



SUSTAINABILITY

Masterclass

6 | 7 | 8 | 9
N O V E M B E R
2023

Co-Organizers:



Program at a Glance (1/2)



Outline of Program
November 6, 2023

DAY 1

FRAMING THE SUSTAINABILITY CHALLENGE

10:00-11:30

Session 1: What is Sustainability: Economic Development, Employment, & the Environment
Nicholas Askounes Ashford, PhD, JD
Professor of Technology, Policy Director Technology & Law Program, Massachusetts Institute of Technology

11:30-13:00

Session 2: Intersections of Planetary & Human Health

Sustainability, Planetary and Human Health: Challenges and Opportunities
Philip Demokritou, PhD

Henry Rutgers Chair and Professor of Nanoscience and Environmental Bioengineering, Rutgers University & Adjunct Professor, Harvard University

Helmut Zarbl, D.C.S., Ph.D., ATS Fellow
Chair and Professor of Toxicology, Department of Environmental and Occupational Health, School of Public Health, Research Dean Rutgers University

The Regulation of Environment & Global Climate Change

Nicholas Askounes Ashford, PhD, JD
Professor of Technology, Policy Director Technology & Law Program, Massachusetts Institute of Technology

13:00-14:30

Lunch & Networking

14:30-15:45

Session 3: Economic Development, Globalization (Trade) & Sustainability

Nicholas Askounes Ashford, PhD, JD
Professor of Technology, Policy Director Technology & Law Program, Massachusetts Institute of Technology

15:45-16:00

Coffee Break

16:00-17:15

Session 4: Global Megatrends, Sustainability, & the SDGs [By Zoom]

Wendy M. Purcell, PhD FRSA
Professor, Rutgers University & Academic Research Scholar, Harvard University

17:15-17:30

Closing Remarks and Discussion - Day 1
Philip Demokritou, PhD, N. Ashford, PhD W. Purcell, PhD

Outline of Program

Outline of Program
November 7, 2023

DAY 2

INDUSTRIAL POLICY, ENERGY CONSIDERATIONS AND PARTNERSHIPS FOR SUSTAINABILITY

09:00-9:30

Refreshments & Networking

9:30-9:45

Introduction to Day 2

Philip Demokritou, PhD
Henry Rutgers Chair and Professor of Nanoscience and Environmental Bioengineering, Rutgers University & Adjunct Professor, Harvard University

9:45-11:15

Session 5: Industrial Policy: Technology, Innovation, & Employment

Nicholas Askounes Ashford, PhD, JD
Professor of Technology, Policy Director Technology & Law Program, Massachusetts Institute of Technology

11:15-11:30

Coffee break

11:30-13:00

Session 6: Energy Consideration and Pathways to Sustainability

Nicholas A. Ashford, PhD, JD
Professor of Technology, Policy Director Technology & Law Program, Massachusetts Institute of Technology

13:00-15:00

Lunch & Networking

15:00-17:15

Session 7: Partnerships for Sustainability – Universities, Business, & Community

Introductory lecture: Universities Driving Sustainability in Partnership
Wendy M. Purcell, PhD FRSA (45 mins)
Professor, Rutgers University & Academic Research Scholar, Harvard University

Integrating Public and Ecosystem Health Systems: Challenges and Opportunities to Move from Knowledge to Action
Kathleen Rest, PhD, MPA (20 mins)
Senior Fellow, Institute for Global Sustainability, Boston College

Greening the University Campuses: The University of West Attica Vision
John Kaldellis, PhD (20 mins)
Professor, University of West Attica

National Strategy on Research, Technological Development and Innovation 2021-2027. Research and Innovation Priorities for the support of Circular Economy and Sustainability

Dr Antonios Gypakis (20 mins)
Head of the Policy Planning Department / Planning and Programming for Research and Innovation Directorate, General Secretariat for Research and Innovation

Implementation of Food Waste Management in Greek Municipalities under a Circular Economy Perspective
Lyberatos Gerasimos, PhD (20 min)
Professor, National and Technical University of Athens

17:15-17:30

Closing Remarks and Discussion - Day 2

Wendy M. Purcell, PhD FRSA
Professor, Rutgers University & Academic Research Scholar, Harvard University

November 8, 2023

DAY 3

SUSTAINABILITY AGRICULTURE AND FOOD SYSTEMS

09:00-9:30

Refreshments & Networking

9:30-9:45

Introduction to day 3

Philip Demokritou, PhD
Henry Rutgers Chair and Professor of Nanoscience and Environmental Bioengineering, Rutgers University

9:45-11:30

Session 8: Sustainable Agriculture and Food systems

Sustainable Agriculture
Jason White, PhD
Director of the Connecticut Agricultural Experiment Station & Clinical Professor of Epidemiology (Environmental Health, Yale School of Public Health)

11:30-11:45

Coffee Break

11:45-12:30

Sustainable Nanotechnology: Nature-derived sustainable materials for agriculture, food systems, and beyond.
Philip Demokritou, PhD

