read each question carefully then circle the answer that best reflects your true opinion.

Did you enjoy this community forum?

Yes Very Much / Yes / Somewhat / No / Not at All

What did you enjoy most about this community forum? *Circle all that apply.*

Factsheets / Remarks & Presentations / Group Activity / Using Mapping Tool / Group Discussion

Does receiving a gift card make you more or less likely to participate in a community forum?

Much More Likely / More Likely / Neutral-No Difference / Less Likely / Much Less Likely

Does receiving food make you more or less likely to participate in a community forum?

Much More Likely / More Likely / Neutral-No Difference / Less Likely / Much Less Likely

Do you think the tool is user-friendly and/or helpful? *Circle all that apply*

User-Friendly / Helpful / Somewhat User-Friendly / Somewhat Helpful / Not User-Friendly / Not Helpful

What types of incentives or support make you most likely to participate in community forums?

_____

_____

_____

c) Compiled Survey Results from Forums for Connecticut Environmental Justice Screening Tool

This summary document highlights the key aspects of the community forums conducted for the Connecticut Environmental Justice Screening Tool. The forums were held in five major cities:

Bridgeport, New Haven, Hartford, Waterbury, and Groton. The primary objective of these forums was to engage with community members, gather feedback on the forum format and incentives, and receive verbal and written feedback about the tool. Throughout the forums, diverse participants actively engaged in discussions and activities, including community members, Spanish-speaking youth, non-profit and health department planners, and city officials.

The forums provided an invaluable opportunity for participants to test out the tool, express their opinions, share feedback, and contribute to enhancing the screening tool. At the end of each forum, participants were given exit surveys to gather their insights on various aspects of the forums, including the format, incentives, and their perception of the tool.

The total number of survey responses received was 68, indicating that not all forum attendees completed the surveys. Despite this, the responses collected represent a significant portion of the participants and offer valuable feedback for further refinement of the Connecticut Environmental Justice Screening Tool and future engagement initiatives.

The responses from the survey provided insightful data on attendees' satisfaction with the forum, their preferences for participant incentives, and their perceptions of the tool's usefulness and user-friendliness. The feedback from different groups, including the Spanish-speaking youth, community members, city officials, non-profit staff, and health department planners contributed to a comprehensive understanding of various stakeholders' perspectives.

The community forums adopted a structured yet interactive format to ensure meaningful engagement with the attendees. The format comprised presentations about the Connecticut Environmental Justice Screening Tool version 1.2, an interactive tool experience, followed by Q&A sessions to address any queries or concerns. Additionally, small group discussions were organized to encourage active participation and foster a sense of community involvement in environmental justice matters.

Overall, the community forums' success in engaging attendees and gathering valuable feedback demonstrates a strong commitment to promoting environmental justice in Connecticut. The input received from the survey responses will undoubtedly play a crucial role in shaping future forums and refining the screening tool to address environmental justice concerns in the state effectively. CIRCA thanks all participants for their active involvement and valuable contributions to this critical initiative.

The total number of attendances: 93

Survey respondents: 68

Response Rate: 73%

Location	Total Attendance
Bridgeport	14
Groton	17

Hartford	18
New Haven	24
Waterbury	20

Forum Groups and Incentive Preferences:

1) Bridgeport Forum – NRZ Community Members: In the Bridgeport forum, community members participated actively. The group expressed a mixed response to the food and gift card incentives. Some members found them appealing, while others stated that they did not significantly influence their participation. Regarding the tool, community members generally appreciated its usefulness but provided feedback on improving its user-friendliness.

2) Hartford Forum - Spanish Speaking Youth Group: The Hartford forum event collaborated with a Spanish-speaking youth group. This group showed a positive response to the food and gift card incentives, as these incentives were found to be effective in encouraging their participation. Additionally, the youth group demonstrated high enthusiasm for the tool, finding it easy to use and understanding its potential benefits.

3) Waterbury Forum - Non-profit Staff and Health Department Planners: The Waterbury forum engaged non-profit organizations and health department planners. This group responded positively to the food and gift card incentives, which were appealing and motivating. As knowledgeable stakeholders, they acknowledged the tool's potential and usefulness but also suggested further enhancements for more comprehensive data analysis.

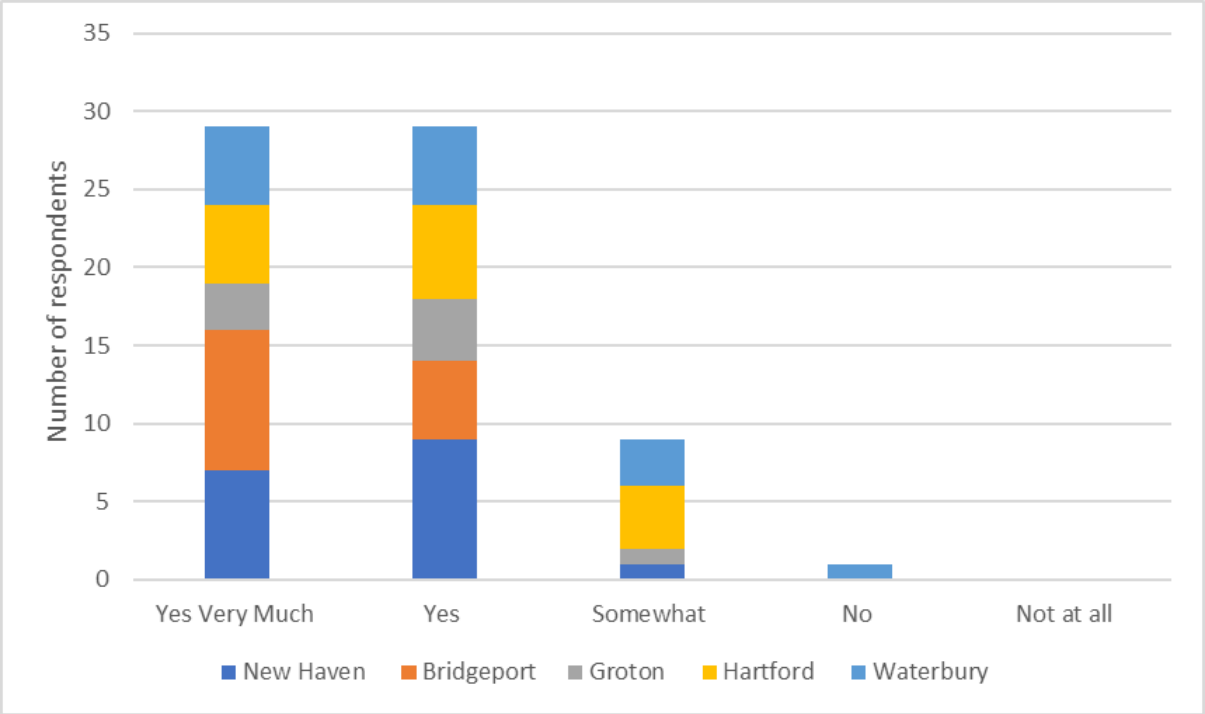
4) New Haven Forum - Spanish Speaking Community Members: The New Haven forum focused on Spanish-speaking community members who showed a favorable response to the food and gift card incentives. These incentives were well-received, encouraging a higher level of participation. The group also praised the tool, finding it useful and user-friendly, especially with the option of a Spanish version of the tool.

5) Groton Forum - City Officials: In the Groton forum, city officials participated in the discussions. This group demonstrated a varied response to the food and gift card incentives, with some officials finding them appealing, while others were more neutral. City officials generally expressed enthusiasm for the tool and considered it easy to use, appreciating its various reporting and comparing functions.

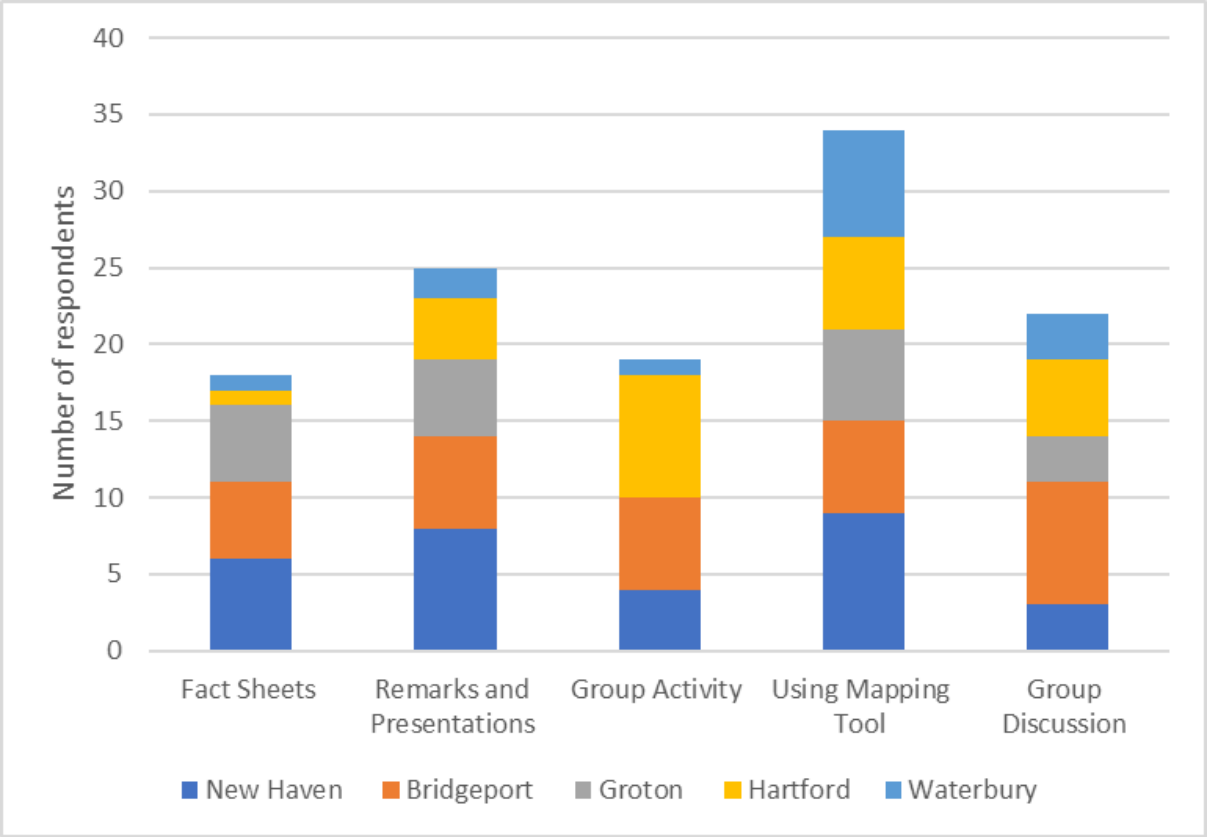
Overall, the Spanish-speaking youth group in Hartford, Spanish-speaking community members in New Haven, and city officials in Groton indicated the highest motivation from the food and gift card incentives. Additionally, these three groups expressed higher satisfaction with the tool, finding it user-friendly and beneficial for their respective needs. However, feedback from all groups contributed to valuable insights to further improve the Connecticut Environmental Justice Screening Tool and future community engagement initiatives.

Survey Questions and Responses

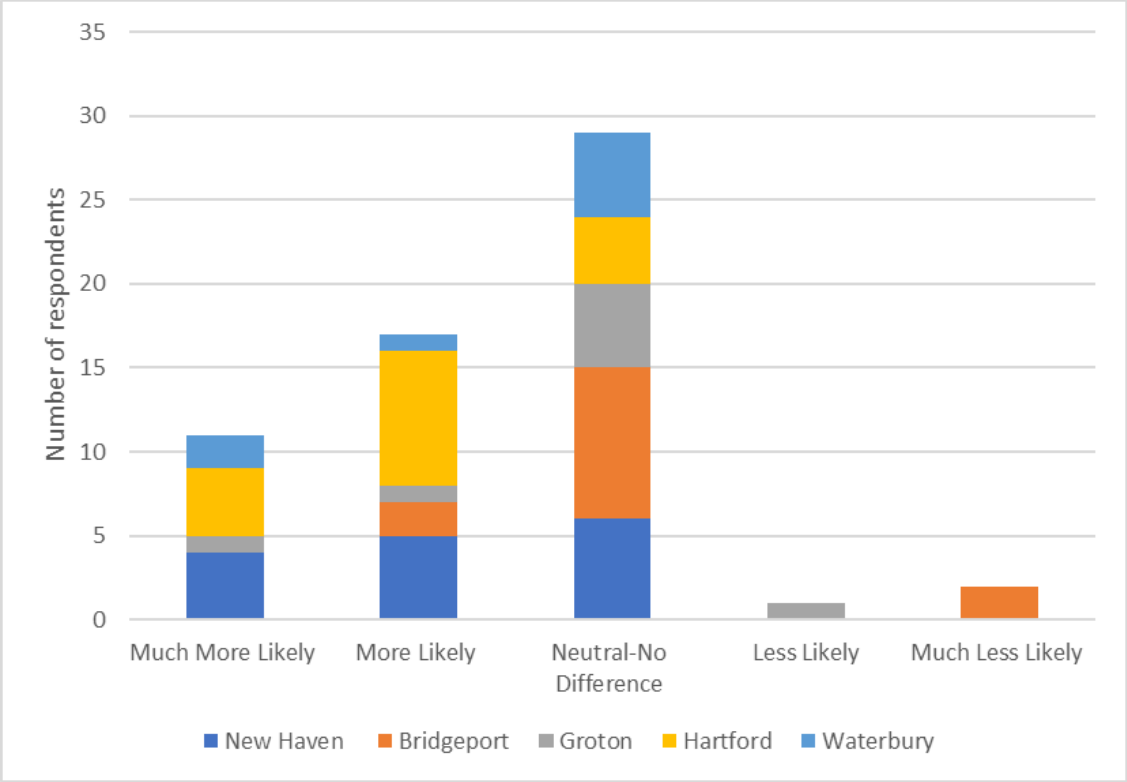
Q1) Did you enjoy this forum?



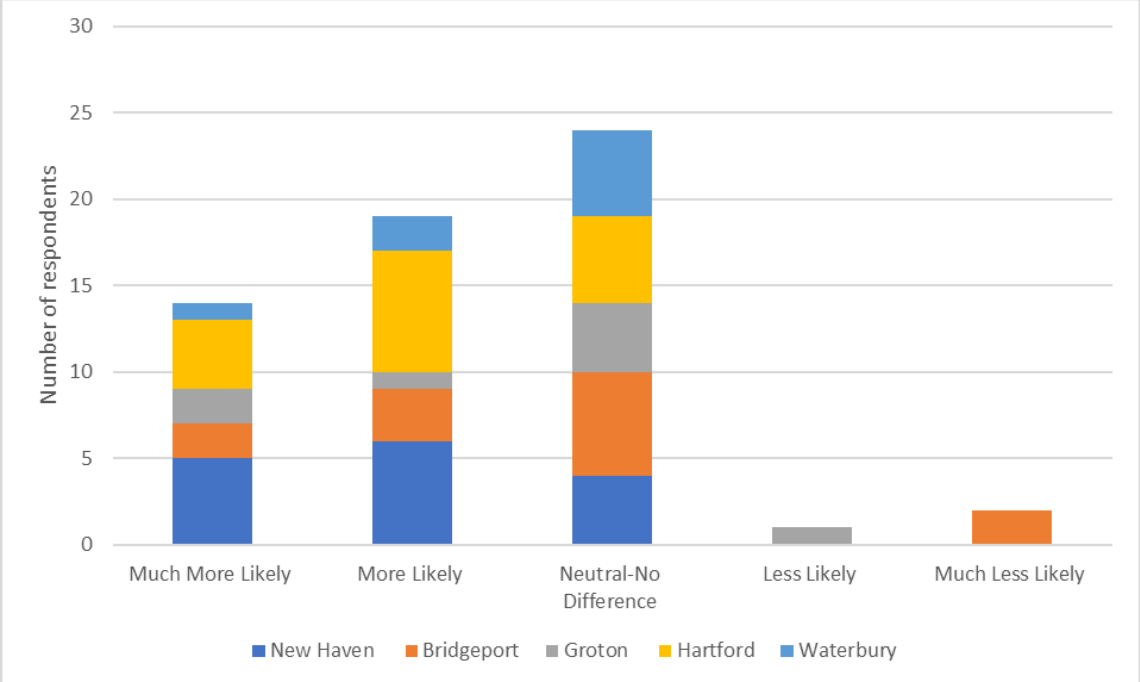
Q2) What did you enjoy most about the public forum session?



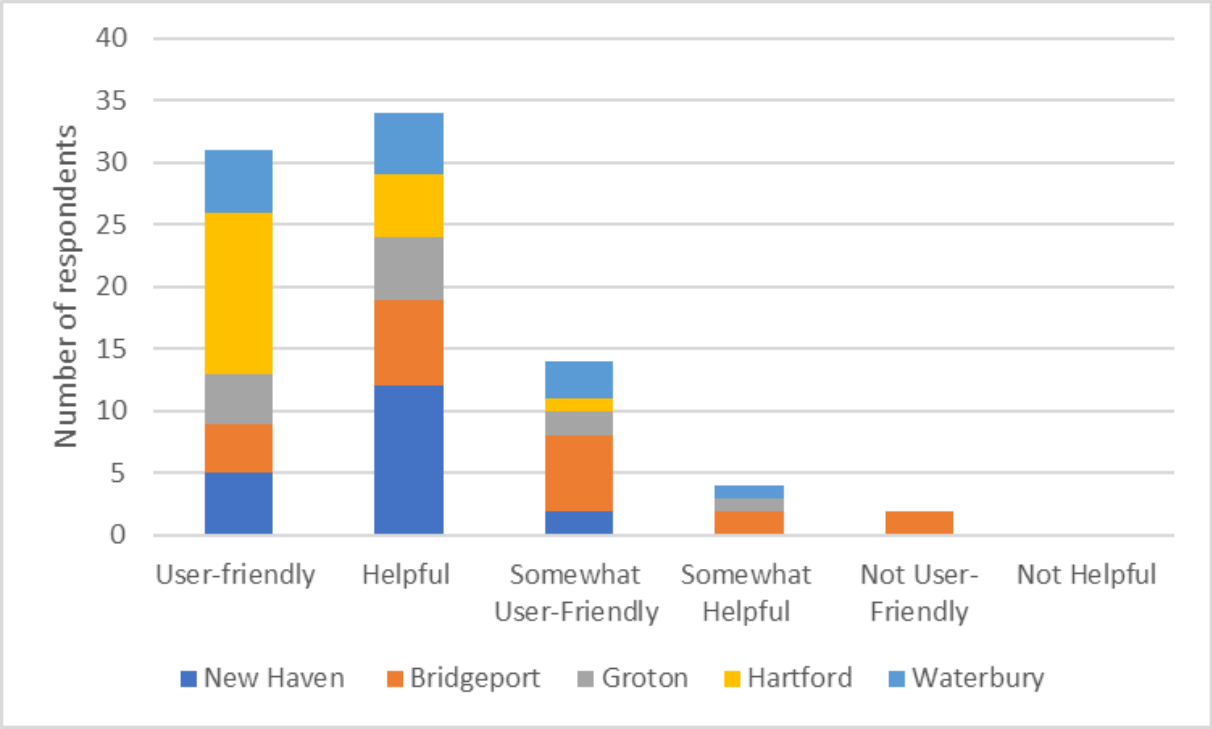
Q3) Does receiving a gift card make you more likely or less likely to attend the forum?



