

COMMUNITY SCIENCE: A PATHWAY FOR ADVANCING ENVIRONMENTAL AND CLIMATE JUSTICE

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History of the EJ Movement



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EJ Definitions

- **Environmental Justice** is the fair treatment and meaningful involvement of all people regardless of race, ethnicity, culture, income or education level with respect to the development, implementation and enforcement of environmental laws, regulations, and policies
 - WHEJAC's definition: The term "environmental justice" means the **just** treatment and meaningful involvement of all people regardless of race, color, national origin, or income, or ability, with respect to the development, implementation, enforcement, and evaluation of laws, regulations, programs, policies, practices, and activities, that affect human health and the environment.
- **Environmental Justice Community** means a geographic location with significant representation of persons of color, low-income persons, indigenous persons, or members of Tribal nations, where such persons experience, or are at risk of experiencing, higher or more adverse human health or environmental outcomes (WHEJAC)

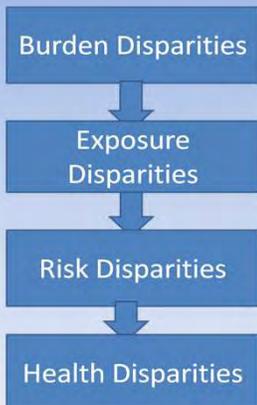
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My Definition of Environmental Justice (EJ)

- EJ Framework is a Three-Legged Stool
 - Leg 1: Differential Burden and Exposure to Environmental Hazards and LULUs (chemical plants, TRI facilities, incinerators, brownfields, heavily-trafficked roadways, industrial zoning, goods movement activities, landfills, depots, etc)
 - Leg 2: High Concentration of Psychosocial Stressors (Crime, Violence, Poverty, Isms, social disorder)
 - Leg 3: Lack of access to high quality health-promoting infrastructure (supermarkets, banks, schools, basic amenities, housing, parks/green space, economic opportunity structures)

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EJ Science = Assessment of Disparities

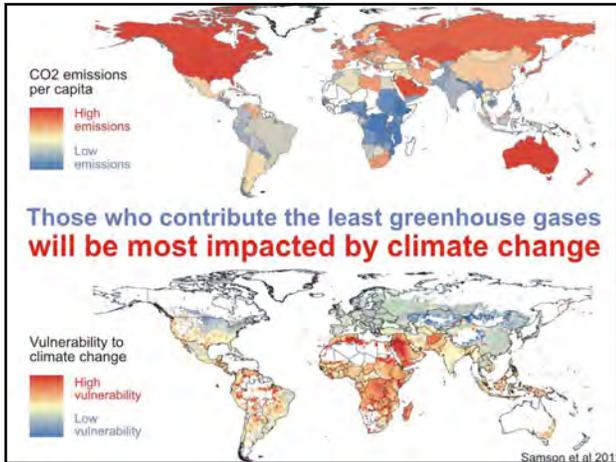


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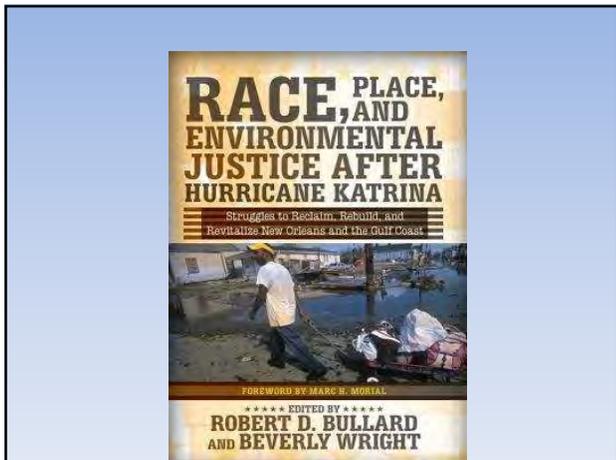
Relevant Health-Related Disparities

- Exposure
 - PM_{2.5} levels (inhalation- ambient/personal monitoring)
 - PCBs, PAHs, mercury (body burden)
 - Blood Lead Levels
- Health Outcomes
 - Asthma
 - Cancer
 - Cardiovascular Disease
 - Diabetes
 - Poor Birth Outcomes (low birth weight, infant mortality, birth defects)