Henry Rutgers Chair and Professor of Nanoscience and Environmental Bioengineering, Rutgers University

12:30-14:00

Lunch & Networking

14:00-15:00

Healthy Diets from Sustainable Food Systems: The Mediterranean Diet
Stefanos Kales, MD
Professor, Harvard Medical School and TH Chan School of Public Health

15:00-16:00

Technological Advances in Food Safety [By Zoom]
Benedetto Marelli, PhD
Associate Professor of Civil and Environmental Engineering, Massachusetts Institute of Technology

16:00-16:30

Smart farming Decision Support Systems. A key factor for sustainability and growth in agriculture
Dimitris Kapnias, Senior manager - Large Scale Projects, NEUROPUBLIC – GAIA EPICHEREIN

16:30-17:00

Global food systems under risk: Are we facing a permanent crisis?
Yannis E. Doukas, PhD
Assistant Professor of Agricultural Economics and Policy, National and Kapodistrian University of Athens, Greece

17:00-17:30

Closing Remarks and Discussion - Day 3

Philip Demokritou, PhD, Jason White, PhD, Stefanos Kales, MD

DAY 4

SUSTAINABILITY IN VARIOUS SECTORS IN GREECE

09:30-10:00

Refreshments & Networking

10:00-10:15

Opening Remarks
Margarita-Niki Assimakopoulos, PhD
Associate Professor, Physics Department, National and Kapodistrian University of Athens

Maria K. Koukou, PhD
Asst. Professor, Department of Agriculture Development, Agri-Food and Natural Resources Management, National and Kapodistrian University of Athens

10:15-11:15

Sustainable Buildings
Margarita-Niki Assimakopoulos, PhD
Associate Professor, Physics Department, National and Kapodistrian University of Athens

11:15-11:45

Standarisation activities and guidelines to decarbonise buildings construction and operation
Alkis Triantafyllopoulos, Mech. Eng. ASHRAE Region XIV SA Chair

12:00-12:30

Sustainability in industrial company WILO
Panagiotis Stapas, Managing Director Wilo Hellas and Vice President ASHRAE Hellenic Chapter

12:30-12:45

Sustainability & EUROPA. Looking into the future.
Dikaiou Eleni, Energy Efficiency Consultant M.Sc., PMP, Europa Profil Aluminium S.A.

12:45-13:15

Decarbonization of European Islands. The Scientific Experiment of Tilos
John Kaldellis, PhD
Professor, University of West Attica

13:15-13:45

Sustainable geothermal applications – the case of Polichnitos
Maria K. Koukou, PhD
Asst. Professor, Department of Agriculture Development, Agri-Food and Natural Resources Management, National and Kapodistrian University of Athens

Michail Gr. Vrachopoulos, PhD
Professor, Department of Agriculture Development, Agri-Food and Natural Resources Management, National and Kapodistrian University of Athens

13:45-14:15

Closing Remarks and Discussion - Day 4

Philip Demokritou, PhD, Margarita-Niki Assimakopoulos, PhD

Program at a Glance (2/2)



SCIENTIFIC COMMITTEE

Professor Nicholas Askounes Ashford, *Professor of Technology & Policy and Director of the Technology & Law Program at the Massachusetts Institute of Technology*

Professor Philip Demokritou, *Henry Rutgers Chair and Professor of Nanoscience and Environmental Bioengineering, Rutgers University*

Professor Wendy M. Purcell, *PhD FRSA Professor, Rutgers University & Academic Research Scholar, Harvard University*

Professor Michail Gr Vrachopoulos, *Energy and Environmental Research Lab, Department of Agriculture Development, Agri-Food and Natural Resources Management, National and Kapodistrian University of Athens*

Assistant Professor Maria K. Koukou, *Energy and Environmental Research Lab, Department of Agriculture Development, Agri-Food and Natural Resources Management, National and Kapodistrian University of Athens*

Professor Vassileios N. Stathopoulos, *Laboratory of Chemistry & Materials Technology, Department of Agriculture Development, Agri-Food and Natural Resources Management, National and Kapodistrian University of Athens*

Professor Christiana A. Mitsopoulou, *Chemistry Department and Research Institute of Energy-Renewable Sources and Transport, University Center of Research 'Antonis Papadakis', National and Kapodistrian University of Athens*

Associate Professor Margarita-Niki Assimakopoulos, *Physics Department, Group of Building Environmental Studies, National and Kapodistrian University of Athens*

ORGANISATION COMMITTEE

Professor Michail Gr Vrachopoulos, *Energy and Environmental Research Laboratory, Department of Agriculture Development, Agri-Food and Natural Resources Management, National and Kapodistrian University of Athens*

Assistant Professor Maria K. Koukou, *Energy and Environmental Research Laboratory, Department of Agriculture Development, Agri-Food and Natural Resources Management, National and Kapodistrian University of Athens*