4) Does receiving food make you more likely or less likely to attend the forum?



Q5) Do you think the tool is user-friendly and/or helpful? *Circle all that apply*



Open-Ended Questions:

What types of incentives or support make you most likely to participate in community forums?

New Haven	Bridgeport	Groton	Hartford	Waterbury
• We should need incentives because it is important for our livelihoods • Great information • Good information • Group Discussion • Keep the same • Don't cut the trees • The grocery gift card is helpful • More gift cards • Any type of information • Information in any form is good • Any assistance preferable a gift card helps the most	• Knowledge • Start earlier • Knowledge • The information provides the tool to use it and what can be done with the information provided • I like to participate when the issues directly affect the community that I live and or work in	• A forum where we could compare the city of Groton's vulnerability assessment from the community resilience plan to the EJ Mapping tool and how to use this tool when applying for grants • Benefits to my position and to serve community	• If it sounds interesting • If your community is impacted, you will want to hear about the aid and the pollution that is occurring • I don't know • Talking to new people • Because I want to help the planet • Anything that catches the attention of the youth because	• Initiatives and projects that effect the communicate of larger • It's helpful when the information is relevant to you (this was) • Food is always a good choice • If this topic benefits my interest or job, I will attend regardless of incentives • To see if one can approve on a lot in my

• Community information and resources • I just like knowing facts about what's going on in my community and how participating can help • Gift card	• Publicity that highlights potential for economic improvements • How it would help my community	• Since the forum was held at 11 AM the food was convenient to the attendees who work • Having a space for public commentary • The food helps + coffee • Your lunch and gift card options were both great	young people hate doing things for free • The people • To hear what the candidates have to say about change	community to make it better

Do you have other comments about the tool?

New Haven	Bridgeport	Groton	Hartford	Waterbury

• Excellent • It was very useful because it was personal • Keep the same • When shall we expect a Spanish version? • Should had a warning part in case emergency • I love the factual information that it holds • Helpful information • Helpful information • When I click in between layers, I would like the blue check button to automatically adjust to the new option I selected	• Very helpful, know the good areas from the bad areas • Need more practice with it • Great that it addresses mental health through depression, would be useful to expand to include disorders (PTSD/trauma) • Demographics should address infant/ children/adolescent/pregnant women • Community self-identified needs to be included • It's very helpful if only all stated had it, then you will know where to move to and know its statistics. • Useful, interesting, adjusting the transparency so streets can be viewed as default would be better, the dark screen is disorienting • It be great to have a tool along that can help to reduce or solve the environmental problems • The tool is powerful! • Instead of typing in location can it simply give option of "my location" where phone. Ipad or GPS already exists • Thank you • Great information. I love that all that info could be found in one place. Just needs to be a little more user friendly. • Need more time to study, it's a lot of information	• Good presentation • Love all of the different reporting and comparing functions • Add a tree canopy analysis • Lots of great information • Access to parks could be an indicator • I found the tool easy to use and continued important information but would be more helpful if date was more recent • If DEEP Is partnered with CIRCA on the tool + DEEP has the right to share facility info on their waste, the tool should display DEEP's data • Linking the tool to state agencies/EPA look up tools would be a great way to see more info for technical managers for towns/cities.	• Use more languages so more people can understand it	• Can more health care about be included such as infant mortality, substance abuse • A list of remediated brownfields • I liked it better on laptop • Not super user friendly

C. Responses to Feedback

a) CIRCA Responses to Feedback Received During the Development of the CT EJ Screen – Advisory Committee and Agencies

Green text indicates that CIRCA staff have taken steps in response to the feedback received.
Red text indicates that CIRCA staff considered but did not take steps in response to the feedback received (not all feedback can be successfully implemented – possible reasons include data scale limitations, data availability limitations, data accuracy limitations, ESRI web app limitations, conflicting advice from other committee members or community members, etc.)
Blue text indicates the conversation is ongoing or unlikely to be resolved for the 2.0 version.

Summary Table – Comments received by 8/3/2023.

Comment from	Total Comments Suggestions	Comments Addressed	Comments Cannot be addressed	Comments that CIRCA is working to include
State Agency Meetings	56	51	4	3
DPH specific	76	59	11	2
MTAC	60	47	10	3

Table of Contents

CIRCA would like to thank the contributors below for their suggestions and feedback:

- Lori Mathieu (DPH):
- Scott Gaul (OPM):
- Adam Cohen (DOT):
- Michelle Riordan-Nold (CT Data Collaborative):
- Jenna Petratio (DOT):
- Kai Chen (Yale Center on Climate Change & Public Health):
- Joanna Wozniak-Brown (OPM):
- Edith Pestana (DEEP):
- Mark Abraham (CT Data Haven):
- Gemma Fabris (DEMHS):
- Alfredo Herrera (GIS Office):
- Karyn Backus (DPH)
- Christine Hahn-Dunn (DPH)
- Meg Harvey (DPH)
- George Bradner (ID)
- Ashley Benitez-Ou (DEEP)
- Sarah Watson (DEEP)
- Kendall Bobula (DEMHS)

- Brenda Watson (Operation Fuel, MTAC)
- Christina Smith (Groundwork Bridgeport, MTAC)
- Alexis Torres (MTAC)
- Reginald Saint Fortcolin (MTAC)
- Cathy Fletcher (MTAC)
- Tayarisha Batchelor (MTAC)

- Dr. Mark Mitchell (CEEEJAC)

Feedback From the State Data Advisory Committee – in Chronological Order

February 23rd, 2022 - SDAC first meeting, welcoming members, addressing their duties, the project scope and GC3 suggestion.

Suggestions/Comments	Response
DPH Staff: There needs to be a clear ask related to contaminants and in relation to what.	CIRCA will prepare data narratives for each indicator explaining the information available

Environmental health is related to home, school, daycare, caregivers, play, etc. If something is not regulated, then data is not publicly available. Some concerns expressed related to lead data -- no MCL for lead in drinking water, lead on water pipes not banned until recently, lead paint may not have actually been removed by 1978.	and explaining the indicator's relation to environmental justice.
OPM Staff: What is expected from the SDAC members? How we will contribute to the process?	CIRCA explained that SDAC members will give feedback about the data and represent their agency's perspective and comments to the tool.

July 1st, 2022 – Data and Methodology Discussion, Reviewing Version 1.0

Suggestion/Comment	**Response**
DPH Staff: Stating "not available" for impaired water bodies and drinking water contaminated is of concern because the data is available, just not mappable. Instead, explain that the datasets are available, but not easily translated into a mapping software	Explanation added.
OPM Staff: The airport and some industrial sites are missing from the U.S. Census	2020 census is used. CIRCA cannot address any issues related to Census data.
DOT Staff: Heritage village in Southbury does not have some Census Data. It is a retirement community	CIRCA asked why Southbury doesn't have any Census data and DOT answered this.
CT Data Collaborative Staff: I haven't yet reviewed your spreadsheet but this source might provide some of the 'sensitive populations' data that you need: https://www.cdc.gov/places/index.html	Most of the data represents these tools based on census data and they are used similarly in the tool.
DPH Staff: What is the rollout plan to move forward? Strongly suggests sharing how this information will be presented to the agencies that provided data. There may be concerns about how information is portrayed.	2 meetings with open calls for state agencies, 5 SDAC meetings, and DPH meeting series completed.
DOT Staff: This link provides an ADA compatible color scheme: https://colorbrewer2.org/#type=sequential&scheme=BuGn&n=3	ADA-friendly one-color scheme is used in the tool
17 municipal transfer stations are missing	Completed with DEEP's assistance
Yale Center on Climate Change & Public Health Staff: NASA shared socioeconomic website has a 1km x 1km 2016 dataset for air pollution data. It has advantages due to machine learning algorithms	We included this new data in ver 1.2
Yale Center on Climate Change & Public Health Staff: Heat vulnerability index has a lot of missing values. Look at heat related susceptibility to access wider data. 'Heat stress' would be a good indicator because more health-related effects exist than just heat stroke	Heat stress ED visits taken out after later feedback from DPH. We will use Urban heat Islands from Yale.

There should be an explanation about the limitations of data.	Added explanations about limitations of data to web tool, fact sheet, and report.
OPM Staff: There is a potential that data will be missing from the end product.	CIRCA and DEEP are not responsible for the original data accuracy. Multiple versions of the tool were prepared and DEEP has hired a staff member for future updates as well.
If something is going to be misinterpreted, then it is not worth mapping. This problem is seen with the drinking water contaminate layer	Drinking water contamination is not used for ver 1.2
OPM Staff: It would help if the timeframe, intended audience, and format was explained. What sort of feedback would be helpful?	Explained during the July 2022 meeting.
The first version is for SDAC. Version 1.1 will be a public version. Only processed data will be shared.	CIRCA ended up postponing public comment due to SDAC suggestion on agency review.It There was not a public version until 1.5.
DOT Staff: Something that may help, which is often how I show my projects. Is a story map where you can embed the interactive maps as you make them with the methodology behind them. you can share the link with the group and we can provide feedback on our areas of expertise. It will create a more agile environment	Story Map was not a required project deliverable, and was not completed before Version 1.5. However, if time allows CIRCA will make a Story Map to help guide public use of Version 2.0.
DPH Staff: Wants to meet with state agencies at the commissioner level. Wants people from her department to know how the map will look on launch	CIRCA contacted DPH since November 2022 to set this meeting. The meeting was held on June 30, 2023
DEEP Staff: Meeting with the Connecticut Association of Health Directors would be productive for feedback. Many of the communities that are overburdened already know their status. User-friendly data will go a long way with the public.	Public forums included attendance from various health officials.
OPM Staff: June 2023 is the conclusion of UConn's contract, so maintenance and response to the launch will be of concern	CIRCA contract ends August 2023. DEEP will hire someone to babysit the tool after that.
CT Data Haven Staff: Town level data could be misinterpreted as tract level data. Switching the basemap when a town-level layer is shown would be better.	Town level DPH data is shown with town level boundaries. Added additional context layer showing town boundaries that can be turned on and off.
CT Data Haven Staff: I don't think it's common to present town level data using tracts, since data users will read the values as values for each individual tract even though they are only values for the town. I would encourage looking at other mapping tools that change the geographic base map depending on the geographic level of the indicator that is displayed	When the output is being computed, we need to combine tracts. For input layers, we can give data on a town level but not for combined layers. When only the town-level layers are turned on, they are shown with town boundaries.

OPM Staff: How are you creating the combined layers? Do you weigh the variables?	We are taking the average of the four equally weighted categories. Other combined layers are weighted. See the following link for example of Michigan methdology: https://www.michigan.gov/egle/-/media/Project/Websites/egle/Images/Maps-Data/ArcGIS-Online/MiEJScreen/MiEJScreen-Score-Matrix.png?rev=10bd388c0ad0463484478d107bd6ed2a The CIRCA fact sheet has the equation with our category names. The CIRCA report also explains the methodology.
DEMHS Staff: ACS generated birth rate variables. Of course there is a population between high population and high birth rate. Are they being tracked by each person or by each hospital?	Birth rate is not used in socioeconomic factors. Low birthweight rate is from DPH. Each person or hospital is not tracked due to data privacy. CIRCA doesn't have access to this data.

November 3rd, 2022 – Updates, Version 1.1, Continued Data Discussion, MTAC Announcement

Suggestion/Comment	**Response**
Much of the data downloaded as shape files with restricted metadata, why are they restricted in the meta data?	Restriction statements about data privacy are included in the ARC GIS metadata so users can understand why that data is restricted.
Possibly show the layers for the Brown Fields, have they been identified as brownfields and not been remediated? Potentially and remediated as brownfields. Which ones are being inputted?	Definition of the brownfields is reviewed with DEEP Staff, DEEP Staff decided on the appropriate brownfield data and shared with CIRCA.
Label the Index vs Race map a bit more clearly. Need to provide some level of context	This was a previous feature that we took out. We put the Race/Ethnicity chart in the Index map instead, following the Washington State example.
Several comments from participants related to population density: Any thoughts on the population density that is influencing the maps? Population density in another name in these maps. Do we have a methodology that is accounting for more than just population density? Urban vs rural population, another mitigating factor that is driving these maps? OPM Staff: To build on some of the prior comments - an option here would be to report the % of the population living in high pollution tracts (rather than the % of tracts, which is just a geographic unit)	Socioeconomic factors are reported based on percentages to take population density comment into account. CIRCA incorporated OPM and CT Data Haven's suggestion about reporting the % of the population affected into the pop-up information boxes.

CT Data Haven Staff: Agree with OPM, that's an approach we often use (exposure metrics) - can also calculate these by % of child population, % of sensitive populations, etc.	
What is the pollution index, understanding that, what are we trying to highlight or normalize that? What is the obvious or underlining statement besides the historical and the population in these maps?	Discussed in meeting – redlining, the maps are following the major highways. Have to be thinking about the historical context on the way that the state has been populated. CIRCA noted in the meeting that users can remove the socioeconomic factors to see the pollution burden alone.
State GIS Office Staff: Seeing a map that is more based on development, not seeing anything unique with these maps.	Responded to this comment during the meeting: the historical or developmental issues are not new. The tool just makes it transparent and visible.
Recommendation: explaining the pollution burden index and the amount of data layers and what does that the percentile actually mean.	Narratives in accompanying resources and full report address this.
What is the purpose of these maps? Funding? Education in these high burden areas? How is this tool end result of the study?	This whole project came out of the GC3. CIRCA has prepared resources to help users understand the purpose and potential applications of the tool.
Index that combine several things, how do you weigh things? Less understandable when you combine layers. Unless you understand the underlying factors, it is not all that useful for combining multiple layers.	See earlier note from July meeting answering the weight question.
Does everyone in one of the areas that are darkened, area in Putnam identified in red, New London that is red and the red in Suffield, are they are all the same issue? What does this mean to me if I live in those areas?	Combination of all the layers, if you want to see the issue within in your community, you can check all the indicators, where it would be the problem. Can click on the tract and see what issues there are – Not every tract has the same issues.
Trying to understand the details to understand the impact because it is a bit hard to do it with the data is provided, perhaps have a better resolution and use census block. (If you have a property on the edge of the tract, what does that mean for that property, what does that mean in relation to the index?)	Census tract was selected as a scale as a "middle ground" between point locations for facilities and town-level DPH data. In addition to that, in our previous conversations with CT Data Haven, we learned that block groups have significant error and accuracy issues. Census tracts are more accurate and reliable.
Wanted to have time to look at the data that is used for the layers.	During meeting Dr. Onat noted that she will send individual presentations for those who have shared the data. Any type of comment will be received in 10 days to 2 weeks. Invite CIRCA if there are meetings that discuss the

	layers and the presentation of the data from the departments that sent it in
CT Data Haven Staff: This is a great start to explain the model, but for reporting to the public, there may be better ways to represent the data than a map. For the reasons the GIS Office suggests, we often avoid maps and use other types of data visualizations (such as bar charts by exposure category, scatterplots, etc) to represent the most important relationships in the data. There are examples in statewide reports such as our Community Wellbeing Index and Health Equity Report and on sites like ProPublica/NYTimes that frequently cover environmental or social inequities across geography.	CIRCA will take these suggestions into account for engagement materials to help users understand the data relationships.

December 9th and December 12th 2022 - State Agency Open Call Meetings Organized by OPM for Questions and information, Version 1.2

Suggestion/Comment	**Response**
Why don't we use this tool for grass roots organizations?	CIRCA prepared a document for ideas of using the tool and use of the tool for different stakeholders.
Is SVI from CDC related to this?	Yes, SVI uses census tract information as we do and we share common layers as well. 2.0 added the CDC SVI as context layer.
Are there any action plans for public? How is the community involvement is outlined	Community engagement during the tool development process included five MTAC meetings and five public evaluation/feedback sessions. CIRCA also prepared a document with ideas of using the tool and uses of the tool for different stakeholders, to be available alongside the tool on the project website.
How can municipal government use this? We don't want to put the burden on them to figure out	CIRCA prepared user guidance materials as well as a document with ideas for using the tools for different stakeholders, available alongside the tool on project website. Sustainable CT can also use the tool, a specific guide for how they can use it for their work with towns can be considered in future versions.

February 24th, 2023 – Updates, Version 1.2

Suggestion/Comment	**Response**
CT Insurance Department Staff: Will power plants be included? Mentions Killingly. What about the	Data about trains coming and going is very dynamic, CIRCA does not have that data.

train accident in Ohio and trains transporting products through neighborhoods in Connecticut.	DEEP Staff notes that the Killingly power plant was not issued a permit, but other facilities, as we permit them at DEEP, will be added to the tool.
CT DEEP Staff: So you're calculating the point density within the census truck so there's no radius of each facility?	CIRCA explains the buffer methodology – the closer a census tract is to the parcel containing the point location of a facility, the higher the score.
CT DPH Staff: I just want to say thank you for all the work that you've done and working with us and working with our data managers. As you know, our Commissioner's office is really interested in possible presentation. So we're still working toward that end. But this it looks amazing, and I know that we still owe you information, too. So DPH Staff and I were just chatting about that. So we have some narratives from our data managers that still owe you information so. But good work here. It's excellent.	Thank you, it is a team work, we are still working with DPH.
CT Insurance Department Staff: This is very impressive. And you know, John, as I'm listening to this, I think of the call you and I were on yesterday when we're asking questions about economic, you know Justice 40. What are the impacts when you know a town is applying for grant dollars? I think DEMHS might be able to use this, towns can use this when they're developing proposals for grants that they can show the economic justice impacts to communities directly.	Thank you.
CIRCA Staff: You mentioned the idea that some of the data censored. Could you describe why that's the case, and I'm sure there's a very good reason, but I just imagine that it could create questions. Suggests explanation for why information is censored so the public has that explanation.	The censored information is generally for health-related data in the tool. If in town any cases reported less than 20, there's the potential for making a person identifiable.. DPH doesn't want to give any personal identifiable information, and that's one of the reasons that they are censoring their data in areas where there is a small number of cases.
CT DPH Staff: The individual information is quite sensitive and held secure within our department and between us and local health departments. Narratives are very important to be able to explain this. CT DEEP Staff suggests finding a better word or phrase to use other than censored.	CIRCA took out the word "censored" and replaced it with "Any rate <20 is considered unstable and not shown due to data privacy."

