

Identifying Communities for Justice40 Investments Using Cumulative Impact Assessment of Climate and Environmental Burdens



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2024-2025 MEDS Capstone Project Proposal

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Client

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Objectives

This project will extend and improve the federal government's approach for identifying disadvantaged communities overburdened by the negative effects of climate change and need prioritization in federal funding from the White House's [Justice40 Initiative](#). Specifically, the project will incorporate a cumulative impact assessment of multiple climate and environmental burdens into the designation of disadvantaged community status and implement cutting-edge spatial analytic techniques to identify cumulative burden hotspots. It will also document the racial, ethnic and socioeconomic characteristics of disadvantaged communities in the U.S. facing cumulative exposure to excessively higher climate and environmental burdens emphasized in the Justice40 Initiative.

Environmental Motivation

In January 2021, the federal government launched the Justice40 Initiative, which aims to direct 40% of overall benefits from investments in climate, clean energy, affordable housing, workforce development, remediation, pollution reduction and clean water infrastructure to disadvantaged communities (DACs). As part of this initiative, the federal government created the [Climate and Economic Justice Screening Tool](#) (CEJST) to identify which communities (census tracts) are considered disadvantaged and in need of federal funding based on the presence of low-income status and one of eight burden categories. While CEJST includes a wide range of useful indicators to evaluate burdens and designate DACs, it relies on a binary classification scheme that identifies U.S. census tracts as either DACs or non-DACs. Specifically, CEJST does not include any measure that represents cumulative burdens or overall harm to communities that occurs due to a combination of climate, environmental, socioeconomic, and health-related burdens (Shrestha 2023). A DAC meeting multiple criteria or indicator thresholds is assigned the same designation as a DAC meeting a single criterion and does not receive any special prioritization for Justice40 funding. By classifying census tracts exceeding a single indicator threshold, CEJST cannot distinguish between areas with severe, moderate, and low burdens. This project seeks to improve CEJST's model by considering the cumulative impacts of climate, environmental, and other burdens across communities.

The technical motivation for this project includes synthesizing approaches from other web-based environmental justice (EJ) mapping/screening tools and exploring cutting-edge spatial analytic techniques for hotspot analysis. For this project, the team will examine web-based EJ tools that use cumulative scoring or cumulative impact assessments. These enhancements to the current version of the CEJST tool can be expected to inform more equitable assessments of environmental and economic needs of DACs, and thus support more equitable allocation of Justice40 funds. Additionally, our project objectives are consistent with recent recommendations

for CEJST data and tool improvements made by the National Academies of Sciences, Engineering and Medicine (NASEM) Committee that oversees the goals of the Justice 40 Initiative (NASEM 2024).

Data Science Need

Data science plays a critical role in creating an equitable framework for identifying disadvantaged communities that are overburdened and deserve prioritization for Justice40 funding. Currently, the CEJST model includes a wide range of climate and environmental indicators used to designate DAC status. However, it lacks measures that represent the cumulative impacts of multiple burdens, or the overall harm to communities caused by a combination of climate, environmental, socioeconomic, and health-related factors. This inability to distinguish between areas with severe, moderate, or lower burdens hinders the model's effectiveness, as identified in the recent NASEM consensus report (NASEM 2024). This project seeks to fill this gap by extending the CEJST tool using data science approaches to create a cumulative burden index and assess the combined impact of various relevant stressors on local communities. This will require a literature review and comparative analysis of methods that have been created at the state and local level so that the project team can build it out on a federal scale.

Additionally, the project team will utilize spatial analytic tools to highlight geographic clusters of communities that are overburdened using the proposed cumulative impact assessment approach. They will implement techniques such as Local Indicators of Spatial Association that can be used to identify census tract clusters with significantly higher or lower levels of burden (Ansen 1995, Bivand & Wong 2018; Chakraborty 2024). The project team will also analyze the EJ implications of cumulative burdens at the national scale, by exploring how the nature and number of burdens relates to the racial, ethnic, and socioeconomic characteristics of potentially impacted populations in the U.S. Conducting an analysis at the federal level (across 84,000+ census tracts) requires a large volume of data. The project team will leverage computing techniques like code optimization and parallel processing to complete the project objectives.

Deliverables

Upon completion of this project, the client will receive the following:

- **Relational database:** The project team will create a relational database to organize all data from federal government APIs. Due to the large volume of data used for this project, it is essential to leverage the speed of querying a relational database. The database will be used by the client and team to perform complex queries for data analysis and serve data on the backend to the interactive dashboard. The database will be archived to a data repository upon completion.