Professor Vassileios N. Stathopoulos, *Laboratory of Chemistry & Materials Technology, Department of Agriculture Development, Agri-Food and Natural Resources Management, National and Kapodistrian University of Athens*

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Associate Professor Margarita-Niki Assimakopoulos, *Physics Department, Group of Building Environmental Studies, National and Kapodistrian University of Athens*

SPEAKERS

Ashford Nicholas Askounes, *Professor of Technology & Policy and Director of the Technology & Law Program at the Massachusetts Institute of Technology*

Demokritou, Philip, *Henry Rutgers Chair and Professor of Nanoscience and Environmental Bioengineering, Rutgers University*

Kales Stefanos, *Professor, Harvard Medical School and TH Chan School of Public Health*

Marelli Benedetto, *Associate Professor of Civil and Environmental Engineering, Massachusetts Institute of Technology*

Purcell M. Wendy, *Professor, Rutgers University & Academic Research Scholar, Harvard University*

Rest Kathleen, *Senior Fellow, Institute for Global Sustainability, Boston College*

White Jason, *Director of the Connecticut Agricultural Experiment Station & Clinical Professor of Epidemiology (Environmental Health, Yale School of Public Health)*

Zarbl Helmut, *Chair and Professor of Toxicology, Department of Environmental and Occupational Health. School of Public Health, Research Dean, Rutgers University*

Assimakopoulos Margarita-Niki, *Associate Professor, Physics Department, Group of Building Environmental Studies, National and Kapodistrian University of Athens*

Dikaïou Eleni, *Energy Efficiency Consultant M.Sc., PMP, Europa Profil Aluminium S.A.*

Doukas E. Yannis, *Assist. Professor of Agricultural Economics and Policy, National and Kapodistrian University of Athens, Greece*

Gypakis Antonios, *Head of the Policy Planning Department / Planning and Programming for Research and Innovation Directorate, General Secretariat for Research and Innovation*

Kaldellis John, *Professor, Mechanical Engineering Department, University of West Attica*

Kapnias Dimitris, *Senior manager - Large Scale Projects, NEUROPUBLIC – GAIA EPICHEIREIN*

Koukou K. Maria, *Assist. Professor Department of Agriculture Development, Agri-Food and Natural Resources Management, National and Kapodistrian University of Athens*

Lyberatos Gerasimos, *Professor, School of Chemical Engineering, National and Technical University of Athens*

Stapas Panagiotis, *Managing Director Wilo Hellas*

Triantafyllopoulos Alkis, *Mech. Eng. ASHRAE Region XIV SA Chair*

Vrachopoulos Gr. Michael, *Professor Department of Agriculture Development, Agri-Food and Natural Resources Management, National and Kapodistrian University of Athens*

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QUESTIONS?

Session 1: What is Sustainability- Economic Development, Employment and the Environment

Prof. N. Ashford, MIT



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NOVEMBER
2023

Co-Organizers:

HELLENIC REPUBLIC National and Kapodistrian University of Athens
RUTGERS School of Public Health
MIT Massachusetts Institute of Technology

Nicks SLIDES to be inserted here

Session 2: The Intersection of Planetary and Human Health

Sustainability, Planetary and Human Health- Challenges and Opportunities

Prof. P. Demokritou & H. Zarbl



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The triad of interconnected challenges of our century: Pollution, deforestation/biodiversity loss, and Climate change



One Health- One Planet



The interconnection between **people, animals, the environment and human health** (US CDC)

- **The triad of interconnected challenges of our century:** Pollution, deforestation/biodiversity loss, and Climate change
- **FACT#1: Growing population:** Human population is growing (8 billion in 2022) and expanding into new geographic areas- Deforestation
- **Fact#2: Food Safety and Security issues:** Need to double food production by 2050 – Increasing demand for animal-based proteins (**Animal agriculture**)
- **Fact#3:** More people live in **close contact with wild and domestic animals**- opportunities for diseases to pass between animals and people (**Zoonotic diseases**).
- **Fact#4: Globalization-** Increased mobility of people, animals, and animal products via international travel and trade- **quick spread of diseases** (i.e. COVID 19)
- **FACT#5: Climate change-** It's here, it's real, and affects planetary health
- We need to ACT **now**, we have the solutions
- We need to do it in a **SUSTAINABLE, socially cohesive, and inclusive manner, across all stakeholders and at a global scale**

Pollution: World's largest planetary and human thread



- **Pollution:** world's largest environmental risk factor for disease and premature death
- **Deaths from pollution:** Approximately 9 million deaths per year, corresponding to one in six deaths worldwide (same level as cancer deaths).
 - **Reductions: Yes,** in the number of deaths attributable to the types of pollution associated with extreme poverty such as **indoor air and water pollution.**
 - Reductions are **offset** by increased deaths attributable to ambient **air pollution** and toxic chemical pollution (ie, lead).
- **Policy:** Despite ongoing efforts by UN agencies, committed groups, committed individuals, and some national governments (mostly in high-income countries), little real progress against pollution can be identified overall, particularly in the **low-income and middle-income countries**, where pollution is most severe.
- **Urgent attention** is needed to control pollution and prevent pollution-related disease, with an emphasis on air pollution and lead poisoning, and a **stronger focus on hazardous chemical pollution.**
- **Sustainability:** The 20th Century motto – generate and use chemicals and materials and “clean the mess” later causes disease and premature death. It's not **SUSTAINABLE**
- **Pollution is a planetary and human threat:** Its drivers, its dispersion, and its effects on health transcend local boundaries and demand a global response in a sustainable manner.