CIRCA Staff agrees, maybe the group can think of different terminology, maybe emphasize the privacy angle. CT DPH Staff notes that individual information can't be shared. CT DEEP Staff suggests referring to HIPAA and legal reasons for why some data is confidential/protected. Go back to the law to protect the tool.	
CT DPH Staff: The tool can be very technical and a plain language explanation is needed for the narratives. CDC has guidance and DPH is working on this.	Health data narratives were sent to DPH for their review. The DEEP data narratives were sent to DEEP for their review. CIRCA prepared multiple user guidance documents.
CT DPH Staff: You're having the public forums. What's the setup for that. Do you have questions that You'll be asking folks? Are you just giving them this presentation?	CIRCA spent two MTAC meetings designing forum agenda. Forum agenda included opening from host organization and DEEP, presentation about tool, hands-on demonstration and exploration period of the tool using iPads, gathering feedback about the features of the tool, what's missing, what's easy or difficult to use, any other comments from attendees. Fact sheets were also distributed at each forum. Forums closed with thanks you and gift cards for participants. Food was provided at all forums.
CT DPH Staff noted that especially with health data people tend to have this need to infer causality or causation or correlation. I just want to make sure that the messaging behind that is very crystal clear to everyone that these maps do not indicate causation.	DEEP Staff emphasizes that communities in higher-scoring areas have the potential to be unhealthy and need attention/work, but are not definitely unhealthy. During the public forums all messaging was very clear that no causation was indicated. CIRCA and DEEP prepared a disclaimer that was reviewed by DPH. The fact sheet also had a bullet point list of what the tool can and cannot do that was reviewed by DPH.
CT DPH Staff: People have a lot of questions about health and environmental. We should talk about possibly inviting the local Health Department to making sure the local health is engaged.	Waterbury forum was held in partnership with Waterbury health department. Ledge Light Health district was invited to partner on Groton forum, but did not choose to do

	so – was still invited to participate as an attendee.

June 29th, 2023 – Joint Advisory Committee Meeting, Updates, Version 1.4

Suggestion/Comment	Response
CT DPH Staff noted that some of the other states with EJ tools have all narratives and indicator details on one main document.	Yes, CIRCA also has a full report. The version 1.5 report was sent to SDAC and MTAC prior to this meeting and shared again during this meeting.
CT DPH Staff: Has the final report been shared with DPH?	The final report draft was distributed to the SDAC members to share within their respective departments. After this meeting, the document was shared again.
CT DEMHS Staff asked whether there would be additional process/updates after 2.0 version in August. Clarity on project timeline.	CIRCA's contract ends in August. For all the feedback from public comments period, MTAC members, and community forums, we are categorizing in them in 2 categories. The first is the things we can complete within the project timeline. Some of the things are either beyond our platform capacity or will take too long or won't be possible. So those are going to be included in the road map of future recommendations for beyond the project period.
CT OPM Staff: The community engagement is a big part of this project as to answer the questions. Who will be doing that after August 18th? Documentation is helpful but having a human being there answering questions is helpful. How would that will be managed in the future? So, like DPH releases a new version of whatever data set is in. Here there's new brownfields data or whatever like those, are those will continue to be updated in the future? That will change what's in the mapping. The changes in the mapping will have impact on communities and their ability to use it. So do you have a sense of how will the updates to the platform be managed after August? It sounds like that's also through DEEP?	DEEP hired an Environmental Analyst to work on the management of the tool. CIRCA also shared the draft file for plain language two-pager on how people can use the tool with the SDAC and asked for feedback in a week.
CT DEHMS Staff asked about actions for state government agencies, and followed up with the following: Thank you for answering all my questions earlier today. My feedback would be to add an "actions for state agencies" section to this document, for transparency so constituents can know what the state possibly plans to use this tool for on our end. That would be my feedback. Thank you for the opportunity.	CIRCA added a section of actions for state governments to the document as suggested by DEMHS Staff.

August 8th , 2023 – Joint Advisory Committee Meeting, Updates, Version 1.9

Suggestion/Comment	Response
will there be additional versions of the screening tool	CIRCA responds as they are contracted for version 2.0 and beyond that is up to DEEP
what was the most common feedback and what was the most surprising feedback.	CIRCA received good feedback about improving the language clarity and accessibility. one piece of surprising feedback was that users wanted town-level Department of Labor unemployment data rather than the ACS tract-level data. Community members were asking what the next steps are for bringing benefits and opportunities to their communities, while state agencies were asking how the state will be using the tool and what the specific purposes are. This is an ongoing conversation that will need to involve DEEP and the other state agencies
DOT will likely have a new impervious surfaces layer by the end of this year.	CIRCA uses 2021 MDCL impervious data and updated after the comment period.
the northwest and northeast corners of the state are missing FEMA web layers, and FEMA does not distinguish in these areas between area of no minimal flood hazard and no data.	CIRCA agrees that this is a data limitation.
why cancer risk was moved from health sensitivity to potential pollution exposure	CIRCA explains that this layer is actually measuring carcinogenic air pollution, so state agency contacts recommended moving this to the potential pollution exposure category.
finding this tool using Google is difficult unless you know exactly what you should search for	CIRCA will work on website search tags
whether the public outreach included outreach to municipal planning and zoning. The suggestion is as the tool evolves there is ongoing communication with local planning staff	CIRCA responds that the Groton forum involved municipal staff and the Waterbury forum involved the local health department. However, more engagement would be helpful, as this is a living tool.

a list or chart of all the indicators included in the tool, as well as their data sources, as well as a short description of what it represents	CIRCA includes that to the website and report.

Feedback Specific to the Department of Public Health in Chronological Order

December 16th, 2022

Suggestion/Comment	Response
DPH Staff provided town-level rates, yet the map displays tracts which have been assigned the town rate. This is incorrect and misleading as we know tract-level rates vary within a town	From second email: Discussion with CIRCA suggests that this cannot be resolved in composite index calculation but she will remove the display of tract boundaries from the maps based on town rates.
First email: There is no data value for the state average or the US average to provide a sense of relative difference in a local area from state and national rates. Second email, continuation of conversation: • CIRCA will add this to the narratives if DPH provides it. We should add another column to the dataset with the state rate.	State rates are presented when DPH shared with CIRCA. - Complete
First email: An overall index value (presumably comprised of all DPH metrics collapsed into a single value per tract) is provided in the tool which we believe is difficult to interpret and thus lacks meaningful value Second email, continuation of conversation: This will continue and they will attempt to provide guidance on interpretation.	Added narrative to the final report and disclaimers to include limitations of tool and guidance for users.
First email: Presentation of the metrics as decile percentiles makes interpretation difficult. This appears to be the national standard though some other state's EJ Mapping Tools have the option of toggling between decile ranges and rate ranges. The group agreed that ranges of the rate should be listed for each decile/color-level in the legend. Second email, continuation of conversation: • The scale will now refer to a rank of 1-10 rather than a decile, although the 1-10 rank is based on deciles. • CIRCA will add rate ranges for each rank level if DPH provides them. My suggestion would be that we revise the datasets we	Done – Ranges added in the pop-ups for the individual indicators from DPH data.

originally provided to create the decile rank after excluding censored towns and add a column with the rate range and a standard error or confidence interval (we'll need to choose which).	
First email: The calculation of the deciles may have included censored data. Revise as needed Second email, continuation of conversation: She will have these revised or we will resolve this when we apply the rate ranges discussed above.	Done – see later notes from January 2023.
Darkest color = 10 (9.2-9.8)	Done
First email: Indicators as listed in the mapping tool are non-specific. "Diabetes" is presented but it does not specify in the tool that the metric is diabetes mortality (as opposed to prevalence). This can be resolved through communication with DEEP/CIRCA Second email, continuation of conversation: She will make changes with input from DPH data stewards.	Done
The current presentation of the mapping tool lacks sufficient narrative and messaging as to the purpose and value of the tool. It was noted that Colorado serves as a good example of such messaging.	Done – additional narrative added.
First email: It is easy for the public to infer causality when overlaying metrics. The tool and component narratives need to address this. Second email, continuation of conversation: CIRCA indicated that they will work on communication about this.	Done – added text to narrative in final report and disclaimer.
The individual narratives for each indicator were drafted by CIRCA without input from DPH. DPH staff are currently providing comments on the individual narratives and will send them to DEEP/CIRCA asap	We received comments from the data stewards and incorporated them.

December 19th, 2022

Suggestion/Comment	**Response**
CT Tumor Registry has asked that any cancer data be removed	Done

January 18th, 2023

Suggestion/Comment	**Response**
DPH will suppress any count <11 (RSE >30)	Done

• Covers both confidentiality concerns and rate reliability concerns	
DPH will not provide any censored tracts or towns in the dataset – only provide data that we want displayed and released • Deciles will be calculated using only displayed data • A state rate will be provided and may be indicated with a town code or tract code of zero.	Done
Each dataset should contain: • Town (or tract) • Count • Decile rank • Decile rate range • Town (or tract) rate • SE (standard error of the rate) • LCL (lower confidence limit) • UCL (upper confidence limit)	Done for all DPH layers

DPH asks for the following to be included in the map, legend, and table displays (see attached mock-up)
• Legend values display the decile rank and the associated rate range
• Map hover-over contains decile rank, rate, LCL, UCL for each town
• Map legend to show decile rank and associated rate range
• Associated tables provide the following fields:
  ○ Indicator/Metric
  ○ Town (or tract)
  ○ Years in dataset
  ○ Town (or tract) count
  ○ Town (or tract) rate
  ○ SE (standard error of the rate)
  ○ LCL (lower confidence limit)
  ○ UCL (upper confidence limit)
  ○ Decile rank
  ○ Decile rate range
	• Legend values display the decile rank and the associated rate range - Decile Rank is Done, arcgis doesn't allow a feature for special rate range display yet.
	• Map hover-over contains decile rank, rate, LCL, UCL for each town – Done for pop-up
	• Map legend to show decile rank and associated rate range - Decile Rank is Done, arcgis doesn't allow a feature for special rate range display yet.
	• Associated tables provide the following fields:
	  ○ Indicator/Metric - done
	  ○ Town (or tract) - done
	  ○ Years in dataset – done
	  ○ Town (or tract) count – tract id is shared.
	  ○ Town (or tract) rate – done
	  ○ SE (standard error of the rate) - done

	○ LCL (lower confidence limit) – done ○ UCL (upper confidence limit) – done ○ Decile rank – done ○ Decile rate range – done

March 20th, 2023

Suggestion/Comment	Response
For fact sheet: The data is represented as tract when in fact all the DPH data is by town.	Added short sentence to the section on how to read the map: "Public health data is ranked by town." This is further addressed in the screening tool.
For fact sheet: Page 2 > Top justify all indicator columns, so the first bullet is at the top of the column	Done
For fact sheet: Can we reword "Does not model the positive or negative likelihood of an individual's risks for poor health outcomes." to be more straight forward and clear to the average person. Something like, "Does not establish causal associations between environmental risks and health."	Done
For fact sheet: Change the word model to something easier to understand like "convey" or "indicate" "Does not model the overall pollution burden nor reflect the number of individuals that may be affected by pollution."	Done
For fact sheet: Same goes for "Does not model the positive or negative likelihood of an individual's risks for poor health outcomes."	Already changed this earlier – done.
For fact sheet: Under "This map does", "Identify the degree to which a community, by census tract, is vulnerable due to socioeconomic and health disparities." Suggestion is to frame the description in alignment with the title: Identify the degree to which a community, by census tract, is burdened by environmental harms and risks.	Done
For fact sheet: I also really like Colorado's "does not" list. They have "Does not provide information about an individual person's health status or environment." Perhaps we can add something like this, again, just to be crystal clear to folks who are unfamiliar with this type of data.	Done
For fact sheet: Page 1> Under the "How to read the map" it is stated that "Higher potential risk = higher rankings = darker areas". Suggestion for something like: Rankings are scored from 0 to 100, with 0 indicating no potential risk and 100, highest potential risk.	This is not quite accurate (it's potentially misleading to say any areas have zero risk at all) and does not reflect the most recent scale. Left our original text in place.

For fact sheet: "Darker areas represent higher potential cumulative…." Suggestion, something like: On the map, low indicator rankings are identified with light-colored areas, and higher rankings range from light blue to darker blue.	This suggested wording seems more confusing to us. Left our original text in place.

May 15th, 2023

Suggestion/Comment	Response
Include a paragraph in each narrative explaining to the user how the indicator relates to environmental justice.	Every indicator has a two-page data description that explains why this indicator has been chosen, supported by peer-reviewed articles to back up the claim. The two-pager includes: why this indicator is used, what the data represents, how the calculation has been done and what the map represents. This information cannot be put into a map tool, it is provided as a supportive material inside the report. We will put a direct link to it once it is complete.
For example, why was diabetes mortality included in a tool for environmental justice?	We have done a lengthy literature search to include this relationship as other indicators. Please check some of the sources that we cite and reviewed in the attachment.
Provide written examples of applied use cases demonstrating how each health indicator would be used per the goals of the tool.	It has been incorporated in the written materials when it is needed.
Remove the use of the term 'risk' (which has a specific meaning in public health) and replace with language that better articulates the applied use or value of the tool.	We will use the term "impact" to describe ranks. The word impact appears on page 5 of 6 in the Int. J, Environ, Res, Public Health 2019, 16, 4470. See link below: https://doh.wa.gov/sites/default/files/2022-07/311-011-EHD-Map-Tech-Report_0.pdf?uid=6430a06d59e7f https://www.epa.gov/sites/default/files/2015-08/documents/deh_english_100-f-07-020.pdf https://calgreenzones.org/calenviroscreen-a-critical-tool-for-achieving-environmental-justice-in-california/ CALlEnviroScreen 3.0 (CES 3.0) is a place-based cumulative impact screening methodology that uses 20 indicators to provide a statewide ranking of California's 8,000 census tracts. In this context, a "cumulative impact" assessment examines "multiple chemicals, multiple sources, public health and environmental effects, and characteristics of the population that influence health outcomes." Areas with high concentrations of these factors have a greater "cumulative impact." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5800177/

Revise the content and language used in the Fact Sheet for the 4 key points about what the tool does. DPH can meet with DEEP staff to discuss strengths and limitations of the statements and how they could be improved.	CIRCA staff already revised the content and language used in the Fact Sheet based on the feedback we previously received from DPH Staff. CIRCA staff expressed that we are open to receiving/reviewing another draft if DPH wants to send one.
Revise the content and language of the disclaimer and the Fact Sheet to align with the reading level of the audience. The CDC guidance is for public health communication to be written at an eighth-grade level. The Federal Plain Language provides guidance on using clear, simple wording and sentence structure (e.g., avoiding the vocabulary that is common among academics) and has the benefit of being written for government communications.	The disclaimer was previously sent to DPH for their review and the feedback was incorporated.
Add explanatory language to help the user better understand the environmental justice index rank as a forced decile rank based on rate range of non-censored geographies.	All these explanations are inside the tool on " Information" widget and also inside the report.
Without further explanation, it may not be clear to the layperson that communities are being ranked against one another	All these explanations are inside the tool on " Information" widget and also inside the report.
It also may not be clear that communities with different ranks may not actually differ meaningfully from one another. Higher decile rank does not indicate higher risk.	Some of the DPH data stewards already provided state rates to present this. We present the state rates to avoid this confusion.
Add explanatory language that the DPH-sourced measures were provided at the town level and that any presentation of the DPH-sourced measures at the tract-level or in the index measures are the town values presented as tracts and may not accurately reflect the variability in rates among tracts within a town.	The map itself is drawn by town level for the DPH sourced data. It is also mentioned in our report that the different levels of data presentation and how it may not reflect the actual tract levels.
Present the tool and narratives to the DPH subject matter experts for review prior to presenting the tool to the Commissioner of Public Health.	We have already presented the narratives to the DPH subject matter experts for review. In fact, we had multiple meetings with the DPH data steward and exchanged multiple emails to obtain the necessary data and narrative edits from them. We

	received confirmation that the revisions have been incorporated. The only departments that have not provided the edits are childhood elevated lead levels, heat stress and asthma ED rates, and Lyme disease.
Present the tool to the Commissioner of Public Health with the requested changes in June 2023	Presented to DPH Commissioner in June 2023
DPH counsels against using 1-year data due to known variability in rates due to small numbers (e.g., censoring RSE<30) and time-based events (e.g., Sandy Hook, COVID).	Except for Asthma Emergency Department Rates, none of the DPH provided data are 1-year data. We contacted Asthma data stewards to provide multi-year data.
For example, metrics in the tool that use BRFSS data that was not sourced from DPH present 1-year estimates that the authors of the tool have modeled down to the tract level. DPH intentionally does not release BRFSS data for small geographies due to challenges with statistical validity.	The only BRFSS data that we use are Depression and Mental Health. These model-based estimates are provided in census tract level by CDC.
Focus on refining a handful of high value indicators before expanding the tool to additional indicators.	Feedback from community feedback sessions and MTAC members advocate for the inclusion of more indicators rather than less.

July 11th, 2023

Suggestion/Comment	**Response**
The scope of this tool should be clearly defined for DEEP, CIRCA, and DPH to avoid any drift into climate and health disparities. Particularly since the recommendation for this tool came out of the GC3, there may be expectations from some stakeholders that this tool is addressing climate and health disparities. If the scope does not include climate and general health disparities, then those indicators should be removed. If the scope does include climate and general health disparities, then appropriate indicators should be discussed.	CIRCA agrees to emphasize the tool is only an Environmental Justice tool. We will add a statement to the report saying that this is not a tool to display climate and health disparities. CIRCA has a climate change vulnerability index to reflect on the climate disparities separate from the EJ tool. Environmental justice has some inevitable overlaps with climate change--including around issues like urban heat islands and lack of tree canopy in low income neighborhoods. But the messaging certainly will stay consistent that this is not a climate change tool. The full report and glossary also provide definitions of environmental justice.

Current and accurate health data are generally not available at fine levels of geographic resolution. Thus, there exists an ongoing trade-off between accurate, available health data and tract-level health data. DPH does not have a recommendation to address this issue but raises it as a challenge that will persist over time.	Noted/agreed. The report text, fact sheet, and web tool all clarify that the DPH data is town-level.
Only include indicators with a) convincing scientific evidence that environmental factors impact the health condition and b) for which the health condition metric measures/represents the impact of ongoing community burden. • Remove health indicators aimed at climate change (Heat Stress, Lyme) • Remove health indicators not scientifically associated with environmental exposures (Lyme, Depression, Poor mental health). • Change from mortality to prevalence (cardiovascular disease, diabetes)	CIRCA agrees to remove the Lyme Indicator and the Heat Stress Related Emergency Department visits layer. It should be noted that heat is an EJ issue, and DEEP focuses on increased heat in urban communities. The EJScreen includes a layer for impervious surfaces and CIRCA is currently preparing indicators for tree canopy cover and urban heat islands based on other feedback from MTAC and the community forums. So although heat effects will not be included as a health layer, there will still be other indicators related to heat effects. CIRCA received feedback during the community forums suggesting that depression and poor mental health should be kept in the tool. CIRCA will do additional research into the scientific literature. References include: Zundel, C. G., Ryan, P., Brokamp, C., Heeter, A., Huang, Y., Strawn, J. R., & Marusak, H. A. (2022). Air pollution, depressive and anxiety disorders, and brain effects: A systematic review. Neurotoxicology, 93, 272–300. https://doi.org/10.1016/j.neuro.2022.10.011 Zhang X, Zhang X, Chen X. Happiness in the Air: How Does a Dirty Sky Affect Mental Health and Subjective Well-being? J Environ Econ Manage. 2017 Sep;85:81-94. doi: 10.1016/j.jeem.2017.04.001. Epub 2017 Apr 5. PMID: 29081551; PMCID: PMC5654562. Qiu X, Shi L, Kubzansky LD, et al. Association of Long-term Exposure to Air Pollution With Late-Life Depression in Older Adults in the US. JAMA Netw Open.