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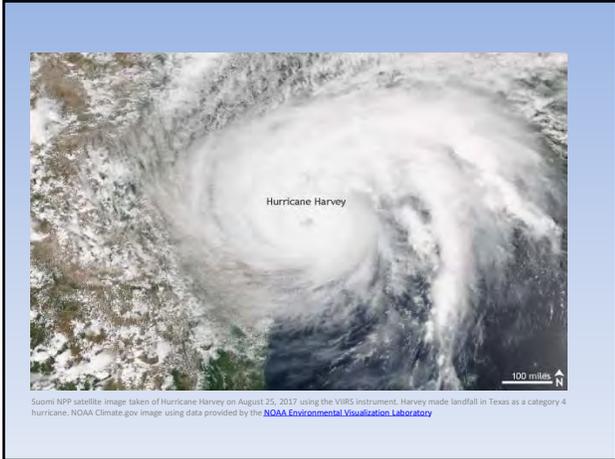
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Baltimore's Urban Heat Island

Baltimore's Urban Heat Island is Ranked Among the Worst in the Nation

- Traditional building materials can increase heat in an area by 9 degrees
- Baltimore's housing topped with Black tar, absorbs heat and exacerbates the issue
- **East and West Baltimore can be 15 degrees hotter** than more affluent areas

The fix: Investment in low-income communities of color, installation of "cool roofs" that reflect sunlight, installation of solar panels, increasing the tree canopy

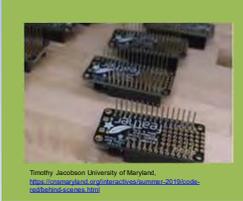
Retrieved from:
<https://newscenter.ill.gov/2011/11/03/cool-roofs-really-can-be-cool/>

Retrieved from:
<https://www.washingtonnature.org/fieldnotes/2017-science-two-minute-takeaway-what-is-tree-canopy>

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Code Red: Baltimore's Climate Divide

- University of Maryland journalists partnered with the A. James Clark School of Engineering at UMD to implement heat and humidity sensors into Baltimore homes for data collection.
- 80 sensors were built with capabilities such as measuring temperature, humidity, date, and time to be updated once a minute, and used for a period of 10 summer weeks.
- Over a dozen data sources were used in conjunction with data from these sensors to inform the study, including health and historical records.

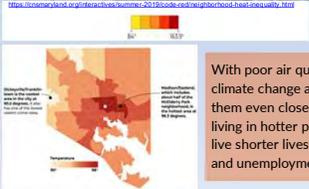


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Code Red: Heat & Inequality



Drastic temperature differences can be observed in city infrastructure, most often attributed to SES. Those who can afford the shadier homes experience significant comfort and security as opposed to those experiencing dangerous heat levels. President and CEO of American Forests says "The single greatest threat from climate change to people in cities is extreme heat"



With poor air quality and damaged infrastructure, the effects of climate change are exacerbated for at-risk communities, putting them even closer to harm's way. Data has shown that those living in hotter parts of the city are "more likely to be poor, to live shorter lives, and to experience higher rates of violent crime and unemployment".

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What Can We Do?

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Framework for Authentic Partnerships

- *Quality processes* that are relationship focused; open, honest and respectful; trustbuilding; acknowledging of history; committed to mutual learning and sharing credit.
- *Meaningful outcomes* which are tangible and relevant to communities. For example: eliminating health disparities, affordable housing, education and economic development.