EARTH

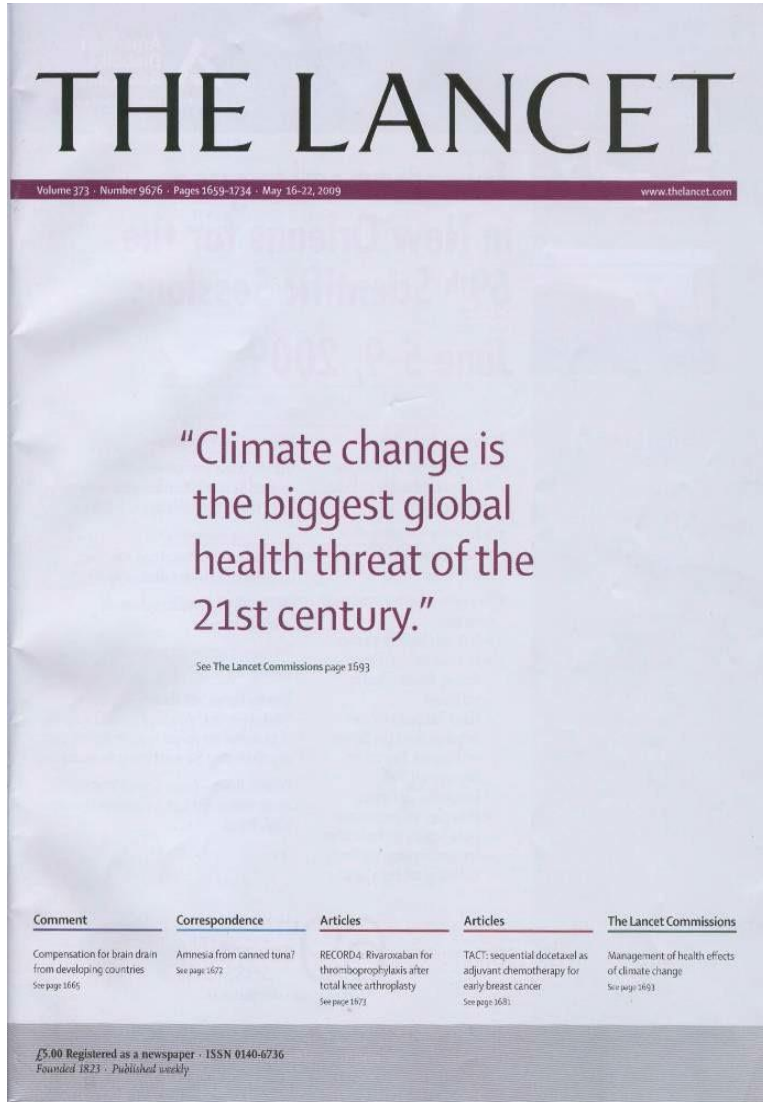
FIRST

We'll Screw Up The

615 ©1999 Bad Habits

Other Planets Later

Climate change and Human Health: The Anthropocene Epoch (1/3)



Anthropocene Epoch:

Current **geological** age: The period during which **human activity has been the dominant influence on climate and the environment.**

"we've become a major force of nature in this new Anthropocene epoch"

“Climate change is the biggest global health threat of the 21st Century. Climate change will have its greatest impact on those who are already the poorest in the world: it will deepen inequities and the effects of global warming will shape the future of health among all peoples.

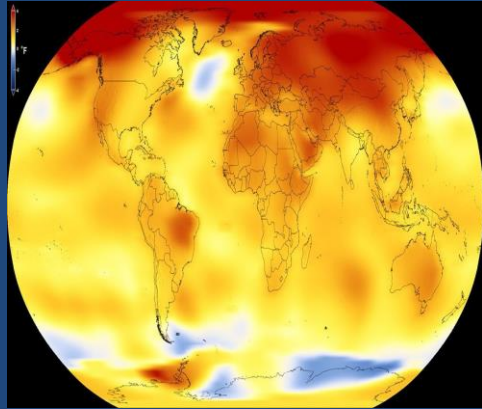
THE LANCET
May 2009

Climate change: Planetary and Human Health (2/3)