	2023;6(2):e2253668. doi:10.1001/jamanetworkopen.2022.53668 Zundel, C.G. 2022. This is the impact of air pollution on your brain and mental health. World Economic Forum, Nov. 29, 2022 CIRCA will change from mortality to prevalence.
Move indicators that are not health outcomes to the other indicator groups • Disability to Socioeconomic • EPA Air Toxins Assessment Cancer Risk to Potential Pollution Exposures • EPA Air Toxins Assessment Respiratory Risk to Potential Pollution Exposures	Continued discussing with DPH Staff. CIRCA never states in the report that the composite index is a health "outcome". We also repeatedly mention in the report that it is not an outcome, so as to not create correlation and causation relation. The composite index category represents a "Health Sensitivity". It is a general condition of the community group to make them more bio-susceptible. Re: disability bullet point: CIRCA notes that disability is a health issue that make the community members more sensitive. CT DEEP Staff agrees, given the wide definition of disability- which may include medical disabilities, for example asthma, COPD or diabetes. CT DEEP Staff notes that USEPA just added disabilities to their definition of environmental justice / CT GC3 recommendations to include disabilities under vulnerability. CT DEEP Staff asks whether the dataset can be narrowed down further. Re: EPA Air Toxins Cancer and Respiratory Risks: the Mapping Tool Advisory Committee suggested to move these two EPA Air Toxins Assessment Risk data to Health Sensitivity because they are related to making the health sensitive in terms of cancer and respiratory. They are model-based results but mark which regions will be impacted the most. The general audience also has hard time associating them otherwise. CIRCA will wait for public comment's response to decide on moving these layers to Potential Pollution Exposure for version 2.0

	The issues above are resolved in the most recent email exchange from July 25, 2023.
Childhood Elevated Lead – Narrative and data needs a full revision by DPH before release and will be provided by DPH to CIRCA on Friday morning. • The data represents only one year but should represent 2016-2020 at the town level. • The summary should indication how the data was censored. • The narrative sentences should be refined, and particularly should mention older, poorly maintained housing and lead paint exposure.	The current Childhood elevated blood lead levels data was subtracted from version 1.5 before the public comment period on July 17th. The draft report reflects version 1.5. When new data and narratives come, CIRCA will update the final report. The new data representation will be added to version 2.0. CIRCA requests decile ranking, standard error, upper and lower confidence limits for each town and state. CIRCA will use the new narrative when it is provided by DPH.
Cardiovascular Disease Mortality – DPH supports adopting the CDC Places prevalence data in lieu of the mortality data as prevalence is more representative of the burden of cardiovascular disease in a community than mortality. • Prevalence data at the town level is not available from CT DPH BRFSS. Other states have used the one-year CDC Places data for this indicator. Although available, the CDC Places data would likely not meet DEEPs statement of high-quality and precise data. If possible, the data should be combined into 5-year aggregations to reduce many of the following limitations (which should be conveyed in the indicator narrative/final report): one-year estimates are subject to temporal events (COVID, Sandy Hook), small sample sizes (~500 per original sampling area of multiple towns), self-report of cardiovascular disease status, and modeling from the multi-town level down to the tract level resulting in smooth but likely inaccurate estimates. • The scientific association of CVD with environmental exposures should be added to the narrative. • The narrative should be adjusted for reporting prevalence as opposed to mortality. The DPH data steward is unable	The current dataset was subtracted from version 1.5 before the public comment period on July 17th. CDC PLACES has previous year data of prevalence rates in percent. CIRCA either needs: 1) Guidance on how to aggregate different year percent values to create one datasets of 5-year for census tracts/towns or 2) An alternative source with clear downloadable link and metadata for 5-year aggregate levels. If DPH cannot guide CIRCA on the either perspective, CIRCA will use CDC PLACES one year data. CIRCA/DPH meeting planned for 7/28 to discuss this. CIRCA will use the new DPH narrative when it is provided. CT DEEP Staff informed us that CT DPH will provide the language on indicators for cardiovascular and diabetes; does not have background to link to EJ--DEEP and CIRCA need to make that link.

to make those revisions before the public comment period, but we can provide this revised narrative during the public comment period.	
Diabetes Mortality – DPH supports adopting the CDC Places prevalence data in lieu of the mortality data as prevalence is more representative of the burden of diabetes disease in a community than mortality. • Prevalence data at the town level is not available from CT DPH BRFSS. Other states have used the one-year CDC Places data for this indicator. Although available, the CDC Places data would likely not meet DEEPs statement of high-quality and precise data. If possible, it should be combined into 5-year aggregations to reduce many of the following limitations (which should be conveyed in the indicator narrative/final report): one-year estimates are subject to temporal events (COVID, Sandy Hook), small sample sizes (~500 surveys per original sampling area of multiple towns), self-report of diabetes disease status, and modeling from the multi-town level down to the tract level resulting in smooth but likely inaccurate estimates. • The scientific association of diabetes with environmental exposures should be added to the narrative as DPH is not familiar with the link between environment and diabetes independent of co-morbid cardiovascular health conditions. • The narrative should be adjusted for reporting prevalence as opposed to mortality. The DPH data steward is unable to make those revisions before the public comment period, but we can provide this revised narrative during the public comment period.	The current dataset was subtracted from version 1.5 before the public comment period on July 17th. CDC PLACES has previous year data of prevalence rates in precents. CIRCA either needs: 1) Guidance on how to aggregate different year percent values to create one datasets of 5-year for census tracts/towns or 2) An alternative source with clear downloadable link and metadata for 5-year aggregate levels. If DPH cannot guide CIRCA on the either perspective, CIRCA will use CDC PLACES one year data. CIRCA/DPH meeting planned for 7/28 to discuss this. CIRCA will use the new DPH narrative when it is provided.
Low Birthweight Rates – Association of LBW with environmental exposures should be added to the narrative.	CT DEEP Staff notes that making the link between the indicators and EJ will be a task for CIRCA/DEEP.
Heat Stress ED Visits – Drop as this indicator is climate related. Alternatively, justify its non-climate association with environmental health.	The current dataset was subtracted from version 1.5 before the public comment period on July 17th. This layer will not be included in

	Version 2.0, although it should be noted that other layers related to heat will be included (tree canopy, impervious surfaces).
Lyme Disease Rates – Drop as this indicator is climate related. Alternatively, justify its non-climate association with environmental health. The one article cited postulates several hypotheses for why there may be an increased risk of LD in communities of color but this hypothesis is not supported by data or scientific evidence.	The current dataset was subtracted from version 1.5 before the public comment period on July 17th. This layer will not be included in Version 2.0.
Depression – Drop as this indicator has not been justified with a scientific association between environmental exposures and depression. Poor Mental Health - Drop as this indicator has not been justified with a scientific association between environmental exposures and depression. • Note: Displayed rates do not appear to be ranked and/or displayed correctly. According to this map, 1/3 of the state has a rank of 0-1. • Note: Displayed rates do not range in rank from 1-10 – there are no instances of a rank below 3. Even the fact sheet does not show a rank below 3.	Depression and mental health has been strongly requested by public groups as they make them sensitive. See earlier list of scientific references. CIRCA will check the data ranges again.
Population with Disability – Move to socioeconomic as disability is a health state, not a health outcome, and disability data comes from the same data source (ACS) as the other socioeconomic indicators.	Continue discussing with CT DPH Staff (see later email exchange from July 25, 2023)
EPA Air Toxins Assessment Cancer Risk and EPA Air Toxins Assessment Respiratory Risk *(same suggestions for both indicators)* – move to Potential Pollution Exposures Concerns as this indicator is not a health outcome but an indicator of exposure. Notes: • Displayed rates do not appear to be ranked and/or displayed correctly as only 2 colors are displayed. • The methods section is incorrect, it has been cut/pasted from the Depression indicator. • The data for both Air Toxins indicators are based on modeled data, not actual measurements. EPA's website says that the	Percentiles represents the data available is below a certain range. This layer only has 2 values for the entire state so it is displayed correctly. Thanks for bringing this typo problem. We will address it Correct, model based results (Ozone, PM 2.5, BRFSS data from PLACES etc). has been used for representing a pattern. Even though a national distribution shows more variety, these EPA layers shows a pattern that is important to reflect in environmental issues.

AirToxScreen results apply best to larger areas, not specific places.	
ACS data are based on a survey and have margins of error, which are often substantial (sometimes 50%) at the town and tract levels. Since all of the socioeconomic indicators come from the ACS, it may be beneficial to add a paragraph to the beginning of the section discussing the limitations of ACS data. • The ACS chart (shown below) has errors.	CIRCA agrees to add this limitation to the report. Thanks for pointing out this typo.

July 25th, 2023 – Following up on DPH's Data Suggestions
Hi [CT DPH Staff]

I would like to thank DPH again for submitting written feedback to EJ tool on 7/12/23. I would like to follow up on two DPH comments that require more clarification from our end so we can address them properly.

1. Responding Although available, the CDC Places data would likely not meet DEEPs statement of high-quality and precise data. If possible, the data should be combined into 5-year aggregations to reduce many of the following limitations (which should be conveyed in the indicator narrative/final report): one-year estimates are subject to temporal events (COVID, Sandy Hook), small sample sizes (~500 per original sampling area of multiple towns), self-report of cardiovascular disease status, and modeling from the multi-town level down to the tract level resulting in smooth but likely inaccurate estimates.
   CDC PLACES has previous 3-year data of prevalence rates in percentages (2020-2021-2022). CIRCA needs guidance on aggregating different year percent values to create one dataset of 3 years for census tracts/towns. We found that simple averages are poorly performing, especially in low-population areas. We also found that, generally, harmonic averages perform better for aggregating multiple years. However, if CIRCA doesn't get a health expert's suggestion on this, we will only use 2022 prevalence model estimates. Can you please give us guidance that if it is ok to take harmonic averages of 3 years or use one-year data?

2. The second comment is about the indicators inside the Health Sensitivity category. We have a major category called "Health Sensitivity". DPH suggested taking out disability and EPA air toxin assessment Cancer and Respiratory Hazard Risk from this category. Our Mapping Tool Advisory Committee suggested moving these to Health Sensitivity because they are related to making the health sensitive regarding cancer, respiratory, and disability. EPA's Cancer and Respiratory risks are model-based results but mark which regions will be impacted the most. The general audience also had a hard time associating them otherwise. Can you please explain the reason for your suggestion on why these three layers should be outside of this category?

Thank you so much for your help. Greatly appreciated.

DPH Response:

I suggest we have a meeting to discuss the points below so we can flush out a solution. I have availability Friday 10-12:30 pm and 3-4 pm.
Quick points for discussion:

- I've reached out to [CT DPH Staff] who is our analyst for the BRFSS to see if she could provide you with guidance for using CDC Places data. – We arranged a meeting with DPH to get guidance
- For the health sensitivity category, perhaps it would be helpful to create an operational definition of "health sensitivity" so the users can be clear about what does and does not fall within that index. DPH has considered these to be tied to health outcomes, although you have indicated that the health sensitivity index is not specific to health outcomes. – CIRCA will prepare a more comprehensive explanation
- Public health considers disability to be a social determinant of health, not a health state (https://disabilityinpublichealth.org/social-determinants-of-health/) and why we feel it belongs with the other ACS indicators. – Since there is a reference CIRCA will add this to socioeconomic factors in ver 2.0
- *EPA Air Toxins* Indicators are an estimate of risk based on an estimate of exposure and EPA's EJ Screen includes this indicator in their Pollution and Sources Category. – CIRCA will add this to Potential Pollution Exposure with the EPA tool as justification.

July 31, 2023 - DPH Public Comment on the EJ Mapping Tool

Suggestion/Comment	Response
DPH Public Comment on the EJ Mapping Tool We have been pleased to collaborate with DEEP/CIRCA over the past year in the development of the EJScreen tool. In our work together, DEEP/CIRCA have made substantial changes to the EJScreen tool which have resulted in a better tool to serve the residents of Connecticut. 1. Understanding the scope of the EJScreen • The scope of this tool should be clearly defined to avoid drift into climate and health disparities and to avoid cross-over or confusion with other maps/tools released by DEEP in the future. - The Report is at times contradictory about whether it includes or does not include climate change as within its scope. Addressing the scope of the tool consistently within the document will add clarity as to how the tool should be used and interpreted.	The draft report states "The primary purpose of the CT EJ Screen tool is to provide a data-driven framework to assist policymakers, planners, and the public in understanding the environmental burdens and vulnerabilities within different communities. The tool employs a comprehensive approach, examining various indicators related to environmental exposures and their potential health implications." (page 7). The version 1.5 and 2.0 do not include climate change related indicators. We will repeatedly state that in the report version 2.0.
2.Methodology, Interpretation, and Guidance • We acknowledge that the authors have made notable improvements in how they educate on the utility and inherent limitations of the tool. We understand that possible misinterpretation of the tool is unavoidable, and we offer further suggestions below for continual improvement. - Make the disclaimer splash screen more concise and visually easier to read to improve the likelihood that the user will read the screen. The fact sheet does this very clearly and could be the main disclaimer with a link to	The disclaimer text was crafted with multiple revisions by DEEP and DPH staff, so CIRCA prefers not to remove the text contributed by these agencies. We have adjusted the spacing to make the disclaimer more readable without removing any text.

the more detailed disclaimer discussion.	
- Use an "I have read and understand the information in this disclaimer" rather than the simple OK box (similar to how town assessor GIS maps work).	Done.
- Do not allow the user to opt out of the disclaimer in the future.	Done
In the EJ Mapping Tool, the health indicators are presented using decile rank based on a range of town or tract rates. Understandably, DEEP's decision to adopt a decile rank model was based on development of similar tools by EPA and other states. - From a public health perspective, however, such a display brings several challenges for assessing health disparities. If the intent is to compare geographies to one another or if the applied use, whether intended or not, is comparing geographies to one another, the display of rates by geography should be based on statistical inference – which is a fundamental component of epidemiology and assessing health disparities. • - A decile rank alone does not provide any measure of the magnitude of the difference between two ranks. For example, a decile rank of people whose heights range from <5ft to >7ft may be informative while a decile rank of people whose heights range from 6ft to 6.5ft may not. Statistical inference is needed to determine meaningful differences. - Consider enhancing the description of rank using some of the language from the Report. Pages 27-28 include clarifying language that explains how the rankings generated by the tool are not reflective of specific numerical differences between each rank, they simply highlight that there is a difference.	CIRCA will include clarifying language about the displaying of rank and how it does only reflect a difference for health layers in the report. The aim of the tool is only to show the difference, not explain how much of the difference. Rank is just a placement within a series of data.
- Several efforts have been made in the past to create indices of overall health and health disparities for Connecticut, but the challenges associated with displaying multiple health indicators in a single index in a scientifically valid manner have yet to be overcome. As such, no health indices by geographic area have been published by Connecticut public health agencies.	CIRCA does not aim to create health overall index, however states that even with the caveats, it shows a health sensitivity. We will elaborate this caveat in the report.
• Accurate and reliable health data are generally not available at fine levels of geographic resolution due to concerns about confidentiality and statistical reliability. Thus, there exists an ongoing trade-off between the availability of health data that is useful (accurate, reliable) for decision making and availability of data at detailed geographic resolutions. DPH does not have a recommendation to address this issue but raises it as a challenge that will persist over time.	Correct, CIRCA will add specifically that any disparity below town level for DPH data should be examined with health professionals and cannot be shown for single indicators.
- Developing maps at smaller levels of geography must balance the need for information with the responsibility to be scientifically defensible. The poor reliability of many health statistics which are based on relatively rare events and/or limited sampling can defeat their intended use – which is to make meaningful decisions based on accurate, reliable data.	Due to this issue, DPH provided multi-year aggregated information for the DPH-provided layers. Unfortunately, CDC has not responded our request for data aggregation, so we state the caveat for prevalence rates.
• Verify that the method for assigning decile rank is consistent among indicators and performed after censoring for small numbers and unreliable rates.	CDC Places data table is updated. AirToxins do not have a range of information (generally

- Displayed rates do not appear to be ranked and/or displayed correctly in all indicators. AirToxins Indicators display as binary, yet the narrative says they are decile ranked. The indicators based on CDC Places data do not contain the complete range of decile ranks.	2-3 values per state). The same equation and calculations for ranks and percentiles eventually result in smaller range. This issue cannot be solved.
3: Indicator Selection • While the Criteria for Indicator Selection may work reasonably well for pollution sources and exposures, accurate health data are generally not available at fine levels of geographic resolution due to concerns about confidentiality and statistical reliability. - Several of the health indicators do not meet the Criteria for Indicator Selection specified in the Report, as they are not accurate/reliable at local levels (modeled estimates, single year estimates), not available for release for all geographies within CT (due to censoring), not available at fine levels of geographic resolution (all DPH indicators), and/or the methodology is not consistent or replicable over time (BRFSS prevalence indicators). DEEP should consider aggregating data over multiple years to reduce censoring and improve reliability.	CIRCA doesn't have health experts and rely on its partner's expertise on presenting the health data. CDC PLACES has previous year data of prevalence rates in percents. CIRCA either needs: 1) Guidance on how to aggregate different year percent values to create one datasets of 5-year for census tracts/towns or 2) An alternative source with clear downloadable link and metadata for 5-year aggregate levels. Since DPH cannot guide CIRCA on the either perspective and CDC has not responded the official request for guidance, CIRCA will use CDC PLACES one year data.
• Development of criteria for health indicator selection may be useful for future iterations. We recommend the following: - Only include health indicators with a) convincing scientific evidence that environmental factors impact the health condition and b) for which the health condition metric measures/represents the impact of ongoing community burden.	CIRCA shows that all the requested data in 2.0 is needed and have relevance with EJ issues.
- Minimize or avoid use of indicators that rely on a limited time series (<3-5 years). If possible, the data should be combined into 5-year aggregations as one-year estimates are subject to temporal anomalies (COVID, Sandy Hook).	CIRCA will include these suggestions for future version recommendation roadmap.
- Use caution when using data from limited samples/surveys. For example, the CDC Places data would likely not meet criteria for high-quality and precise data as it relies on small sample sizes (~500 per original sampling area of multiple towns) that has been modeling from the multi-town level down to the tract level resulting in smooth but likely inaccurate estimates	CIRCA will include these suggestions for future version recommendation roadmap.
- Use caution when using data from the EPA AirToxScreen. The data for both Air Toxins indicators are based on modeled data, not actual measurements, and EPA's website says that the AirToxScreen results apply best to larger areas, not specific places such as tracts.	CIRCA states that in the data narrative for 2.0. However, as long as EPA keeps that, these information is relevant to show a pattern.
• Move indicators that are not health outcomes to the other indicator groups. - Disability is a broad category, and it is unclear how the ACS disability metric applies as a health sensitivity. Recommendation is to move to the socioeconomic index as a social determinant of health, like race and education, rather than a health sensitivity.	Done.
- EPA Air Toxins Indicators should move to Potential Pollution Exposures Concerns as these indicators are not health sensitivities as they are not based on actual health outcome data but are instead an estimate of risk based on an	EPA Airtoxins layers moved to the related pollution category. The methodology is corrected.

estimate of exposure. EPA's EJ Screen includes this indicator in their Pollution and Sources Category. Note: The AirToxins Respiratory Risk methods section is incorrect, it has been cut/pasted from the Depression indicator.	
4: Narratives • The narrative for every indicator should include a sufficient summary of the scientific association between environmental exposures and the indicator as justification for inclusion in the tool and for guidance to the users on which exposures should be evaluated with the health indicator.	The narratives have been updated to include brief links with EJ issues. The primary purpose of the Report is to document the methodology and development of the project, rather than a literature review about each indicator, so these explanations are brief.
5: Fact Sheet. • The second bullet of the Fact Sheet should be rephrased to make its meaning clearer. Suggest rephrasing to: Identify areas that that may be more vulnerable to impacts from accidents or emergencies involving the release of environmental contamination.	Done.
• In the Fact Sheet, consider enhancing the description of rank using some of the language from the Report. Pages 27-28 include clear language explaining how the rankings generated by the tool are not reflective of specific numerical differences between each rank, they simply highlight that there is a numeric difference.	Added text clarifying the rank description, although the fact sheet has limited space so the full explanation can still be found in the report.