- **Streamlined data processing workflow:** The project team will create a reproducible workflow in Python or R that pulls data from federal government APIs into a relational database that can be updated. This workflow will create a cumulative burden index using current CEJST burden indicators and generate a variety of model outputs. This workflow will be documented and available on GitHub for the client and the public to use.
- **Updatable and reproducible analytical report:** The project will report results from the cumulative impact assessment of climate and environmental burden indicators. The project team will conduct a comparative analysis between the current CEJST approach and our proposed model that allows DAC prioritization based on cumulative burdens. The report will include maps and tabular data that capture different ways of defining DAC status based on cumulative impact assessment. It will also identify geographic hotspots or census tract clusters with significantly higher cumulative burdens and document their socio-demographic characteristics.
- **Public-facing interactive dashboard:** The project team will create an interactive dashboard based on the CEJST interface that allows users to implement multiple approaches for aggregating relevant climate/environmental burdens and identify DACs based on cumulative impacts. The dashboard can be used by local communities and policymakers to explore the cumulative impact assessment results.

Data Access and Availability

All data needed for this project is publicly available online and requires no non-disclosure agreement to use. A table of model variables and links to data repositories is provided in the Supporting Materials section. The CEJST model repository that this project builds off of is available on GitHub: <https://github.com/usds/justice40-tool>

Project Requirements

In order to meet the project goals, the project team will need to build off of the current CEJST tool (version 1.0) developed by the White House Council on Environmental Quality. It is important for the team to review the technical documentation of CEJST to have a deeper understanding of the data sources and methodologies. The project team will also review and integrate approaches used by other web-based EJ mapping and screening tools that include cumulative scoring or cumulative risk assessment: [CDC ATSDR's Environmental Justice Index \(EJI\)](#), New Jersey's [EJMAP](#), [CalEnviroScreen](#).

This project will involve the following technical requirements:

- Python or R for data analysis
- SQL to query databases and SQLite or DuckDB for database management
- GIS in Python or R for spatial analysis
- Advanced data science tools for analyzing big data, such as parallel processing, code optimization, and cloud computing (or computational server access)

Supporting materials

Data Sources

All data for this project is publicly available via the following sources:

<i>Variable</i>	<i>Source</i>
Mean household income	US Census Bureau's American Community Survey API (https://www.census.gov/data/developers/data-sets.html)
Climate change burden category (expected agricultural loss rate, expected building loss rate, expected population loss rate, projected flood risk, projected wildfire risk)	Federal Emergency Management Agency's (FEMA) National Risk Index: https://hazards.fema.gov/nri/data-resources
Energy burden category (energy cost, PM2.5)	Department of Energy (DOE)'s LEAD Tool from 2018: https://www.energy.gov/scep/low-income-energy-affordability-data-lead-tool-and-community-energy-solutions EPA AirToxScreen: https://www.epa.gov/AirToxScreen
Health burden category (asthma, diabetes, heart disease, low life expectancy)	Centers for Disease Control and Prevention's (CDC) PLACES data from 2016 - 2019: https://www.cdc.gov/places/index.html Center for Disease Control and Prevention's (CDC) U.S. Small-Area Life Expectancy Estimates Project (USALEEP) from 2010 - 2015: https://www.cdc.gov/nchs/nvss/usaleep/usaleep.html#data
Housing burden category (historic under-investment, housing cost, lack of green space, lack of indoor plumbing, lead paint)	National Community Reinvestment Coalition (NCRC) dataset of formerly redlined areas using digitized maps from the Home Owners Loan Corporation (HOLC) from 2010: https://www.openicpsr.org/openicpsr/project/141121/version/V2/view Department of Housing & Urban Development's (HUD) Comprehensive Housing Affordability Strategy dataset from 2014 - 2018: https://www.huduser.gov/portal/datasets/cp.html Data from MultiResolution Land Characteristics (MRLC) consortium; data analysis provided by The Trust for Public Lands and American Forests Percent Developed Imperviousness (CONUS) from 2019: https://www.mrlc.gov/data/nlcd-2019-percent-developed-imperviousness-conus US Census Bureau's American Community Survey API (https://www.census.gov/data/developers/data-sets.html)