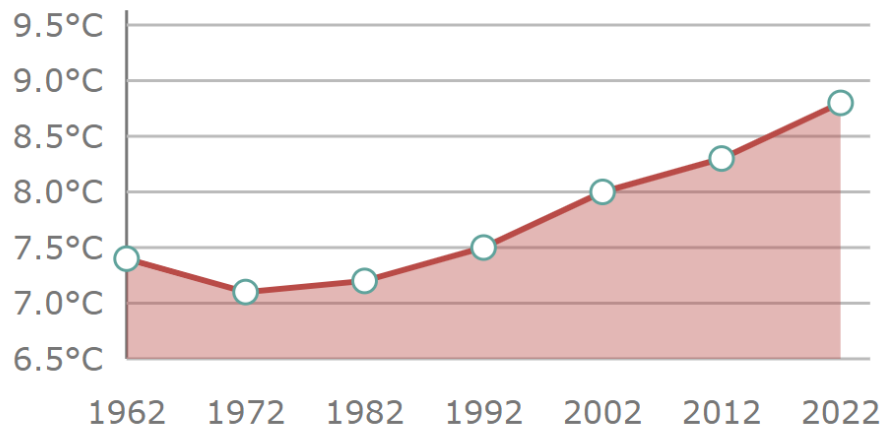
“Climate change... It’s real, it’s happening now and it’s affecting New Jersey and the World.....”

Dr David Broccoli, Co-Director Rutgers Climate Institute :

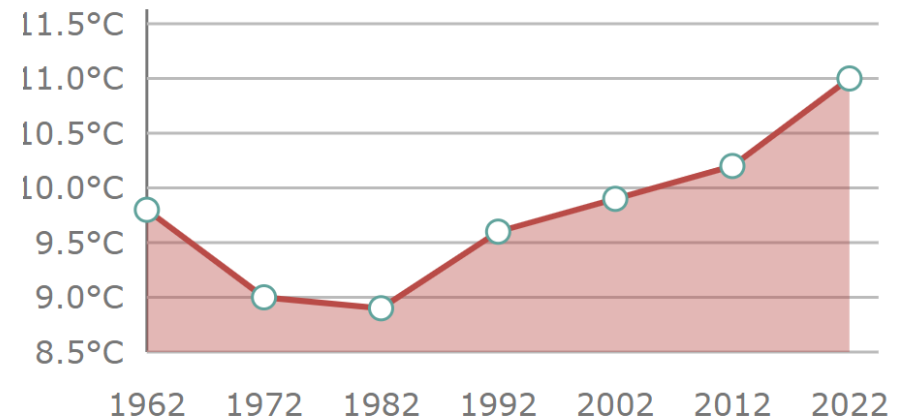


- **Past eight years** confirmed to be the eight warmest on record
- **2016 warmest year so far; July 6th, 2023 hottest day on record**
- **Greece:** The average annual temperature was about 17.8 °C in the years after 1978 and about 19.4 °C in the last four years.
 - **1.7 °C increase in the last 45 years**