[Achieving the Promise of Authentic Community-Higher Education Partnerships: A Community Partner Summit](#)

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Framework for Authentic Partnerships

Transformation at multiple levels, including:

- a. Personal transformation, including self reflection and heightened political consciousness
- b. Institutional transformation, including changing policies and systems
- c. Community transformation, including community capacity building
- d. Transformation of science and knowledge, including how knowledge is generated, used and valued and what constitutes "evidence"
- e. Political transformation, including social justice

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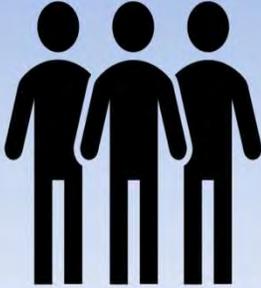
Boyer's Five Dimensions of Science

- Scholarship of Inquiry
 - Scholarship of Integration
 - Scholarship of Teaching
 - Scholarship of Engagement
 - Scholarship of Application
- Need to do all five dimensions to holistically assess and solve local level environmental health problems, reduce health disparities, and empower local communities

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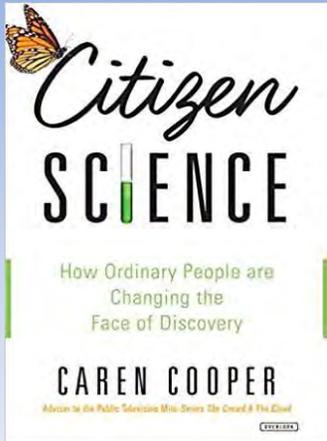
Engagement Bridges

- Issues
- Impacts
- Opportunities
- Benefits
- Partnerships



- Food
- Faith
- Family
- Health
- Jobs

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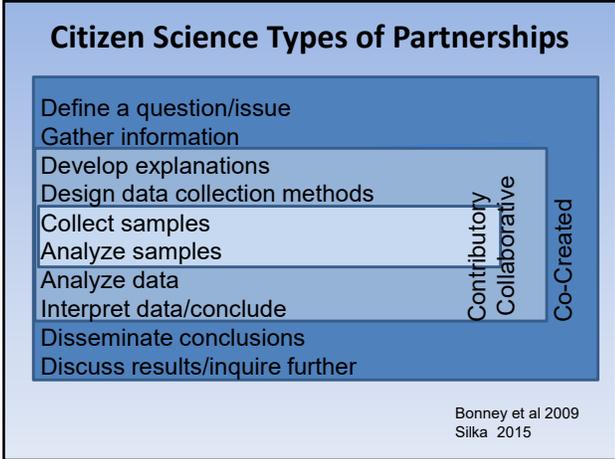
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Classifying Citizen Science Projects

Project	Brief Description of Project	Wiggins and Crowston Classification	Roy et al Classification	Haklay Classification
Galaxy Zoo	Classifying images of galaxies	Virtual	Mass Contributory	2- Distributed Intelligence
eBird	Collecting bird observations	Investigation	Mass Contributory	2- Distributed Intelligence
What's Invasive	Restoring local bay's clams and oysters	Conservation	Mass Contributory	2- Distributed Intelligence
Reclaim the Bay	Restoring local bay's clams and oysters	Action	Local Community-led	3- Participatory Science
Corfe Mullen Bio-blitz	Identifying species in Corfe Mullen village and local area	Investigation/Education	Local Co-created	3- Participatory Science
Climateprediction.net	Volunteers' computers used to run climate prediction models	Virtual	Mass Contributory	1- Crowdsourcing

European Commission Report

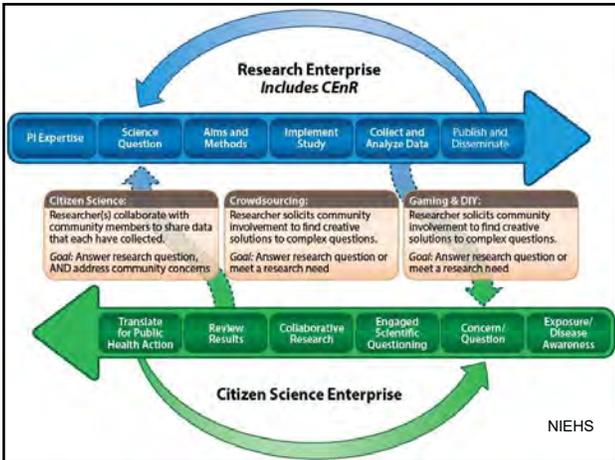
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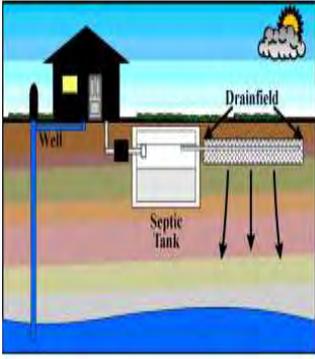