Legacy pollution burden category (abandoned mine land, formerly used defense sites, proximity to hazardous waste facilities, proximity to superfund sites, proximity to Risk Management facilities)	Department of the Interior's (DOI) Abandoned Mine Land Inventory System (e-AMLIS) from 2017: https://www.osmre.gov/programs/e-amlis U.S. Army Corps of Engineers' Formerly Used Defense Sites (FUDS) from 2019: https://www.usace.army.mil/Missions/Environmental/Formerly-Used-Defense-Sites/FUDS-GIS/ Environmental Protection Agency's (EPA) Treatment, Storage, and Disposal Facilities (TSDF) data from 2020 calculated from EPA's RCRA database as compiled by EPA's EJScreen: https://enviro.epa.gov/envirofacts/rcrainfo/search Environmental Protection Agency's (EPA) CERCLIS database from 2020 as compiled by EPA's EJScreen: https://cumulis.epa.gov/supercpad/cursites/srchsites.cfm Environmental Protection Agency's (EPA) RMP database from 2020 as compiled by EPA's EJScreen: https://www.epa.gov/ejscreen/technical-documentation-ejscreen
Transportation burden category (diesel particulate matter exposure, transportation barriers, traffic proximity and volume)	EPA AirToxScreen: https://www.epa.gov/AirToxScreen Department of Transportation's (DOT) transportation access disadvantage from 2022: https://www.transportation.gov/priorities/equity/justice40/transportation-insecurity Department of Transportation's (DOT) traffic data from 2017 as compiled by EPA's EJScreen: https://www.epa.gov/ejscreen/download-ejscreen-data
Water and wastewater burden category (underground storage tanks and releases, wastewater discharge)	Environmental Protection Agency's (EPA) UST Finder from 2021 as compiled by EPA's EJScreen: https://www.epa.gov/ust/ust-finder Environmental Protection Agency's (EPA) RiskScreening Environmental Indicators (RSEI) model from 2020 as compiled by EPA's EJScreen: https://www.epa.gov/ejscreen/technical-documentation-ejscreen
Workforce development burden category (linguistic isolation, low median income, poverty, unemployment, high school education)	US Census Bureau's American Community Survey API (https://www.census.gov/data/developers/data-sets.html)
Tribal lands category (Land Area Representation depicts the exterior of a Federal Indian land area)	Bureau of Indian Affairs' Land Area Representation (LAR) dataset from 2018: https://www.bia.gov/bia/ots/dr/s/bogs

References

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- Shrestha, R. (2023, March 18). CEQ’s Climate and Economic Justice Screening Tool Needs to Consider How Burdens Add Up. World Resources Institute. Retrieved October 16, 2024, from <https://www.wri.org/technical-perspectives/ceq-climate-and-economic-justice-screening-tool-cumulative-burdens>



October 18, 2024

Dear MEDS Capstone Committee,

I am writing in my capacity as a national expert in environmental justice and geographic information systems tool design and development, with a particular emphasis on leveraging these tools for community action and engagement. I am delighted to offer my enthusiastic support for the MEDS capstone proposal titled “Identifying Communities for Justice40 Investments Using Cumulative Impact Assessment of Climate and Environmental Burdens”, authored by Haylee Oyler, Kat Le, and Dr. Jayajit Chakraborty

Since January 2023, I have served on a National Academies of Sciences, Engineering, and Medicine (NASEM) Committee that provides recommendations regarding data and tools for enhancing the White House Council of Environmental Quality (CEQ)’s *Climate and Economic Justice Screening Tool* (CEJST) and addressing the goals of the *White House Justice40* Initiative. These recommendations were recently published in a NASEM consensus report titled [Constructing Valid Geospatial Tools for Environmental Justice](#). One of our key recommendations in this NASEM report focuses on enhancing the analytic functionalities of the CEJST tool for assessing the cumulative impacts of various climate and environmental burdens on disadvantaged communities, with the goal of allowing a meaningful distinction between communities facing multiple burdens and those with fewer burdens. Another key recommendation focused on documenting the racial/ethnic and socioeconomic characteristics of disadvantaged communities facing cumulative exposure to excessively higher climate and environmental burdens. The proposed MEDS capstone project seeks to address both these key recommendations from our NASEM report and thus contribute to identifying which disadvantaged communities in the U.S. should be prioritized for more equitable Justice40 funding decisions. This project will lead to the development of a conceptually and empirically valid approach for combining multiple climate, environmental, and other relevant burdens from the current CEJST tool that will be informed by cutting-edge data science and spatial analytic techniques. It will also include a detailed, national-scale analysis of the environmental justice implications of cumulative burdens in the U.S., which has been highlighted as an important goal in Presidential Executive Order 14096 [*Revitalizing Our Nation's Commitment to Environmental Justice for All*].

The CEJST tool and all datasets that will be used for this proposed project are publicly available and accessible online. This project will not require any additional funding or resources. Based on my academic background and expertise, if this capstone project gets selected, I will be happy to provide my professional guidance to supervise the proposed tasks and preparation of deliverables. The topic is important, timely, and relevant, and I am confident in our collective potential to improve the White House CEQ’s CEJST tool and ensure the equitable allocation of Justice40 Initiative funds.

Sincerely,

A handwritten signature in black ink, appearing to read "Jayajit Chakraborty".

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