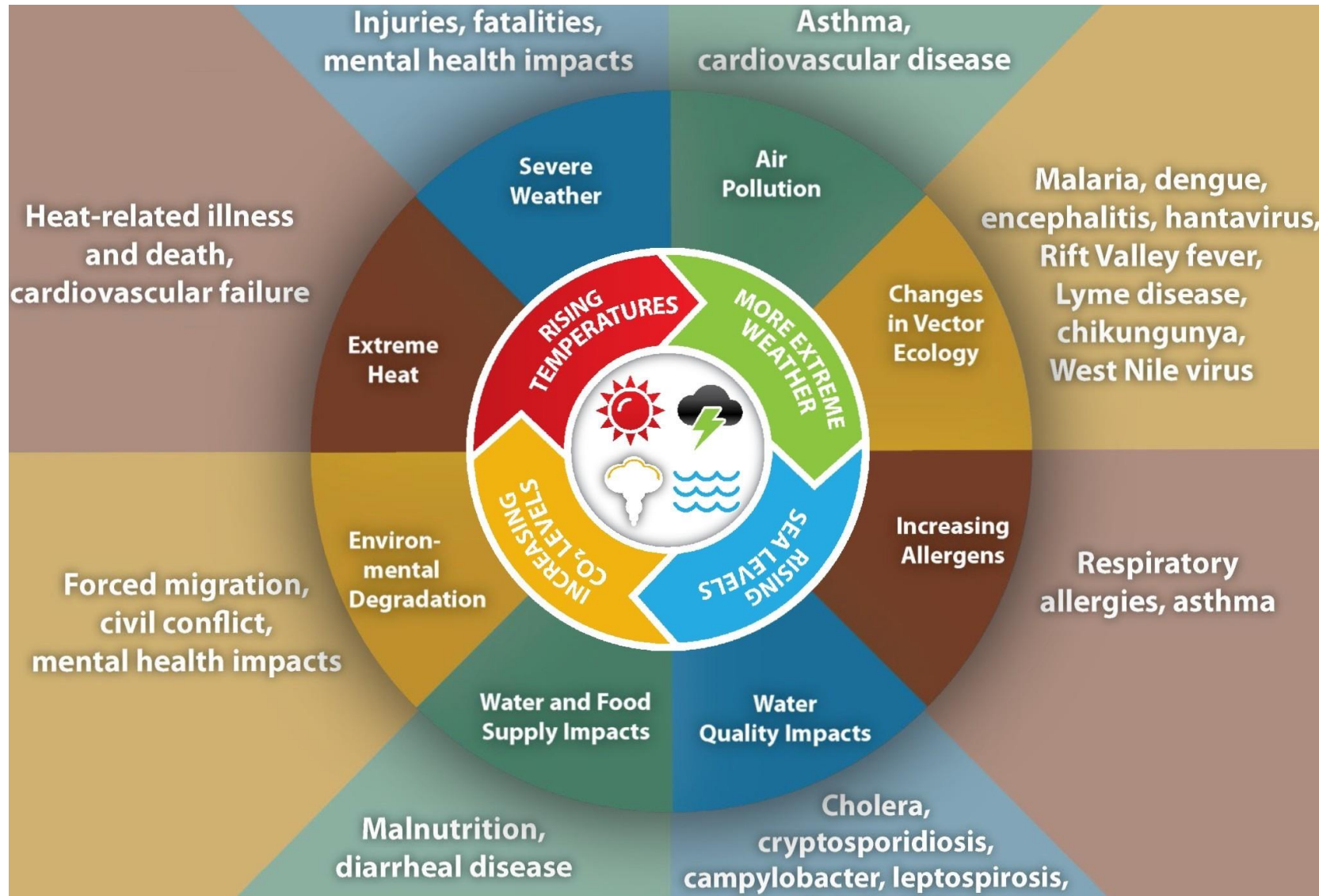
Europe



North America



Climate change and Human Health (3/3)



The logo for the Sustainability Masterclass. It features a central globe surrounded by eight orange circular icons representing various sustainability themes: a leaf, a water drop, a recycling symbol, a person, a gear, a plant, a leaf, and a leaf. The text "SUSTAINABILITY Masterclass" is overlaid on the globe. Below the globe, the dates "6 | 7 | 8 | 9 NOVEMBER 2023" are displayed. At the bottom, the co-organizers are listed: Hellenic Republic National and Kapodistrian University of Athens, Rutgers School of Public Health, and MIT Massachusetts Institute of Technology.

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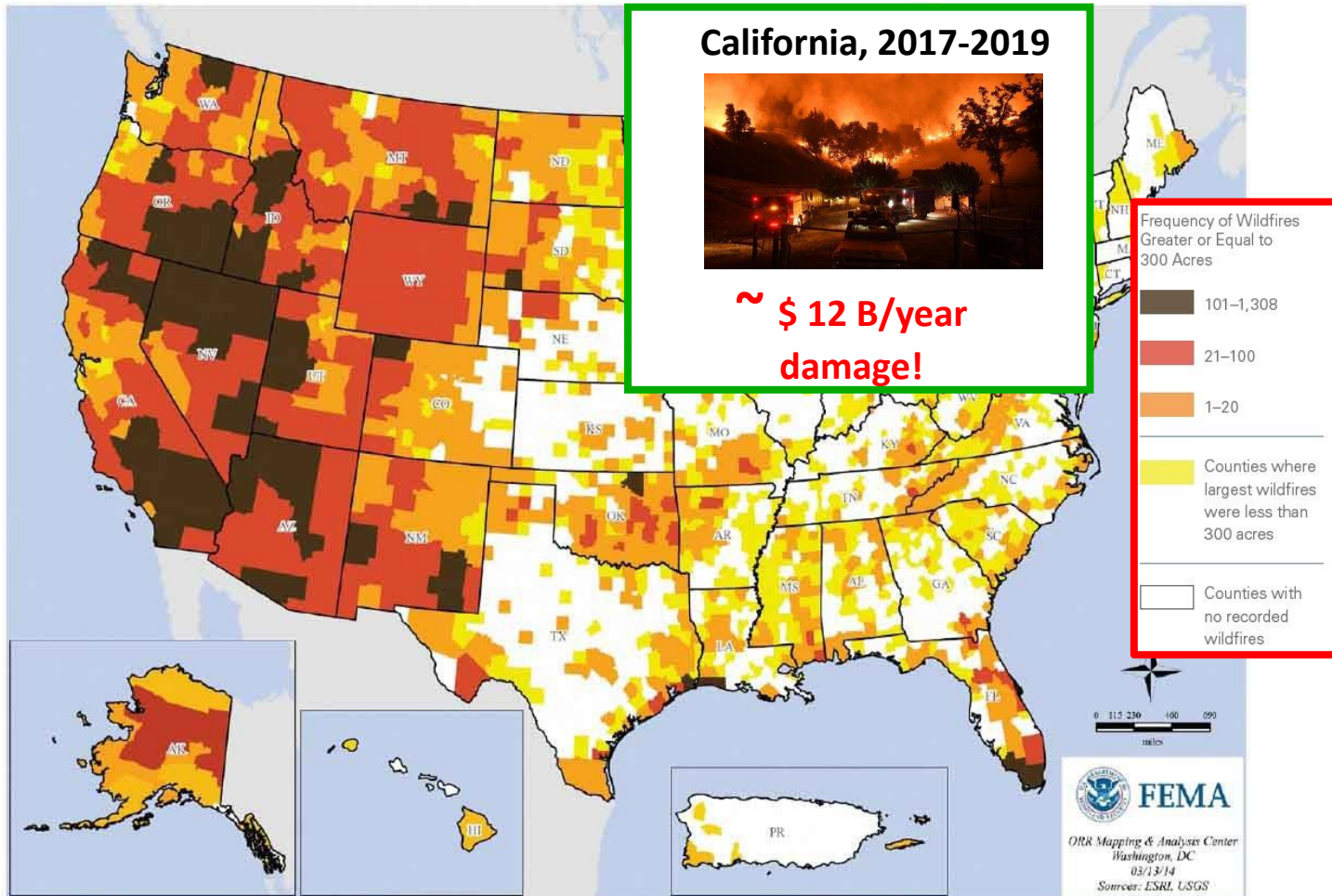
HELLENIC REPUBLIC
National and Kapodistrian
University of Athens