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Community-Driven Water Research



Septic system failure: High prevalence of failure in West End (24%), White Level (18%), and Buckhorn/Perry Hill (11%)

Exposure pathways: Septic system failures represent pathways of exposure to fecal contamination

Household drinking water: Evidence of *E. coli*, fecal coliforms, *Enterococcus* and F-specific coliphage; Turbidity levels exceeded national drinking water standards for turbidity (1.0 NTU)

Surface water: Fecal indicators were detected at WERA control and study sites exceeding EPA standards

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Installation of Safe Up-to-code Water and Sewer Services

Paved Streets and Install Up-to-code Surface Water Drainage

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Apps and Tools for Environmental Justice

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AARP

- Pilot Testing of My Block Counts - community block assessment app
- Bridge the "digital divide" via digital literacy training
- Community members share the results of their community block assessment via social media
- Goals - improved understanding of environmental justice and planning/zoning policies; engaging older adults with digital technologies to improve digital literacy
- Current status - recruiting for virtual workshops



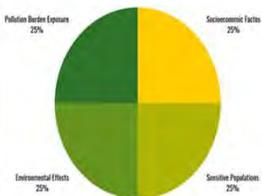
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MARYLAND'S EJ SCREEN

[HTTPS://DNR.MARYLAND.GOV/PAGES/PARKEQUITY.ASPX](https://dnr.maryland.gov/pages/parkequity.aspx)

EJ SCREEN DATA LAYERS

LAYERS & WEIGHTING OF MODEL



POLLUTION BURDEN EXPOSURE
GEOGRAPHIC PROXIMITY
EX. AIR TOXINS HAZARDS



POLLUTION BURDEN ENVIRONMENTAL EFFECTS
EFFECTS THAT COULD BE MITIGATED
EX. PROXIMITY TO WATER DISCHARGE, LEAD PAINT



SENSITIVE POPULATIONS
POPULATION CHARACTERISTICS WITH HEALTH DISPARITIES



SOCIOECONOMIC FACTORS
POPULATION CHARACTERISTICS



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MARYLAND'S PARK EQUITY MAPPER

Maryland GIS tool for mapping Greenspace

- **Park Equity:** Creating equal access to opportunities in parks and other green spaces for all Marylanders
- **Greenspace benefits:**
 - **Instoration:** Encouraging physical activity
 - **Restoration:** Direct and restore attention and focus
 - **Mitigation:** Environmental exposure reduction
 - **Economic:** Increased housing and business value
 - **Ecological:** Increased stormwater and climate (e.g. heat) mitigation
 - **Sociologic:** Decreased crime (when well maintained)

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MARYLAND'S PARK EQUITY TOOL

[HTTPS://DNR.MARYLAND.GOV/PAGES/PARKEQUITY.ASPX](https://dnr.maryland.gov/pages/parkequity.aspx)

PARK EQUITY DATA LAYERS

LAYERS & WEIGHTING OF MODEL

Layer	Weighting
Park Distance	32%
% Non White	18.2%
Income	9%
Density	9%
% Children < 18	8%
% Adults > 65	9%
Linguistic Isolation	9%
Walkability	3%

- PARK DISTANCE**
LOCAL AND STATE DATA
- POPULATION DENSITY**
US CENSUS
- INCOME**
US CENSUS
- % NON-WHITE**
US CENSUS
- LINGUISTIC ISOLATION**
US CENSUS
- % CHILDREN < 18**
US CENSUS
- % ADULTS > 65**
US CENSUS
- WALKABILITY**
EPA EJ SCREEN
- ACCESS TO TRANSIT**
MARYLAND DOT

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Climate and Health Equity Mapper