Feedback From the Mapping Tool Advisory Committee in Chronological Order

MTAC Meeting 1: Initial meeting of Mapping Tool Advisory Committee, January 13th, 2023

Suggestion/Comment	**Response**
One participant says energy burden and energy poverty should be emphasized – access to reliable energy. When there's a threat of bad weather (which is happening more often), often it is the same people who are at risk of losing power.	Energy burden data will be included as indicator for Ver 2.0
One participant adds that power access also impacts whether you can install infrastructure like chargers for electric cars. This leads to more disparity. Wants to know if there is data about energy capacity in this way – where chargers can be installed, etc. EV is essentially a poverty issue because it is dictated by one's income –	The data is not available.
Participants say that the tool should identify what people are struggling with and what communities are struggling	Sensitive population marks this
One participant says that the Pollution Burden map looks very similar to maps of food apartheid in Connecticut, even though food access isn't on the list of data layers in Pollution Burden.	Food access is added as context layer for ver 2.0
Multiple participants weigh in on the titles environmental effect and environmental exposure: these terms feel jargony and need to be defined and or explained a bit better	Category names changed in response to group feedback.

One participant asks if there will be a glossary of terms, and perhaps slides at the start of a presentation so that the presentation itself is easier to understand.	Separate Glossary is prepared.
Also asks whether there will be a "how to use tool" resource	Done.
Maybe also change "sensitive population" to something like "health sensitivity"	Done.
Make sure the information is translated well enough that the people can understand this without the aid of academics and/or secondary sources.	Small descriptions are presented and configured in the tool.
The socioeconomic factors that are listed are important but they need to have some sort of descriptions that emphasize the data – put an overall picture of what these indicators actually mean	Done.
One participant suggests looking at zoning information – how is it used to perpetuate existing issues?	Cannot be addressed in the map
One participant brings up hyper-local issues – Bridgeport compared to Fairfield County as a whole, for example. Bridgeport has number one in inequality – is there a layer on life expectancy? Suggests adding layer on life expectancy	Life expectancy complete for ver 2.0
Socioeconomic Factors suggestion: access to a vehicle, as this represents adaptive capacity to risk (e.g ability to move, evacuate)	Complete for 2.0
One participant says that being able to show affordability is an important measure and/or factor for the EJ Map	The affordability data is not available.
One participant suggests distance to usable green spaces. This also intersects with vehicle access. Maybe walkability layer?	Walkability data is not available for the analysis but green spaces could be used.
Sidewalk infrastructure – is it safe to walk? Connects back to one participant's experiences during the COVID-19 pandemic in her neighborhood.	This scale of analysis is not available.
How to define parks? Not just green spaces but usable green spaces.	Complete for 2.0.
One participant asks whether gentrification can be added to socioeconomic factors.	Reliable data for this is not available.
One participant suggests separating the socioeconomic factors – or having the option on the map to see it in categories of health, mobility, and housing/energy.	Not be possible within the timeline for data processing.
One participant wonders if the disease data should be prevalence rather than mortality rates	Later addressed with DPH – will use prevalence.
One participant asks whether flood zones are included	Not in the index, but could be included as a context layer.
One participant asked whether they could view layers of DEEP defined EJ block groups on the tool.	Done.
Is there a way to sort certain layers from highest to lowest? One participant wants to know if there is a list	Added chart feature to sort towns highest to lowest.

option for the map – like could you see the tracts/towns in order of scores for particular layers.	
Can the map display urban heat, less canopy cover areas?	Complete for 2.0
Is there a way to do on-screen comparisons?	Swipe tool added
One participant suggests making the X and Y axis labels more descriptive.	Done.
If we select a municipality, would it be able to show the % of census tracts or % of the population that has a certain threshold (ex: 90%) of particular burdens or characteristics?	EJ thresholds cannot be defined by CIRCA, would need a statutory description.
Are you able to download this in a GIS-readable format (to then overlay your own data based on your project), or can you only view this data in this online tool?	The data will be downloadable from the ArcGIS Hub site
Descriptions need to be added on to the map, for example: a color scale that shows a percentage/rank	Done.
Will the tool be translated into Spanish and Mandarin/Cantonese?	Spanish tool complete.
Ranking scale explanation (comparing census tract) is slightly confusing	Additional explanations added.

MTAC Meeting #2, February 17th, 2023

Much of this meeting focused on planning the community evaluation forums. Suggestions related to the tool or the accompanying resources are listed below.

Suggestion/Comment	**Response**
One participant suggests sharing stories of how other communities/states have used mapping tools to benefit their communities	Done.
Perhaps CIRCA could create its own video.	Done.
One participant asks whether people will have a way to give feedback after the workshop, if they think of something later	CIRCA says there will be public comment period, plus option to give feedback through the website, plus staff contact info.

MTAC Meeting #3, February 24th, 2023

Much of this meeting focused on planning the community evaluation forums. Suggestions related to the tool or the accompanying resources are listed below.

Suggestion/Comment	**Response**
General agreement from the group that the fact sheet is very dense.	Fact sheet revised through multiple iterations.
Two participants think there is too much information about "who" did the tool (GC3, RGGI, etc).	
One participant says nobody reads terms and conditions, is there a way to make this smaller	
One participant says they don't like that the indicator table shows some indicators on only one line and others on two (this is due to the length of the indicator name). Perhaps bullet points would make this easier to read.	

One participant says they like the second side of the fact sheet more than the first side. One participant wonders if the table of the indicators can be closer to the map/explanation of color scheme. One participant says that the "Who can use" section actually answers more questions than just "who." This should only answer the question that is asked. • One participant suggests changing this section to just a bulleted list of "who" can use it, and less about the why/how. • One participant says some of the text currently in the "who" section might be better on the front page. One participant suggests putting the disclaimer on the second page, and the "who" on the first page. One participant asks if the math / equations can be simplified. One participant suggests simplifying the explanation of the scores. General agreement that brevity is important, we need to be intentional about what information is included. • Less text, more bullet points. • icons/visual aids might be helpful to include on the fact sheet	
One participant suggests moving the first sentence of every pop-up (the general EJ index definition) to the bottom of the pop-up, so that someone clicking around to multiple places will not have to see it over and over again. • One participant says that a screenshot of this tool with a pop-up visible for a specific layer might be a helpful image to put on the fact sheet. • CIRCA asks whether the group prefers the pop-up with a small table versus the pop-up with more text and a pie-chart. • One participant says the table version looks cleaner but the second one is more detailed. • One participant asks whether the pop-up can have two pages – unfortunately no. • Participant suggests an option to hover for more or maybe a "more" button. • One participant asks if it's possible to put the town names more obviously on the map so people know where they're clicking. • One participant asks what users are actually looking for when they click on a pop-up for the health layers – the table or the bolded text. In general the need-to-know information should be the first thing visible in the pop-up, with the definitions/specific data information below it.	Pop-up table format adjusted, within constraints of still being able to include all necessary information for data context and caveats.
CIRCA asks about whether different categories should have different colors (with consideration of color-blind readers – no reds or greens, using light-to-dark of a single color).	Color adjustments made.

• One participant thinks it would be helpful for the different categories to have different colors, will help users differentiate and make screenshots clearer. • One participant suggests orange for health sensitivity.	

MTAC Meeting #4, June 2nd, 2023

Suggestion/Comment	Response
One participant suggested that we have a presentation explaining that there will be multiple versions of the tool and future versions may be able to include layers/features that aren't included in this one	Explained during the presentation to launch the public comment period.
One participant emphasized the need for translating the tool. • The participant suggested translating the tool before translating the accompanying materials. • Latino Conservation Week is in July, so having a Spanish version of the tool available in July for the public comment period would be especially good.	Spanish translation complete.
One participant observed in the Hartford forum that people had trouble understanding the numbers in the tool – maybe the legend needs to be bigger or easier to understand	Complete.
There were many comments and questions during the forums about what to do about the disproportionate pollution burden, how to make things better, what to do next. One MTAC participant said that it would be helpful to have a one-pager about "now that you have this information, these are things you can do." Maybe a collection of resources or local partners. • Another participant agreed with this, and said it would be helpful to have specific guidance for community members / residents. • One participant also emphasized that people need to know how to protect themselves in a concrete way, otherwise the tool could make them afraid. • More specific than just "this tool can be used for XYZ". • One participant suggested something like "find your local NRZ" or equivalent. • One participant suggested guidance for how to use the tool in grant applications.	Completed with input from MTAC members, CEEJAC member, SDAC.
One participant asked if there will be additional guidance from DEEP about applying for federal grants, especially when there is limited capacity or corruption at the local government level.	Question for future DEEP position.
One participant said that during the Junta forum she could tell the difference between what CIRCA was saying and what the translator was saying – there will always be a limitation here and we should be mindful of the gatekeeping.	
One suggestion for data from forum attendees was breast cancer data. CIRCA noted previously voiced concerns about cancer data and	CT DEEP Staff provided some background on the

possibly misleading data presentation. One participant noted this could also been perceived as gatekeeping information.	DPH rationale and the concern about correlation/causation. The participant responded that they understand this, but said it would be better to present the data and be upfront about what we know and what we don't.
One participant asked DEEP Staff for examples of states "doing better" for communities impacted by pollution.	DEEP Staff offered examples of assistance with grant writing, assistance with enforcement of facility standards, more staff support for helping towns work with industries, generally more handholding for municipalities. New Jersey has staffing time allocated to this.
One participant asked what the plan is for updating data – pointed out that for many factors (like food insecurity), using pre-COVID data will not be helpful since the situation changed so dramatically during the pandemic.	DEEP has hired a staff member for managing the tool.
One participant pointed out that it can be difficult to find state data and it would be helpful for the mapping tool to be hosted on its own site.	CIRCA responded that CIRCA created a separate website for the tool
One participant asked whether there's any way to get companies to test the water in the communities highlighted on the map.	Beyond the scope of this tool.
One participant asked if clicking on a layer will also lead to more information about the layer.	Done.
One participant asked whether the lack of capacity in non-profits / teachers / etc. can be reflected on the map.	CT DEEP Staff responded that this is not really an exposure /environmental burden factor.
One participant said that translating the tool should happen before community events; it's not helpful to ask people to test the tool before it's translated.	Spanish tool completed before public comment period started.

b) CIRCA Responses to Feedback Received During the Development of the CT EJ Screen – Public Comment Responses

Green text indicates that CIRCA staff have taken steps in response to the feedback received.
Red text indicates that CIRCA staff considered but did not take steps in response to the feedback received (not all feedback can be successfully implemented – possible reasons include data scale limitations, data availability limitations, data accuracy limitations, ESRI web app limitations, conflicting advice from other committee members or community members, etc.)
Blue text indicates the conversation is ongoing or unlikely to be resolved for the 2.0 version.

Black are questions that are informative to clarify how the tool and methodology function.

Summary Table – Comments received by 08/01/2023

Comment from	Total Comments Suggestions	Comments Addressed	Comments Cannot be addressed	Comments that CIRCA is working to include	Questions Answered
Public Forums	44	29	12	1	2
CEEJAC	21	7	5		9
Webinar	5	1			5
Public Comment Period form submissions	44	31	7	4	2

Contents

Public Forum Feedback

Verbal comments during the forums held on March 21st, April 26th, May 17th, May 24th, and May 30th, 2023 in Bridgeport, Waterbury, Hartford, Groton, and New Haven, respectively.

Suggestions for new/additional map layers:	**Responses**
Substance abuse / illegal drug use -- One participant looked up his address, and explained that he usually doesn't hang out near where he lives because of safety concerns / drug use. Usually he takes public transportation to another neighborhood and spends time there. (The area he lived was darker on the map than the area he traveled to – suggesting that his perceptions of it being safer in the other neighborhood is consistent with what the map suggests.)	CIRCA is looking for data for a substance abuse layer for version 2.0
Energy burden (this was suggested in multiple sessions)	CIRCA added this to version 2.0

HIV/AIDS	Data is not available for CIRCA to use in this mapping application.
Breast Cancer	DPH Cancer department suggested taking the cancer-related data out from this kind of mapping representation.
Infant Mortality	Data is not available for CIRCA to use in this mapping application.
Justice 40 & DOH Justice 40 as a context/boundary layer	Added as context layer to 2.0
3-year childhood asthma	Data is not available for CIRCA to use in this mapping application.
Federal grants require a HUD index layer screenshot on the area, so this should be added as a context/boundary layer	Location affordability index from HUD is added as context layer.
Noise from gun fires, ambulance, police sirens	Data is not available for CIRCA to use in this mapping application.
Suggestions for new/additional tool features:	**Responses**
Add a way for users to add their own data – maybe they could add a point showing that they experience asthma in their home or that they avoid a particular area.	Unfortunately, the map is not designed to add individual dynamic data.
Make the tool available in multiple languages – the languages most commonly spoken in CT	The tool and user documents will be available in Spanish.
Include information about what can be done to avoid having all this pollution in one place.	CIRCA included ideas for the use of the tool and possible actions for individuals, community organizations, and local/regional/state governments to help address the challenges identified in the tool in the accompanying resources page.
Provide resources for what to do next with the information. Don't only show the problem, show what we can do about it. Add info about where to get funding/help to fix the obstacles.	CIRCA included ideas for the use of the tool and possible actions for individuals, community organizations, and local/regional/state governments to help address the challenges identified in the tool in the accompanying resources page.
One participant suggested making a contact page of organizations people can contact to help their community.	CIRCA included links to grants and organizations in the accompanying resources page.
Contact list of DEEP departments to report issues?	CIRCA included specific departments in data narratives and information on how to report environmental contamination concerns to DEEP in the accompanying resources page.
Add a way to use this with Siri or other voice control tools, for people who are not able to navigate a touch screen. (Accessibility issue.)	This is not possible with the ArcGIS platform.

Maybe include some photos of the sites with contamination, so you can click on a site and see a photo of the pollution problem there.	CIRCA doesn't have exact photos of the specific contaminations.
Make icons and print bigger.	Icons are as big as the platform allows.
There was consistent confusion about the need to switch off layers so that they don't all stack on top of each other when viewing different layers – maybe we could add a permanent info box to remind people to turn layers on/off.	CIRCA included these instructions in the accompanying tutorials.
It should be explained somewhere that all health layers are purple (and in general what the color-coding for the different categories are), don't assume people will automatically know that from the color of the logo. Spell out the color scheme more clearly.	This was added in the About section of the tool.
The socio-economic factors part might be easier for people to consume/understand if there was a story line explaining what makes you more susceptible.	Story map and narrative has been updated.
One participant suggested adding a feature to show a pop-up for when an emergency is happening – live data acting as a notification that an area is unsafe.	Emergency and live data is out of scope of the tool.
"Too many clicks – once I must click 4 or 5 times before getting what I want, I'm over it."	The initial map is open at the beginning so that users can immediately see the EJ Index Score displayed on the map. Due to the amount of information included in the tool, we cannot reduce the amount of clicking needed to explore all the other layers included in the map and all the functions of the widgets.
Questions/comments indicating areas needing clarification:	**Responses**
What is EPCRA? This shows up in the attribute table pop-up but is not listed in the table of indicators on the fact sheet or as a layer to be turned on.	Detailed info about the indicators in composite index tables have been added.
Are census tracts the only way the information is given?	Yes, for most of the layers. DPH-provided health layers are displayed by town.
Is there any plan to link the data to licenses held by facilities?	CT DEEP is the state entity that manages licenses. Data Narratives have links to the relevant state entity.
Can it give more information on the types of chemicals being handled/released from facilities?	Data narrative includes generic information. For more detailed information, please contact related department.
Is flooding considered?	Flood layers are added as context information.

Can this tool be used to track changes over time? In the future, could we compare what the neighborhood looked like now vs. then?	Yes, this could be a potential future use of the tool.
With the swipe function, how do you distinguish between two layers with similar colors? Which is left and which is right?	Descriptions of how to use the swipe tool has been added.
Colors of the layers are too similar	Monochromatic colors are chosen to accommodate for color-blindness.
Not sure how to interpret the information	Descriptions have been added as pop-ups.
Not user friendly for those without any knowledge of technology	Multiple versions of tutorials are prepared.
Point out that the map has a home extent button	Done in tutorial
What do we do now? How do we make our community better with this information?	CIRCA included ideas for the use of the tool and possible actions for individuals, community organizations, and local/regional/state governments to help address the challenges identified in the tool in the accompanying resources page.
How can we help people address the concerns that arise because of the tool?	CIRCA included ideas for the use of the tool and possible actions for individuals, community organizations, and local/regional/state governments to help address the challenges identified in the tool in the accompanying resources page.
Define Distressed Municipality, EJ Block Group – participants wanted to know what that means	CIRCA added this information in the report.
Can you add categories?	No, but the tool allows for adding data.
Other comments:	
The health data likely does not include people who do not go to healthcare facilities because they don't have insurance, and/or people who are undocumented. So probably all of the health data is an underestimate, and the actual numbers of people experiencing these issues is higher.	The tool contains an indicator for people who do not have health insurance; however, data limitations in the source data are always possible. CIRCA provides a disclaimer about data accuracy and in particular states the accuracy levels for the American Community Survey.
One attendee noted that toxic releases/facilities from military sites might not be included in the data. There might need to be a caveat about this.	CIRCA added caveat about the data accuracy related to this point.
What we have to figure out is how to turn this into opportunities for us."	CIRCA included ideas for the use of the tool and possible actions for individuals, community organizations, and local/regional/state governments to help address the challenges identified in the tool in the accompanying resources page.
Concern that this information can be used by banks and financial institutions to redline / that this will affect property values.	The CT Green Bank uses data like this to target resources for green infrastructure to areas that need it the most. There's funding right now for projects in EJ communities, so appearing on a

	map like this can be used as an incentive to invest in these communities. Participants with the concern about redlining said that this information about investment incentives is a very important point to mention to users. CIRCA messaging related to the use of this tool highlights its utility for prioritizing resource investments.
Two neighbors had different EJ index values. When we looked in detail, the socioeconomic factor difference impacted the range. Census tracts are bound to give some level of error.	Data limitations in the source data are always possible. CIRCA provides a disclaimer about data accuracy and in particular states the accuracy levels for the American Community Survey.
Spanish-speaking individuals had a difficult time with the words. They needed time to look words up on their phones or ask the interpreter.	CIRCA prepared a fully-Spanish version of the app.