RUTGERS
School of Public Health

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Institute of
Technology

Climate-Driven Wildfires and Health: A case study

Climate-Driven Wildfires and Health (1/4)

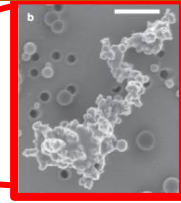


Frequency of Wildfires in USA

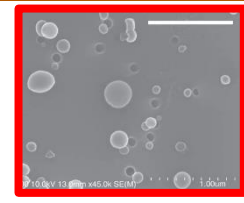
www.nfpa.org

Climate-Driven Wildfires and Health

Canadian Wildfires, June, 2023 (2/3)



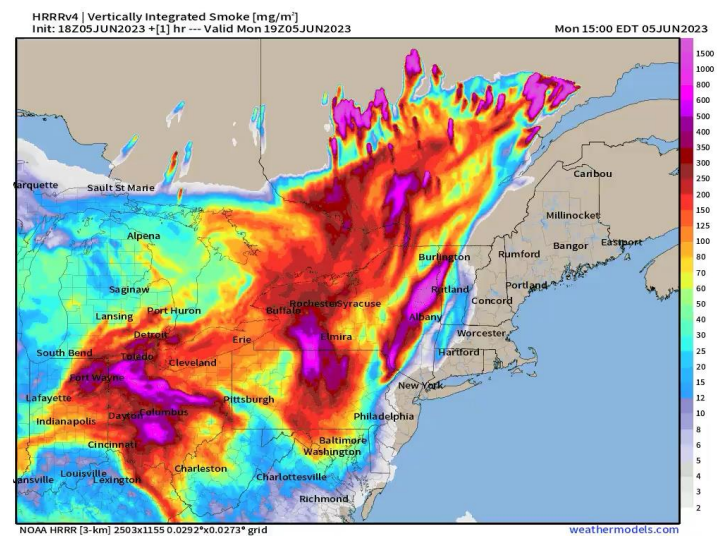
1-5 % of
Black Carbon



95-99 % of Organic &
Brown Carbon

Radiative warming by black carbon lifts the wildfire plume & extends its spread & lifetime [2]!