- Under Development
- Current Indicators
 - FEMA National Risk Index
 - Proximity to Flood Zones
 - Health Infrastructure (e.g. HPSAs, insurance coverage areas)
 - Health Outcomes (e.g., Asthma)
 - Social Vulnerability Index (SoVI)
 - Community Disaster Resilience Index (CDRI)
 - Context Layers (e.g. segregation)

- PROXIMITY TO FLOOD ZONES**
- CANOPY COVER**
- MEDICALLY UNDERSERVED AREAS**
- PROXIMITY TO NURSING HOMES**

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EPA Na-Tech Disasters

- In collaboration with Duke University, we will assess disaster readiness to what is known as "natural hazard-induced technological disasters (NaTech events)" in Duplin County, NC, and North Charleston, SC.
- Methods - modeling combines with long-standing community knowledge of hazards in the respective areas to create a holistic understanding of disaster readiness
- Research activities - interviews, community walks, Photovoice, focus groups, public participatory geographic information systems (PPGIS) mapping, community block assessments, and other groundtruthing data collection methods
- Planned outputs -
 - A tool to evaluate risks of contaminant exposures for local communities
 - Field study of one urban and one rural community, with a focus on young children and the elderly
 - Strategies for risk mitigation, such as awareness campaigns, health promotion, and emergency readiness plans, co-developed with community stakeholders.

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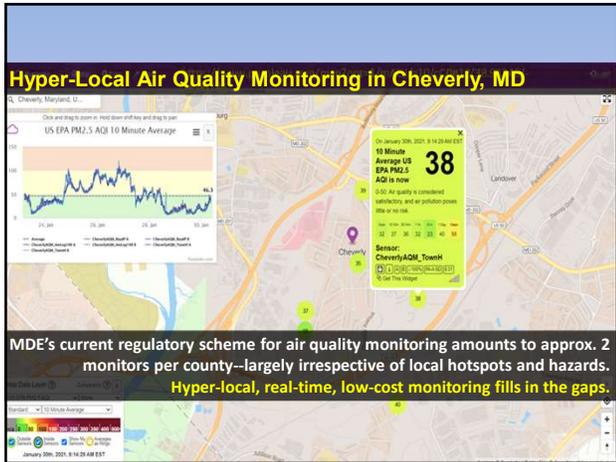
EPA Na-Tech Disasters

- Project outcomes include:
 - A framework for understanding the additional risks borne by vulnerable populations including low-income families, children, and the elderly
 - Enhanced readiness of communities to NaTech exposures
 - Better quality and length of life in vulnerable urban and rural populations

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Air Quality, Environmental Justice, and Cumulative Impacts

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**Environmental Injustice
and Uniontown**

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Uniontown, Alabama

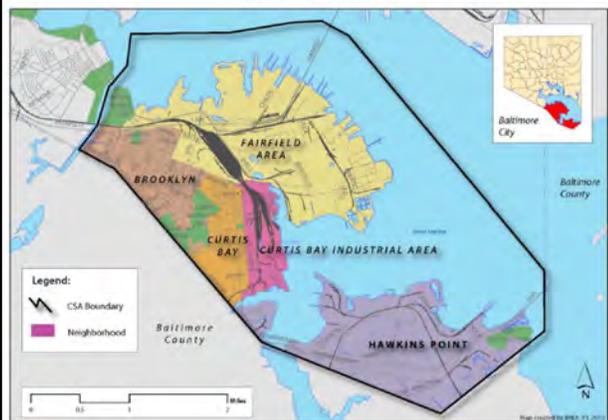


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Environmental Justice and Youth Engagement in Curtis Bay, Baltimore

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Figure 1: Baybrook Area



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Toxic Air Emissions Reported to the Toxics Release Inventory in 21226 Relative to Other Zip Codes in the U.S.

Year	Toxic Air Emissions		
	Rank	Percentile	Pounds
2005	7	99.93%	13,736,694
2006	9	99.91%	11,939,943
2007	1	99.99%	20,670,026
2008	1	99.99%	21,650,020
2009	2	99.98%	13,798,694
2010	75	98.96%	2,205,260
2011	73	99.00%	2,084,433

Rank is out of 8,949 zip codes in the U.S. (not counting territories)

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