CEEJAC Meeting Comments – May 22, 2023, Introduction of the version 1.4 and feedback. Recording

Suggestions/Comments	**Responses**
I'm curious as to when pollution sources change rapidly sometimes in certain communities. So for example, the airport situation has been a thing in my whole life here in Connecticut. Smaller Airports use lead, Tweed started using larger jets. When those things happen more quickly, how does that get factored in? Or if there is a sudden spill in a body of water, how does that get updated?	Instant events like this are not going to be integrated because the tool is a screening tool rather than a live update tool. It shows the most up to date data to give a general picture. However, spills or any other information can be integrated as context layer when that data becomes available.
I can see great potential for this tool. Have you thought about ways in which someone might use this information to spotlight areas where these burdens exist, that would be then in some way harmed economically? I'm imagining, you know, the worst case scenario of redlining of certain areas. But that's just kind of where my mind goes. Also on the positive side, I think it's important to know about this and do plan to share it. But any thoughts about that? Are we going to see the State rally around those communities? And then, as a result of that, perhaps you may see private industry then rally behind those communities.	The information about where these burdens exist is already accessible, as these are all public data layers and are already often used for economic or government purposes (for example, realtors already have access to information about crime rates in neighborhoods, etc.). Conversations with the state data advisory committee members as well as the community forums have demonstrated that the general map that is being shown is not a surprise to anyone, because it is influenced by historical policies and disparities in lived experience. One of the goals of this tool is to make this information transparent and accessible to everyone, not only government entities or private economic interests so that community residents have the same access to information and are equipped to communicate about these challenges.

The reason why we were going to invest time and effort into creating a tool like this was so that it would actually guide the state in its allocation of funding and supports: the CES plan, the Conservation Management Plan, the Energy Efficiency Board Plan, or the Green Plan. These, to my knowledge, are meant to work together on energy and environmental issues. And then the plan is meant to also inform State entities and philanthropy and other groups. I'm not really hearing that in a clear or transparent way, yet how this will direct funding research and support to those distressed communities.	CIRCA included ideas for the use of the tool and possible actions for the state to help address the challenges identified in the tool in the accompanying resources page. CIRCA itself does not have the authority to require additional state action, so can only offer this guide as suggestions.
Is there a way to track historical pollution?	Unfortunately, no. If they are not in the list given for permit or any information provided from DEEP and EPA, that historical information is not included.
What about going forward? Would you be able to include the information from today in a new map 10 years or 20 years from now?	Yes. The method and procedure is transferrable to include new information.
Question about socioeconomic factors, and how they differ from the Department of Economic and Community Development's criteria for distressed municipalities.	The tool uses 2017-2021 American Community Survey 5-year estimates. This tool is compatible with the DECD designations to show a bigger picture, and distressed municipalities are included as a context layer. The ultimate source of socioeconomic related data is the same (based on surveys).
What does housing burden represent?	You are burdened if you are paying more than 30% of your gross income to accommodation. This could be mortgage or rent.
Are airports listed as potential pollution?	Airports are not listed as individual pollution burden, however they are included into various datasets. i.e. Noise level includes all noise in interstate roads, railroads and aviation-related noises.
Considering the long-term and short-term goals of the project, I don't see that there was any initiative happening to use this as a guide for policy making at state level, considering how state has had resistance to pass the EJ law 1147. Is your role to promote long-term action coming out of your work with the short-term goal of creating the tool?	Hopefully this tool will help to support the case for legislators for long-term action. There are other states using these kinds of tools for making policies. DEEP has been our partner in this project and has helped to make the data accessible. CIRCA itself does not have the authority to require additional state action.
How long is the public comment period?	CIRCA initially planned to extend the public comment period from 2 weeks to 3 weeks in

	response to this comment, but delays in feedback from other state agencies prevented this, so the public comment period had a 2-week window.
Is the tracking tool going to take into account energy burden?	Energy burden is added to version 2.0
Do you see this tool helping communities identify which zones are at most risk for flooding and where might benefit most from nature-based solutions?	CIRCA has a separate tool called Climate Change Vulnerability Index that will be most useful for this purpose.
Two most important EJ issues of CT are air pollution and flooding. Not just coastal flooding but also flash flooding. This information should be in the same map. Can we put there which houses flood regularly?	CIRCA puts flood zones as a context layer to the tool. We cannot show individual houses but a region that is prone to flooding. Flash flooding zones are not available as dataset.
Can you overlay multiple layers?	Yes, There is a swipe tool that also shows two layers side by side. However, the more overlay will make the tool crowded. That's why we have composite indices.
Can the community add their own data and mark streets?	There is an add data widget for communities to create their own data. However, 3rd party information cannot be hosted on the mapping tool.
If the State doesn't provide protection, some of the neighborhood data will be posted without their knowledge. Let's say, for example flooding in the area, and what that's going to imply for their home values. So I know that there are ways to create these protections, to explicitly state that this information cannot be used, that people will get in trouble legally, and if we don't put those in somehow, I'm really afraid that our best efforts to help people in terms of their health and the environment will be hurting them economically.	CIRCA has a disclaimer for prohibiting third-party interpretation and misuse of the data. It is also worth noting that the data sources used in the map are public so all of this information has already been "posted" for years. During this CEEJAC meeting a realtor who was present pointed out that neighborhood flooding is already something realtors take into account when they are showing homes.
Can we get point data for air pollution using air pollution monitoring devices live?	Not at this moment. The dataset is not available and the tool's aim is not to support live data but to give an overall picture.
Can we showcase clean energy projects? Can you add methane?	CIRCA doesn't have current access to the datasets.
Response to previous concern about making data available and potential mis-use: CT never moves forward beyond data gathering. I'm worried that by saying that we shouldn't have the data outward facing publicly that we would not be doing a service to people who maybe are black and brown, and haven't yet purchased a home, and might be encouraged to purchase in a low lying area. For example, being told by a realtor that that's a less expensive area and it'd be easier for them to access	CIRCA intends for this tool to be publicly available and accessible. One of the goals of this tool is to make this information transparent and accessible to everyone, not only government entities or private economic interests, so that community residents have the same access to information and are equipped to communicate about these challenges.

as a first-time home buyer. So I'm thinking about Hartford Bloomfield, Windsor Locks, Windsor areas which are heavy with black and brown home ownership and are also very low lying communities. And Bridgeport is another one. Especially since insurance doesn't cover the flooding, and there aren't policies for that. That knowing that, maybe this isn't the best place for, like a single mother to move in with her 4 kids or something, and they're going to immediately lose their home when it's flooded. I use that as the example of how, when rich people have a problem, we just run right to the aid, and we find immediate pots of money to allocate broadly. These problems have been known for a long time, but what hasn't happened is – because they don't have a voice of their own, and they don't have political power, they're powerless, they're unable to advocate for the dollars and cents – the investments that have been not occurring in their communities.	
New Jersey compile their data at the block group level instead of track. Why was the census track used in in instead of block group?	The American Community Survey has varying accuracy levels depending on scale, and the smaller that you go to the block group level, the less reliable the estimates are.
Response to previous concern about making data available and potential mis-use: As a licensed realtor, you know, I know that that FEMA map was out there. We already have access to a lot of this information. We are painfully aware. And we we're supposed to go through training regularly every year, pretty much on the effects of redlining, and some of the really disgusting laws that we're in place here in Connecticut.	CIRCA appreciates this insight.

Webinar on July 17, 2023, written comments, Recording. (recording contains additional verbal Q&A)

Suggestions/Comments	**Responses**
Some of the indicators might seem to have internal correlation - how do you account for this? For example a young population with high under 5 component will have lower educational attainment than an older population.	We did some initial random forest analysis to compare if any indicator has an internal correlation briefly. However, our efforts were not enough to conclude concrete statistical results. We are considering doing a Spearman correlation to check the link between various layers. However, when it comes to tools like this that honor public feedback, there was also some compromise between addressing the public need and trying to make it more precise. It is true that you can get the same picture with only a few layers, but that would

	not be superior to the already available federal tools. Moreover, it is inevitable that some of the burdens are repetitively happening in the same regions. Regarding your specific question, educational attainment is defined by anyone over 25 years old and doesn't have a high school diploma. So it doesn't double count with our Young population data.
Was wondering whether population was standardized for the indicators before the percentile and rank calculations were conducted for each of the indicators.	The pollution layers are not based on population, they are place-based, so there is no need for population standardization. Socioeconomic factors, on the other hand, are standardized by using the percent population affected. For example, we used % the elderly population in a census tract and compared those percentages to calculate percentile and ranks. Health layers have different variety of sources. CIRCA calculated and obtained from BRFFS (look CDC PLACES), they are based on the percent population comparison similar to the socioeconomic factor indicators. Department of Public Health provided datasets that include rate comparisons between different tracts (mostly age-adjusted rates and converted into deciles). CIRCA obtained this decile rank from DPH as-is and did not do any standardization. CIRCA relies on DPH's expertise in these health layers.
How was pollution exposure are defined? Is it by census boundaries?	Potential Pollution Exposure is a composite of multiple indicators that are the estimated level of exposure to environmental pollutants within census tracts. The indicators illustrate measured environmental concentrations and releases of contaminants from pollution sources. These layers are generally model results for a general state. CIRCA overlaid a census tract boundary on them and ranked the tracts based on the percentile of raw data.
Do you include the MOE from the ACS estimates for the derived indicators?	Unfortunately, no. Indicators only use ACS estimates to calculate the population percentage affected foreach census tract. This way, we can standardize the information and use it to calculate percentiles and ranks
Are there water impairment layers?	Water impairment is not suitable to be represented as an indicator in census tracts. The rivers and lakes in the water impairment layers cover almost all of the state, making it difficult to distinguish the impact between the census tracts. In other words, if a river passes a census tract, we must mark it. This leads to almost a one-color map and will give false interpretations. The resolution of the rivers does not work with indicators.

	However, water impairment is added to 2.0 as context layer.

Public Comment Period

Suggestion/Comment	Response
CEEJAC: I wasn't able to compile multiple census tracks and acquire the demographics of a certain region after using the drawing tool. I was able to do this on the national EJ Screening Tool but am not able to do this here on the CT EJ Screening Tool. Would you be able to add this feature?	We were not sure of the functionality of the "draw" tool, so we added this feature to two other widgets: Select and Reporting. For version 2.0, we added a select by tract for these widgets with the Demographic information. This dataset will include: • Total Population • %BlackAfricanAmerican • %Native American • %AsianAmerican • %NativeHawaiianPacificIslander • %HispanicLatino • %white • %Other (category for 2 or more race) • %Minoritized • %Poverty • MedianIncome ($) • %Unemployment • Town Name • Tract Name
DPH: Since there is already a way to toggle for a legend, why are the ranks also displayed in a drop-down when selecting environmental health and health conditions layers? Personally, I would remove the ranks that are not on the legend and add a descriptor or definition of the indicator as well as the data source. 1) The Chart feature would sure be better if results could be ranked and the user can quickly identify top/bottom 10 of 'x'. 2) The map tool provides no analysis (indexing) when selecting multiple layers; a statement to that effect should be made in the intro page or in the "About" drop-down. 3) There are 7 indexed data points, and at 3 are indices of other indices;	Unfortunately, the drop down is an ArcGIS Online feature that we are not able to change with this platform. 1) We added all the composite indices to display values by category for each town. Thus, the users will be able to see top/bottom selected layer within the area for the average highest rank values for all indices. Unfortunately, doing this for all the indicators will crowd the tool and make it less user-friendly. Additional tables like that can be prepared as a supplemental tool. 2) We added this statement to the About drop-down.

shouldn't they be nested so that the visual representation also translates to how the data is analyzed? 4) In the "About" drop-down, the "Pollution Burden" section is mislabeled as "Population Burden." 5) The "add data" feature is awesome but I believe the tool should already provide boundaries by Local Health Department or District.	3) Unfortunately, this is an ArcGIS Online feature that we are not able to change with this platform. 4) The About drop-down has been simplified and rewritten. 5) Added as context layer for boundaries.
Central Connecticut State University: Drop Down Box: "About Data" has problems--Table 1 is too small to read anything, as is Figure 1. These need to be placed on another page entirely and greatly enlarged. Explanation for percentiles for Figure 1 is totally confusing. What kinds of pollution are impacting these census tracts? I can't tell what the specific issues are for any given tract. Air quality (if so, what kinds of pollutants?), solid waste?, proximity to Superfund sites?, etc. What about flood zones? What about sewer backups or street flooding--problems in Hartford are completely ignored with this tool. Proximity to polluting facilities, like powerplants? Why bother with this website at all???? What's wrong with the EPA EJScreen mapping tool!!!!??? I don't understand what this project is supposed to accomplish that the EPA site doesn't already do--and do better. There isn't anything about this application that is worth keeping. Use the EPA EJScreen. It's easier and clearer and much more informative.	We are simplifying the section and adding external links for About Data page to make it more understandable. The current version require user to check different composite indices to examine that or use widgets. To make it simpler, we are adding different charts under the EJ index to show which pollutions indicators have the most impact for the selected census tract. FEMA and CIRCA flood layers will be added as context layer. Unfortunately, we do not currently have access to GIS data for sewer backups or street flooding to display. We understand your interest in the EPA EJScreen mapping tool, and we acknowledge its usefulness and the valuable information it provides. Our intention with the Connecticut Environmental Justice Screening Tool is to complement and enhance existing resources, including the EPA EJScreen, to better address the unique environmental justice challenges specific to Connecticut communities. We strive to achieve the following goals with our project: • Community Focus: Our tool is designed to cater specifically to the needs of Connecticut communities, taking into account their local environmental

	concerns and social justice issues. • Local Data: By utilizing more localized and up-to-date data, we aim to offer a more comprehensive and accurate picture of environmental justice in the state, focusing on issues that may not be adequately represented in broader databases. • Customized Features: The Connecticut Environmental Justice Screening Tool provides unique functionalities tailored to Connecticut's context, allowing users to delve deeper into specific topics and explore the data at a more localized level. • Community Engagement: Our project aims to actively engage communities in the decision-making process, allowing them to provide feedback, suggestions, and insights that can shape future policy initiatives. However, we recognize that each tool has its strengths and encourage users to utilize the resources that best suit their needs and preferences. These tools should not be considered as separate tools but rather as a helper to assist users in understanding the complete feature. We continually strive to improve our tool based on user feedback and preferences, with the ultimate goal of enhancing environmental justice practices and positively impacting communities. We genuinely value your input and would love to hear more about the aspects of the EPA EJScreen that you find especially helpful. Your insights can help us identify potential areas for improvement and make sure that our tool meets the diverse needs of all users.
DEEP: Make sure the layers are downloadable on AGOL.	CIRCA created a data hub to download the layers and add REST endpoint for the EJ Index.

For PPE: impaired waters per the 305(b) Integrated Water Quality Report (IWQR) to Congress. The data can be found at: https://portal.ct.gov/DEEP/Water/Water-Quality/Water-Quality-305b-Report-to-Congress	Water impairment is not suitable to be represented as an indicator in census tracts. The rivers and lakes in the water impairment layers cover almost all of the state, making it difficult to distinguish the impact between the census tracts. In other words, if a river passes a census tract, we must mark it. This leads to almost a one-color map and will give false interpretations. The resolution of the rivers does not work with indicators. CIRCA added the impaired waters dataset as a context layer.
The map (ver 1.5 at https://connecticut.maps.arcgis.com/apps/webappviewer/index.html?id=85bf095c8fc043edaa15ca5f78299fe3) says that the unemployment rate for Killingly Ct (census tract 9041.01) is 93.00%. That can't possibly be correct so I assume it indicates a bug somewhere. I think there is something wrong with your unemployment calculation. East Hampton is listed at 40% on the map popup. According to the table I found on the state department of labor site it's actually just over 2%	Thank you for bringing this bug to our attention. Indeed, there was an error in the data reading. We corrected the code. In addition, we compared Estimate Unemployment Rate Population age 20 to 64 from ACSST5Y2021.S2201 American Community Survey 2017-2021 5-year estimates with the State Department of Labor unemployment rates for town by 2023. Since we received multiple feedback referring to the town rates from the State Department of Labor, we used this dataset for consistency for the version 2.0 of the CT EJScreen Tool. We also double checked all the other data processing to make sure there were no typos in data reading.
Alliance for the Mystic River Watershed :Needs disaggregated data regarding the Eastern Pequot Tribal Nation in order to not erase them and make it harder for them to access funds.	The Connecticut EJScreen tool is currently constrained by the available statewide data, which, unfortunately, only exists at the census tract scale and therefore is impacted by census count errors and other census limitations. While this scale of data provides a broad overview, it can, regrettably, obscure specific environmental justice issues occurring within smaller communities or sub-regions of a census tract. Consequently, injustices occurring below the census tract scale are not clearly highlighted in the tool's current configuration. We will add some language to the tool's description and disclaimers to clarify this so that users understand that a large census tract that appears to be less vulnerable may still have pockets of great vulnerability within it. That being said, we recognize the need for a more flexible tool that can adapt to these limitations

	and give a voice to communities who are underrepresented in larger datasets. To this end, we have incorporated a feature into the EJScreen tool that allows users to add their own data. This feature empowers users to create and present maps that more accurately reflect their specific community's environmental concerns, providing an alternative way to highlight environmental justice issues that the broader census tract data might overlook. We also added the tribal boundaries to the tool as a context layer.
Comments on Draft Report version 1.5: Overall a good document and clearly a lot of work went into it (I especially appreciated having abbreviations and terms defined at the beginning), but caught a couple errors and have some suggestions for alternate data sources & calculations. Methodology: 1) Formula 2 has a typo; "+" should "x". At a more fundamental level, I would suggest using Rank = P/10 instead of the current formula. Setting Rank to (P/Pmax) x 10 adds an additional layer of abstraction to the data (creating a decile of a percentile of the raw data) and inconsistent results with datasets that are calculated as straight deciles (eg asthma emergency visits). 2) Since the data is taken directly from EJScreen, the methodology for superfund sites does not match the other datasets. For increased consistency, raw location data can be obtained here https://www.epa.gov/superfund/superfund-national-priorities-list-npl 3) The current methodology for race/ethnicity (p 80) only uses data for people who identified as a single race, thus inadvertently excluding multiracial individuals. A simpler calculation that accounts for multiracial individuals would be: (total population) - (non-hispanic white alone) Formulas:	The Rank formula was decided after multiple versions because i)P/10 simply didn't reflect if the dataset is not homogenous. For example, if a lot of tracts have the similar values for the top scores, it will fall under same range of percentiles. This might result in top percentile to be 85percentile. However, it reflects the same top rank. In order to be consistent between the indicators, we set this formula. That way, even though the top percentile scores low, it will still reflect high rank for easy public understanding. Additionally, this way, if the dataset is continuous (meaning has values representing all the tracts) the formula results simplify to P/10. The idea is to reflect the top to bottom ranks similarly among the indicators. We will work on the EPA Superfund layers. We corrected the race indicator calculation. Corrected formula 3 and 4. We actually calculate the score by multiplying the ranks for Pollution burden and Sensitive Population. In order to be consistent with the Rank stretch. We normalize (apply Eq 2 with the score values this time). So simply dividing it is not correct. We added the required narrative to the document. We are working on processing this NLCD dataset.

1) Formulas 3 and 4 would be easier to read if they were written in the same style as formula 5. Example: Pollution Burden = (0.5 x average(Potential Pollution Source) + average(Potential Pollution Exposure) / 1.5 2) Formula 5 is great and easy to read, but should be divided by 10 Alternate data sources: 1) I would like to suggest NLCD impervious surfaces (2019) as an alternative to open street maps. Although it is a slightly older dataset, it is more consistent and higher quality. https://www.mrlc.gov/data?f%5B0%5D=category%3AUrban%20Imperviousness Unclear wording: 1) I am slightly confused by step 5 for "Pollution Indicator Proximity Estimations with Buffers" (p 30). Is a single value assigned for each point within 5 km, or is the value calculated as (area of intersecting buffer x buffer score) / total tract area? Typos: 1) There are two missing references on p 34 (Section: "How to interpret the Map") 2) Incorrect data source is listed for "Proximity to Superfund site" in table on p 36 3) Many of the "Methods" sections for the datasets were copy-pasted from brownfields and need to be edited. Many of them are also missing the closing parenthesis after "between 0 (least impacted) and 10 (most impacted" 4) First sentence under iii) Socioeconomic factors (p 64) should be "Socioeconomic Factor is a composite index that assesses social and economic conditions within a census tract." 5) Educational Attainment (p 66) mentions using 2 tables but only mentions "less than 9th grade" by name and does not include "9th to 12th grade, no diploma". 6) Median Income (p 73) mentions map symbology (eg lightest to darkest), which feels out of place with the rest of the document. 7) Race/ethnicity (p 79) has a typo where it refers to "ethnic minoritized groups" instead of	Regarding the question about unclear wording: It is close to the first option but for 1km. After the multiple buffers are created for a single point, a census tract may include multiple buffer rings and scores. So the summation of all the scores within a census tract is considered while comparing it with each other. For example: two census tracts side by side. One of them has the pollution indicator source so it includes the buffers for 250m, 500m,750m but the buffer ring for 1000m goes to the neighbor tract. Then one of them will have score of (1+0.5+0.25=1.75) and the other will have 0.1 as weight. Typos: All typos are corrected. Thank you!

"ethnic minority groups" 8) The table for asthma emergency dept. visit rate (p 87) has inconsistent numbers for value and rate range 9) Emergency department visits for chronic lung disease (p 88) refers to "percentile range" but uses deciles 10) Low Birthweight Rate of Infants (p 91) uses the acronym NH without defining it Additional comments: This form gave me an error message when I tried to include a link to a new data source in the "new data source" box.	
environmental justice focuses on the intersection with crime and conservation outcomes.	FBI only has data for Bridgeport, Hartford, Stamford and Waterbury from 2019. It doesn't appear that statewide data by town is available.
Eversource Energy: Who will update the data in this tool? The tool is very technical. Do you feel it's user friendly for the average resident?	After August 18th, DEEP will update the tool. CIRCA has prepared multiple user guides to help increase the user-friendliness of the tool.
Save the Sound: I'm writing to convey impressions on the EJ mapping tool. I think the tool's index rating system does a good job of reporting on the vast potential pollution sources, as well as potential pollution exposure, socioeconomic factors, and health sensitivities. It is a vast and inclusive set of criteria. Thank you for the opportunity to comment.	Thank you
Acadia Center: Acadia Center appreciates the unique opportunity to provide comments on the Connecticut Environmental Justice Mapping tool. Acadia Center is a nonprofit research and advocacy organization pushing for equitable climate solutions and a transition to clean energy that benefits all communities in Connecticut. We are pleased to see version 1.5 of the state's Environmental Justice Screening tool and the invitation to provide comments on the tool. As	We added this feature to two widgets: Select and Reporting. For version 2.0, we added a select by tract for these widgets, the Demographic information. This dataset will include: • Total Population • %BlackAfricanAmerican • %Native American • %AsianAmerican • %NativeHawaiianPacificIslander • %HispanicLatino • %white • %Other (category for 2 or more race)

an organization, we have closely worked with and supported the efforts of the Governor's Council on Climate Change (GC3), and are delighted to further contribute by providing comments on the Environmental Justice tool. We acknowledge the broad data categorization and the extensive enumeration of factors in the Environmental Justice Index including Pollution burden and Sensitive Population. We understand that the screening tool is unable to give an individual exposure level to pollution. However, we understand the use of taking advantage of the data and factors in the tool to provide specificity on the group's susceptibility to pollution. Acadia Center advises designing the tool to explore how specific combinations of socioeconomic factors in the Sensitive Population category could present varying environmental justice index scores of specific groups within a census tract (for example race + poverty level alone). An incorporated update of this recommendation in Version 2.0 will help census tracts and communities understand their socioeconomic disadvantage with the supported data to seek out opportunities to better their communities and close gaps of inequalities that result from such factors. This accommodation will further close the limitation of the tool in providing individual-level exposure and vulnerability to pollution within a census tract. We would like to also acknowledge the various advisory teams that have contributed to shaping this tool to create the current version. We commend the University of Connecticut research group for its collaborative effort in creating the tool. Acadia Center is eager to provide additional support to see the finalization and adoption of the state's Environmental Justice tool.	• %Minoritized • %Poverty • MedianIncome ($) • %Unemployment • Town Name • Tract Name In addition to that, we added EPA EJScreen guideline for demographic index under the context layers. "The Demographic Index in EJScreen is a combination of percent low-income and percent people of color. These are the two demographic factors explicitly named in Executive Order 12898 on Environmental Justice. For each Census block group, these two numbers are simply averaged together. The formula is as follows: $Demographic\ Index = (\%\ Low\ Income + \%\ People\ of\ Color)/\ 2$ For example, if a Census block group has a low income indicator value of 25% and a people of color indicator value of 75%, the Demographic Index value would be 50%. Please refer to page 26-27 for EJScreen Technical Documentation.
Conservation Law Foundation: The Environmental Justice Mapping Tool is strong in its cumulative impacts approach and is accessible and well-presented.	We are pleased to learn that you find the Tool to be strong in its cumulative impacts approach and accessibility. Your recognition of the broad collection of data and the cumulative nature of

• CLF commends the broad collection of data included in the tool, and the cumulative impacts approach that is taken in compiling the information. With a suite of 46 indicators and datasets that include environmental, socioeconomic, and health factors, the tool is a robust depiction of environmental justice across Connecticut. The combination of both "Sensitive Populations" and "Pollution Burden" appropriately reflects the cumulative nature of these factors and of environmental justice. • We specifically note the importance of including race and ethnicity as a socioeconomic data set, which the tool does. Race has repeatedly been shown to be the strongest predictor of the disproportionate presence of environmental harms and lack of environmental benefits. In light of the recent Supreme Court decision in Students for Fair Admissions, Inc. v. Harvard, CLF applauds the inclusion of race and ethnicity data in the screening tool and underscores the importance of continuing to rely on these data. We maintain that consideration of race is an indispensable component of environmental justice. • Additionally, the approach taken by CIRCA and DEEP in communicating around the tool is commendable. The supporting materials that explain the data and methodology and provide guidance on using the map are helpful in making the tool accessible to everyone, regardless of their level of familiarity with web mapping tools or environmental justice datasets. The inclusion of all materials, including the mapping tool itself, in both English and Spanish will help ensure that this tool is widely used, crucially providing information to people who may be experiencing the very burdens the tool	the tool's indicators encourages us in our mission to provide a comprehensive depiction of environmental justice across Connecticut.

is highlighting. DEEP should consider translating the tool and materials into additional languages beyond Spanish in the future to further expand access.	
Conservation Law Foundation: We recommend the inclusion of climate-related datasets and tribal lands in the EJ Mapping Tool. • The mapping tool is focused on the intersection of pollution and health, but a complete picture of environmental justice must include climate impacts as well. The same communities that are most overburdened by pollution are also often those impacted first and worst by climate change-induced threats like flooding and extreme heat. Climate impacts can also exacerbate health issues. Heat can worsen chronic health conditions such as asthma or directly cause illness or death via heatstroke, flooding can spread pollutants and cause harmful mold, and storms can cause dangerous power outages. Climate impacts are inseparable from environmental justice, and failing to reflect this in the mapping tool results in an incomplete picture. • We recommend including flood risk, extreme heat risk, and urban heat islands in the mapping tool and factoring these into the calculation of the EJ Index. Notably, CIRCA has already produced vulnerability indices for flooding and heat in Connecticut, so combining these existing analyses into the environmental justice tool is one possibility. Any climate data used should be forward-looking and as granular as possible. Flood data should include not just sea level rise but inland and precipitation flooding as well; the recent flooding events along the Connecticut River underscore the importance of this. We recommend not relying on FEMA using additional or alternate data sources.	Regarding your recommendation to include climate-related datasets, we are pleased to inform you that we will include "urban heat island" as an indicator in the tool to address the fact that heat-related health concerns are especially urgent for environmental justice communities. While we acknowledge the importance of climate-related data, the guidance we have received from other state agencies and our project team has led us to focus specifically on pollution burden and sensitive populations for this screening tool. CIRCA does have a separate tool, the Climate Change Vulnerability Index (CCVI), which focuses on flood vulnerability and extreme heat vulnerability across Connecticut, taking into account many of the same social vulnerability factors that the EJ Screening Tool uses. The CCVI provides higher resolution and dense data that can be accessed to understand climate change vulnerability in detail. We are actively working on the capacity of ArcGIS Online platform to include the CCVI as a context layer in the Environmental Justice Screening Tool, ensuring that climate data complements our environmental justice efforts. We also appreciate your suggestion to include flood layers as context. While we have a high-resolution coastal flood model for coastal areas, we acknowledge that for inland regions, we rely on FEMA flood layers due to the lack of alternative data. We will continue to explore opportunities to improve and expand our flood data resources. Regarding your suggestion for additional climate resources in the tool, we would like to direct you to the CCVI for higher resolution data on factors related to adaptive capacity for floods and extreme heat, including distance to the nearest cooling centers. Unfortunately, we don't have access to data about state incentive programs for clean vehicles and electric bikes. These resources

• It would also be useful to include data on climate resources in the tool, such as locations of cooling centers, state incentive programs for clean vehicles and electric bikes, both of which include enhanced incentives for residents of environmental justice communities, and information about energy efficiency programs and assistance, such as Operation Fuel. This information could be incorporated as additional context rather than being factored into the index. Including links to relevant resources would help increase awareness and would provide crucial information for viewers of the tool who see that their community is in a highly burdened area. • CIRCA and DEEP should also consider how to better reflect tribal lands and populations in the tool. While Census data on race and ethnicity does include Native American and Indigenous populations, reservation locations and boundaries are often a more accurate way to incorporate these populations. It is concerning that the tool doesn't include the boundaries of tribal lands or reservations, and we urge CIRCA and DEEP to work with local Indigenous populations to reflect both state and federally recognized tribal lands, and any additional information as relevant, in the tool	can provide essential support and offset environmental burdens in affected communities, and we will include them in our future update recommendations to DEEP. Regarding your concern about tribal lands, the Connecticut EJScreen tool is currently constrained by the available statewide data, which, unfortunately, only exists at the census tract scale and therefore is impacted by census count errors and other census limitations. While this scale of data provides a broad overview, it can, regrettably, obscure specific environmental justice issues occurring within smaller communities or sub-regions of a census tract, such as the lands of some of the state-recognized tribes. Consequently, injustices occurring below the census tract scale are not clearly highlighted in the tool's current configuration. We will add some language to the tool's description and disclaimers to clarify this so that users understand that a large census tract that appears to be less vulnerable may still have pockets of great vulnerability within it. Nevertheless, we understand your concern about tribal lands, and we have added tribal boundaries to the tool as a context layer.
Conservation Law Foundation: State environmental justice resources should be made readily available through the tool, and DEEP should make sure funding and staff resources are sufficient to usefully maintain the tool in the future, and should conduct ongoing outreach around the tool. • The EJ Mapping Tool can play an important role as a resource center for people to access funding and information to help address environmental injustices. We suggest that DEEP clearly link between the tool	CIRCA will pass these recommendations along to DEEP.

and relevant information such as grants, technical assistance, and resources like cooling centers that can help offset environmental burdens. There should be easily accessible contact information so users can reach out to appropriate staff at DEEP, other state or local agencies, and other relevant organizations to ask questions or get assistance. Information should be translated into key languages and interpretation services should be provided as relevant. • We note that DEEP plans to assume long-term ownership of the EJ mapping tool and will hire a staff person to assist in ongoing updates, maintenance, and use of the tool. We urge that appropriate and sustainable funding and resources are allocated to support this endeavor. • Finally, information and outreach around the tool has been commendable so far, and we urge DEEP to continue these efforts when assuming ownership of the tool. This may include hosting additional information webinars or making staff available to answer questions and provide training on using the tool. It is also important that information about the tool is intentionally distributed to the communities that need it most. DEEP should utilize the CEEJAC and existing networks of grassroots organizations focused on environmental justice to help connect directly with community members. Tools such as this are only as useful as the data they are based on and are only impactful if they are adequately used by the public and in guiding policy and planning decisions.	

D. User Guides

The tool provides a range of resources designed to aid users in efficiently navigating and comprehending the web application:

1. Mini User Guide: A succinct two-page guide offering insights into the web application interface. This guide is presented in both English and Spanish, ensuring its accessibility to a wider audience.
2. Tutorial: A detailed step-by-step guide which introduces users to the various features of the web application, ensuring they leverage the tool to its fullest potential.
3. Widget Descriptions: This section provides in-depth descriptions of the widgets incorporated within the web application, shedding light on their functionality and significance. These descriptions are available in both English and Spanish.
4. Video Tutorial: A visual guide in the form of a video tutorial that showcases a step-by-step walkthrough of the web application's features, offering users an interactive and engaging learning experience. The video has English and Spanish subtitles.

Users can access the materials through https://connecticut-environmental-justice.circa.uconn.edu/user-guides/

E. Frequently Asked Questions

What is environmental justice?

Environmental Justice is the idea that people should be treated under environmental laws regardless of defying characteristics (race, socioeconomic status, culture, ethnicity, gender, etc.). The environmental justice movement emerged to illustrate that communities with socioeconomic challenges and different racial and ethnic characteristics are being impacted at a higher rate by environmental decisions – specifically industrial pollution, landfills, pesticides, disposal facilities, and lead poisoning.

Why is mapping environmental justice important?

The detailed mapping of pollutant impacts facilitates the recognition of environmental challenges facing distinct communities. This crucial knowledge enables policymakers to comprehensively understand community health statuses and any concerns linked to their collective well-being. Establishing inter-agency collaborations and forming specialized panels allowed the EJ Screening tool to tackle various environmental issues that have substantial impacts on Connecticut residents.

What is CT EJ Screening Tool?

CT EJ Screen is a screening tool that identifies areas and/or communities with high environmental burdens from pollution and accounts for the vulnerability of these communities. The CT EJ Screen uses various data, creating a GIS map illustrating the marginalized and burdened communities.

Why was CT EJ Screening Tool Created?

CT EJ Screen was created after the Equity and Environmental Justice Working Group recommendation in the Governor's Council on Climate Change in January 2021 to create a visual representation of the distribution of environmental and climate health vulnerabilities across Connecticut. DEEP and CIRCA have partnered to create this representation and tool for Connecticut.

How is CT EJ Screening Tool being used?

The CT Screening Tool helps identifies communities that have the most environmental burdens. However, at the same rate, residents, policymakers and community leaders can look at their town/county and identify environmental burdens and pollutants in that area. The purpose of the mapping tool will equip policymakers, urban planners, environmental advocates, or just interested in environmental justice with valuable knowledge on leveraging geospatial data for positive community impact.

Who can use CT EJ Screening Tool?

Anyone can use the mapping tool! The mapping tool can range from policymakers to your next-door neighbor. It is meant to be inclusive and cater to all.

What are indicators?

Indicators are processed raw data to be used in the cumulative index model. Raw data is unprocessed information from any point source. The indicators are broken down into four categories: potential pollution sources, potential pollution exposure, socioeconomic factors, and health sensitivity. These indicators are meant to illustrate the various burdens taken into account when calculating the pollution and the mapping score. The varying levels of these effects can be found in more detail on our page.

How are CT EJ Screening Tool scores calculated?

Each indicator is assigned a percentile range and normalized rank for each state census tract based on the available data. The combination of these indicator scores gives the indices. The ranks range from 0 (least impacted) to 10 (most impacted). For more information on scoring, view our diagram explaining the process and read the report.

What are some limitations of the mapping tool?

Some limitations of the mapping tool include the datasets being equally weighted (some datasets are more prevalent than others and impact more, but in the case of the map, each data set represents one indicator). The resolutions of the data layers are inconsistent; some layers are census tract and others are town level. This tool does not contain information about every environmental, health, or demographic factor and cannot guarantee the completeness or accuracy of the information contained within these datasets. Decisions on the cumulative impact of environmental health risks should not solely be based on this map. It is also not intended to represent specific diseases or conditions related to the environment.

How can community members be involved in the CT EJ Screening Tool?

You can contact us through one of the members on our contact us page, or you can reach out to us through our public comment. The public comment is accessible and sends a direct message on concerns and or additional comments that you might have regarding the screening tool.

How can I find out my community's score?

In the GIS-created mapping tool, you can input your address and/or the zip code you reside in. Here, it will then take you to the census tract you currently live in and present the score, the indicators, and any additional information on pollution burdens.

Where can I find out more information about environmental justice in my town/county?

For additional resources, you can look at our resource page. As for the additional support with environmental justice, we recommend utilizing some of the links added below to research more regarding communities and environmental injustice:

Can the EJ screening tool tell me about specific conditions and or diseases?

No. While the CT EJScreen tool is a powerful resource for understanding and addressing environmental justice issues, it's crucial to note that it is not designed to represent specific diseases or risk conditions related to environmental pollution. Moreover, the decisions regarding the cumulative impact of environmental health risks should incorporate additional sources of information and not rely solely on this tool.

This Mapping Tool DOES NOT: evaluate health risks; predict health outcomes of communities or individuals; explain the cause of health issues or health concerns of individuals; identify a population's health risk due to a potential source of pollution; release private addresses, information, or names.

What was the methodology for developing the screening tool?

CT EJ Screening Map bases its methodology on Washington State Health Disparity Map, CalEnviroScreen, and EPA EJScreen. When comparing and combining the methodology of different EJScreen tools from different states, it's important to understand that while the core concept is the same, the specifics may vary based on each State's unique environmental and demographic considerations. The CT EJ Screening Map methodology is adjusted based on the State's specific needs.

The basic methodology goes as follows: data collection, indicator selection and calculation, cumulative index calculation, and mapping. To learn more about our methodology, read our report.

How do I interpret the cumulative indices?

The cumulative indices express the potential impact on the community. Specifically, the pollution burden consists of several measures which evaluate the buildup of environmental exposures and their consequences within communities. These measures symbolize potential sources and exposures to pollution. Evaluating sensitivity involves using socioeconomic measures and health predispositions that contribute to increased vulnerability to heightened pollution exposure. To comprehend the total

impact for each census tract, the model calculates and impact score, then assigns percentiles in line with their rank order. The rank order allows users to grasp their position relative to the whole State.

What is the resolution of the CT EJ Screening Tool?

Although the data processed as indicators may have various resolutions, the cumulative index maps are represented in Census Tracts.

F. Applications for Statewide Mapping Tools

This section displays information on how some states are using their mapping tools to bring resources to overburdened communities (OBC), with New Jersey being the model state. Other states and federal government agencies are mentioned as well.

Washington Environmental Health Disparities Map

The tool was developed by the Washington Department of Health (WDOH). It was designed in collaboration with the University of Washington's Department of Environmental and Occupational Health Sciences, Front and Centered, Washington State Department of Health, Washington State Department of Ecology, and Puget Sound Clean Air Agency. Focus groups in the state provided input that would later help in the development of the map. It was first published in January 2019. Maintenance and training on how to use the map is funded by the state. Although the map only has an English version, the DOH has Tutorial videos in English, Spanish, Russian, or Vietnamese.

New Jersey Environmental Justice Mapping, Assessment and Protection Tool (EJMAP)

New Jersey Department of Environmental Protection (NJDEP) developed the tool using their Geographic Information System's digital data. The map was funded by the CDC through New Jersey grants and created on May 19, 2022. A tutorial was posted on their YouTube page however, both the map and the tutorial are only available in English. NJDEP introduces EJMAP: "The primary purpose of this information is to support the implementation of the Department's proposed EJ regulations by providing applicants, residents, and other interested parties with the baseline information necessary to analyze a facility's contribution to environmental and public health stressors in its host OBC" (NJDEP).

When Governor Murphy signed the historic Environmental Justice Legislation (S232) in 2020, New Jersey became the first state to require mandatory denials for permits on new facilities that didn't fulfill the commitment to protect environmental justice communities. Under the bill, when assessing permit applications, NJDEP is required to evaluate the environmental and public health impacts of some facilities that negatively affect overburdened communities. Viewthe 8 types of facilities covered by the EJ rules.

NJDEP developed the final rules for their EJ Law, where they were adopted in April. Rule requirements consist of community engagement before the proposal of facilities in OBCs and the utilization of the EJ Map where community-level environmental and public health data is available. The tool helps applicants locate OBCs and avoid adding environmental and public health stressors. For more information on the bill, click here.

California Communities Environmental Health Screening Tool (CalEnviroScreen)

CalEPA requested the Office of Environmental Health Hazard Assessment (OEHHA) to develop the tool. Reports started being released in 2010. Public workshops and meetings were held statewide for comments on draft reports and versions of the tool. The first version was finalized in 2013 along with a press release. The Spanish version was released in 2015. The science-based tool can be utilized to identify burdened communities that are disproportionately impacted by pollution sources.

The state is working to reduce greenhouse gas emissions and improve public health and environmental impacts, specifically in disadvantaged communities. The California Transformative Climate Communities (TCC) Program is a part of the state's Climate Budget which helps fund climate adaptations and resilience. Applicants must demonstrate a project area that shows the need to bring in integrated infrastructure and connectivity planning and implementation."Vision: The Transformative Climate Communities Program empowers the communities most impacted by pollution to choose their own goals, strategies, and projects to reduce greenhouse gas emissions and local air pollution" (Ca.gov).

Environmental Protection Agency EJScreen

The EJScreen is a screening tool with national data displayed for the use of EPA to make an approach in joining environmental and demographic socioeconomic indicators. The tool helps identify racial and ethnic demographics, income, environmental issues, disproportionate impacts that can be compared to other areas, and other factors along the topic. It may aid in supporting educational programs, grant applicants, community awareness, ect. The purpose is for the EPA to be more open with their data and their environmental justice work. The tool helps stakeholders make informed decisions and it creates a common ground where agencies and the public can meet when dealing with environmental concerns.

Center for Disease Control and Prevention (CDC) Environmental Justice Index

A series of statistical data is collected to measure the negative environmental impacts on health for subdivisions of counties. The data derives from the U.S. Census Bureau, the U.S. Environmental Protection Agency, the U.S. Mine Safety and Health Administration, and the U.S. Centers for Disease Control and Prevention. The census tracts are ranked into factors such as environmental, social, and health. Then, the tracts are categorized into different modules and domains.

Climate and Economic Justice Screening Tool

The Council on Environmental Quality (CEQ) developed the tool after the Executive Order 14008 was issued in January 2021. The tool uses information based on indicators of burdens that disadvantaged communities face. It helps federal agencies identify disadvantaged communities to benefit from the Justice40 Initiative programs. Benefits include investments in climate, clean energy, and related areas that alleviate overburdened communities. A Spanish version will soon be available.

G. Environmental Justice Lesson Plan for High School Students

Environmental Justice in Connecticut and Beyond

In this section, students learn about environmental justice in Connecticut and other parts of the US, by studying how communities are struggling with environmental inequities, how to use the Connecticut Environmental Justice Mapping Tool, learning how to bring transparency and data to their communities by using the Connecticut Environmental Justice Mapping Tool, and learning how communities have fought for environmental justice. There are four lessons in this section adapted from California Coastal Commission, (California Coastal Commission, 2022) each taking up to one hour:

- **Lesson 1: What is environmental justice?**
  - ➢ The objective is for students to learn about how communities struggle with environmental injustices/inequities and what role Connecticut plays through state efforts.
- **Lesson 2: What is environmental racism?**
  - ➢ The objective is for students to understand how historical systemic racist policies and practices have disadvantaged people of color (POC), particularly black, in Connecticut and nationwide.
- **Lesson 3: How to use the Connecticut Environmental Justice Screening Map Tool?**
  - ➢ The objective is for students to learn how to use the Screening tool to bring resources to their communities.
- **Lesson 4: How do communities fight for environmental justice?**
  - ➢ The objective is for students to learn how communities fight for environmental justice and how to develop environmental justice solutions using the Screening tool and other resources provided.

Student Handouts: Designed for in-person learning. Includes activity worksheets, discussion questions, and exit tickets for each lesson. Download handouts as a PDF.

Teacher Handouts: Designed for in-person learning. Includes anchor charts, model worksheets, and templates to record thoughts and ideas from discussions. Download handouts as a PDF.

These lessons are intended for students who have prior knowledge of concepts of discrimination, forms of racism, and discriminatory practices.

These lessons are adapted from California Coastal Commission and follow the 5E model of inquiry-based learning: Engage, Explore, Explain, Elaborate, and Evaluate. Each lesson is based on a guiding question that students will attempt to answer throughout the lesson. The purpose of these guiding questions is to keep students engaged by practicing their critical thinking skills while they develop multiple answers throughout the lesson. Modifications to each lesson plan is encouraged, if needed, to accommodate the learning strategies of your students. For example, in lessons that require watching or listening, videos can be substituted; view the link to see more videos on the Environmental Justice for Students and Educators page. Think about starting each lesson at the "explain" activity to have students focus on core ideas. The "elaborate" and "evaluate" activities can be used as lessons on their own. Additional activities are included as well. See the last page of this packet to view **additional activities**.

Environmental justice is a sensitive topic. Listed below are resources and best practices to help keep the classroom a safe space for learning and discussion about the topic and to ensure respect and productivity for students, from Coastal California Commission:

- "Establish discussion agreements that foster listening, respect, courage, and accountability. Examples include:
    - **Use "I" Statements:** Think of the difference between "We all agree" versus "I agree", and "No one agrees with you" versus "I disagree". Using "I" statements helps avoid generalizations and creates a brave discussion space for students.
    - **Intent versus Impact:** Acknowledge your impact, even though it was not your intent. Think of someone accidentally stepping on your foot. While it was not their intent, it had an impact.
    - **Practice "both-and" thinking:** Be open to new ideas and perspectives. Avoid binary, "either-or" thinking.
    - **Take space, make space:** Be aware of how much space you are taking in a discussion. If you are sharing a little or not at all, consider taking up more space. If you are sharing more than others, consider making space for other voices.
    - **Expect and accept lack of closure:** In discussions about difficult topics, there may not always be concrete answers or conclusions.
- Offer sentence starters for students to frame their opinions during group discussions. These are especially helpful for English language learners. Examples include:
    - I think_____ because_____.
    - I agree/disagree with_____ because_____.
    - I see it differently because_____."

For additional information about leading healthy classroom discussions, visit EduTopia. For leading classroom discussions about race, see resources from Teaching Tolerance and the National Museum of African American History.

Lesson 1: What is environmental justice?

Objective: for students to learn about how communities struggle with environmental injustices/inequities and what role Connecticut plays through state efforts.

Engage	Students brainstorm synonyms and definitions of the words "environment" and "justice", and brainstorm what is environmental justice.
Explore	Students listen to a podcast about environmental (in)justices in Connecticut while answering questions and following along with the Bingo activity.
Explain	Students share and discuss their answers with the class.
Elaborate	Students learn the State of Connecticut's definition of environmental justice.
Evaluate	Students complete an exit ticket.

Engage: (10 minutes) Instruct students to write down what comes to their mind (synonyms and/or definitions) when they think of the words "environment" and "justice", and where they overlap, through filling out a Venn-diagram (see student handout page 1). As a class, go around the room and collect students' answers while recording them on the class anchor chart (see teacher handout page 1). Introduce guiding question: "What is environmental justice?"

Explore/explain: (20 minutes) In class**,** play this podcast (Pellico and Shen, 2023)_about environmental justice efforts in Connecticut. For timesake, play up to the first 20 minutes. Assign students to answer the following questions about the podcast, record their answers, and fill out their Bingo Board (see student handout page 3-4).

- What event or problem caused people to start taking action? (sewage flooding, storm water runoff, water waste discharge, etc.)
- Who took action? (community members, parents, activist groups, environmental justice advocates, etc.)

- What was the solution, if any? Who decided on the solution? (community meetings, listening sessions, the EPA investigated the causes of the sewage back up and sewage systems, no solution, etc.)
- How is the podcast related to the environment? How is it related to justice?
- What is environmental justice?

Explain: (15 minutes) Regroup as a class. Ask students to share their answers to each question. Invite students to respond to their classmates' answers. Have students define their own definition of environmental justice and record it (see student handout page 4)

Elaborate: (5 minutes) Show students the State of Connecticut's definition of environmental justice see teacher handout page 4).

Evaluate: (10 minutes) For students' exit ticket (see student handout page 5), ask them to answer either of the questions:

- Do you agree with this definition of environmental justice? Why or why not? OR
- What would you add to or change this definition?
- How does Connecticut's state definition of environmental justice compare/contrast to yours?

Lesson 2: What is environmental racism?

Objective: for students to understand how historical systemic racist policies and practices have disadvantaged people of color (POC), particularly black, in Connecticut and nationwide.

Engage	Students examine a graphic and answer questions about a Los Angeles pollution study by the United Church of Christ.
Explore	Students learn about historical systemic racism and watch a video about redlining.
Explain	Students reflect on the video by answering discussion questions.
Elaborate	Students discuss the video as a class.
Evaluate	Students complete an exit ticket.

Engage: (10 minutes) "Show students this picture (Pulido, 2000) from the United Church of Christ's study of uncontrolled hazardous waste sites in Los Angeles County in 1987 see teacher handout page 5). Walk through the map and ask students to record their answers individually (see student handouts page 6), share with a partner, and/or discuss as a class. Introduce guiding question: What is environmental racism?

- How many uncontrolled toxic waste sites are in zip codes with a Hispanic population greater than 20 percent (gray and light gray areas)?
- How many uncontrolled toxic waste sites are in zip codes with a Hispanic population less than 20 percent (white areas)?
- Why do you think that the companies dumped more toxic waste in these areas instead of others?
- This map is from 1987. Do you think that there are still toxic waste sites in these neighborhoods? Why or why not?" (section from (California Coastal Commission, 2022))

Open conversation and collect students' answers. Refer back to resources on teaching topics about race if needed. If needed and as a class, define; race and how it's different from ethnicity, prejudice and how it's different from racism. Visit this resource from Racial Equity Tools (Racial Equity Tools, 2020) for definitions.

Explore: (20 minutes) Clarify that groups of people, like governments, industries, and corporations can participate in historical racist actions or have racial bias beliefs, just like individuals. Define institutional racism (Potapchuk et al., 2005), see teacher handout page 5). Show students a video about segregation, the racial wealth gap, and how historical systemic racist policies and practices have disadvantaged black, indigenous, and people of color (BIPOC) in Connecticut and nationwide. If time, play up to the first 20-30 minutes of the video A History of Environmental Justice and Racial Policies in Connecticut (CT DEEP, 2020b) by CT DEEP.

Explain: (10 minutes) Have students reflect individually on the video by answering one of the following questions, (see student handout page 7):

- According to the video, what was the difference in the environmental conditions between wealthy white neighborhoods and low-wealth black/POC neighborhoods?
- How was redlining a form of systemic racism?
- What is something in the video that surprised you? What questions do you still have?

Elaborate: (15 minutes): Discuss students' answers as a class. Explain the impacts of systematic racism and how communities are disadvantaged by burdens and fight for environmental justice. Emphasize that these communities tend to lack resources such as time, information, income, transportation, and political power. If time, have students discuss the following questions:

- Which neighborhoods do you think environmental injustices are more likely: in neighborhoods that were redlined or places that were not? Explain your thinking.
- Why do you think polluting companies and industries choose to put their pollution sites in communities of low-income/low-wealth and of color, and not white and wealthy neighborhoods?

- How is environmental racism related to environmental justice?
- In your opinion, who has the responsibility to fix the lasting negative effects of redlining and other forms of systemic racism?

Evaluate: (5 minutes) Revisit guiding question: what is environmental racism? Instruct students to name an example of environmental racism (see student handout page 7), for their exit ticket. If time, ask students to share with the class, and ask their classmates for feedback.

L3: How to use the Connecticut Environmental Justice Mapping Tool?

Objective: for students to learn how to use the Screening tool to bring resources to their communities.

Engage	Students watch a video tutorial on how to use the Connecticut Environmental Justice Screening Tool while following the user guide.
Explore	Students partner up to complete the mapping tool activity and explore the utilization of the application for the Connecticut Environmental Justice Screening Tool.
Explain	Students discuss findings amongst themselves and compare results with other groups while answering questions.
Elaborate	Regroup as a class, discuss findings, and answer students' questions, if any.
Evaluate	Students answer question and report to their teacher as an exit ticket.

Engage (15 minutes): As a class, students watch this video tutorial by UConn CIRCA on how to use the Connecticut Environmental Justice Screening Tool. Play the video from the beginning until 10:40. In lieu of the video, have students follow along with this user guide. The tutorial is available in English. Subtitles only are available in English and Spanish. To access Spanish subtitles, click on the video link above, once on YouTube, click settings icon on video, and click Spanish subtitles.

Explore (20 minutes): Instruct students to partner up in groups of two and use a device (each student should have their own device) to explore the application (español). As they explore the application, have students complete the mapping tool activity (see student handout page 8). In the activity, student

groups will select an area/neighborhood (one area per group) then each partner pulls three scores from that area (six scores total). Students will record their answers on the activity table.

Explain (10 minutes): Instruct students to discuss findings amongst themselves and compare neighborhood results. Have students answer questions below (see student handout page 9):

- How do the two neighborhoods you looked at compare to each other when it comes to these scores?
- How do the neighborhoods you looked at compare to the neighborhoods your classmates looked at?
- Were you surprised by any of these results?

Elaborate (10 minutes): Regroup as a class, open a discussion about their findings while recording answers to previous questions on class anchor chart see teacher handout page 7). Answer students' questions, if any.

Evaluate (5 minutes): Have students answer the following question and report to their teacher as an exit ticket (see student handout page 10)

- Why do scores vary in different neighborhoods/regions?

Lesson 4: How do communities fight for environmental justice?

Objective: for students to learn how communities fight for environmental justice and how to develop environmental justice solutions using the Screening tool and other resources provided.

Engage	Students review examples of environmental injustices from previous lessons.
Explore	Students watch a video about scholar activist fighting for environmental justice in their community, and answer questions about the video.
Explain	Students list action steps that the activist in the video used to identify environmental burdens in their communities and fight for justice.
Elaborate	Students determine if there was fair treatment of environmentally burdened communities.

Evaluate	Students complete an "exit ticket" by naming one way that communities have fought for environmental justice.

Engage: (10 minutes) Review by asking students to volunteer to share their examples of environmental injustices (see student handout page 11). Emphasize that communities burdened by environmental injustices (such as communities living near polluting facilities or with high pollution exposure and experiencing social vulnerabilities and health impacts) have often been overlooked by government and institutions. Remind students that the suffrage from disproportionate distribution of toxic waste fell on those communities. Emphasize that these communities have fought against environmental injustices, predominantly with less access to resources and power. Introduce guiding question: How do communities fight for environmental justice?

Explore: (15 minutes) Explain that communities have used different strategies, methods, and tools to fight and act on corporations creating environmental burdens that cause them harm. Introduce students to a video (In The Know, 2022), which includes a student activist whose community faced or is facing environmental burdens. As a class, watch the video. As they watch, have students record their answer to the following questions (see student handout page 11):

- What environmental burden did they face? (unregulated sewage pollution entering Seaside Beach, incinerators and power plants causing air pollution and resulting in health disparities, vehicular pollution, etc.)
- What actions did they take? (local volunteer work, community organizing, data collection, created an organization, shared their story on TV or in the news, protested, learned about pollution in their neighborhoods etc.)
- What was the outcome? (the company shut down their power plants, ongoing fight, etc.)

Explain: (5 minutes): Ask students to share their findings with the class. Gather students' answers on class anchor chart see teacher handout page 8.)

Elaborate: (25 minutes): Restate the definition of environmental justice, and its requirements for fair treatment and meaningful involvement. Ask students to write or draw examples of fair treatment from their school and home lives. Examples are, equal amounts of time for class work, equal amounts of food at school lunches, student body government elections, extracurricular activity involvement, etc. (see student handout page 12). If time, discuss and create a class list see teacher handout page 9). Have students discuss and reflect on previous lesson and focus on the high rankings where scores were pulled from. Have them continue using the scores based on the table to brainstorm solutions for the challenges in these areas. (Having meditation centers for areas with high levels of depression, installing air sensors in ozone areas, and cleanup brownfield sites) (see student handout page 12).

Evaluate: (5 minutes) As an "exit ticket" (see student handout page 13) instruct students to answer the following: what's one thing you can do to advance environmental justice?

Additional activities

The following activities can be added or substituted to lessons in this unit and are adapted from Coastal California Commission. Click here to view more activities.

- "**CalEnviroScreen:** an interactive mapping activity exploring pollution and population indicators in California, and how these factors intersect. See full activity on the Coastal Commission website

- **Emotion journal**: upon completing each lesson, instruct students to reflect on what they have learned and what emotions came up for them. This is especially recommended for lessons 2 and 3 about environmental justice and environmental racism. Questions to consider:

  - How are you feeling about what we learned about?
  - What emotions come up for you when you think about _____?

- **Idea journal**: Upon completing each lesson, have students brainstorm and write ideas for ways to take action for environmental justice. Have students add ideas to this list throughout the unit. In Lesson 5, students can use ideas from their lists when generating action steps to take for environmental justice.

- **Environmental advocate research project**: Have students find local organizations who advocate for environmental justice in communities experiencing environmental injustices.

Have individual students or groups of students pick one organization, go to their website, examine their social media pages, and read news articles involving these organizations. Instruct students to report on their organization, addressing the following questions:

- Where does this organization work? Which communities does it organize?
- Does this organization work with other groups? Which ones, and why do you think they work together?
- What projects, facilities or infrastructures with environmental burdens has this organization fought against? What environmental burdens do these projects, facilities or infrastructures pose to communities?
- What challenges has this group encountered while fighting for environmental justice?
- Are there other groups who dislike the work that this group is doing? Why do you think this is?
- What victories has this group achieved?
- What defeats has this group experienced, and how did they learn from these experiences?
- What actions or strategies has this group used to fight for environmental justice?"

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