Canadian Wildfires, Quebec, Summer 2023

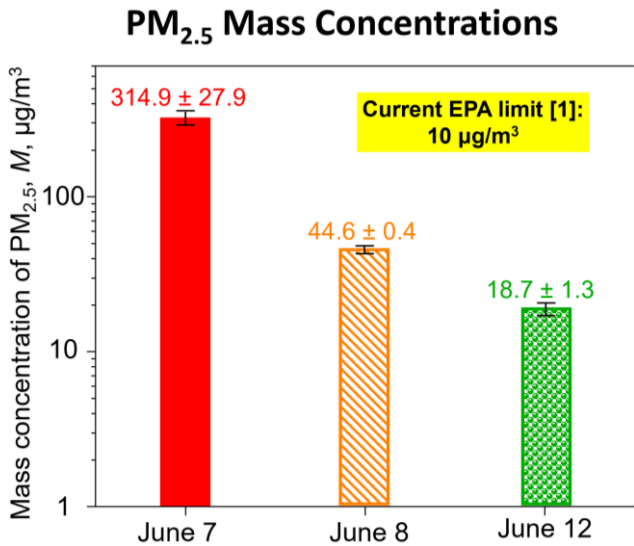


Canadian Wildfire smoke in NYC, June 7, 2023

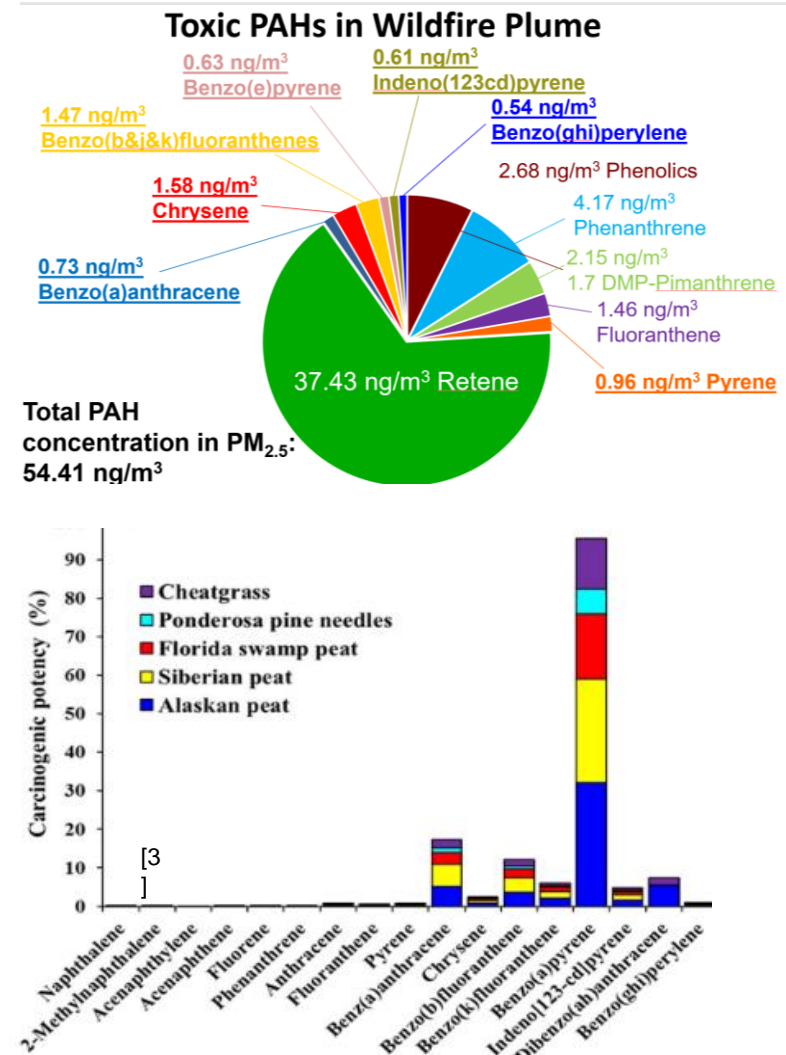
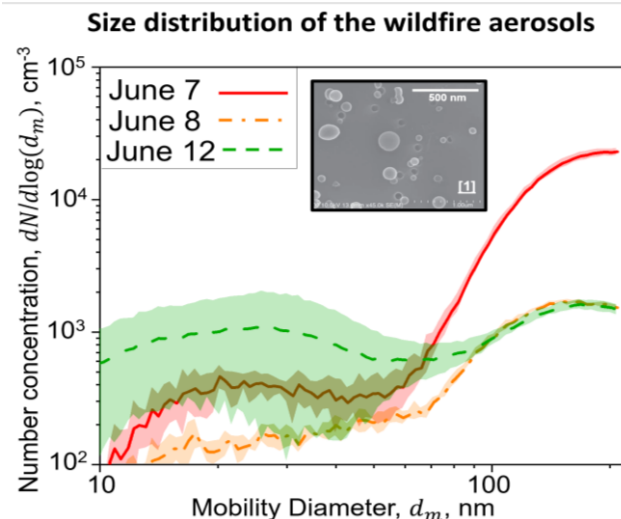
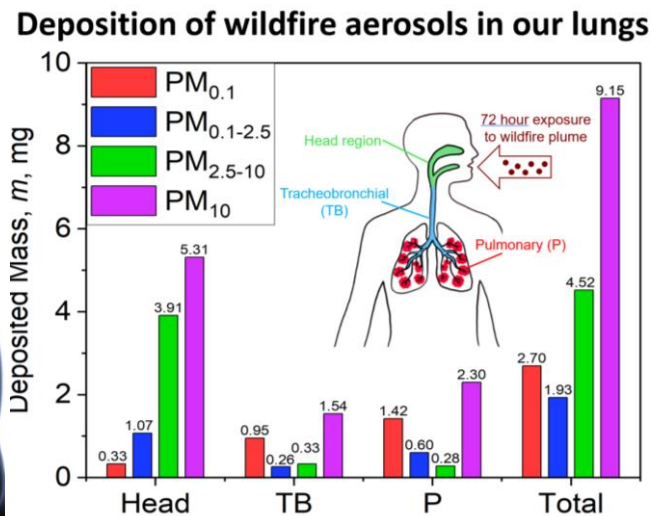
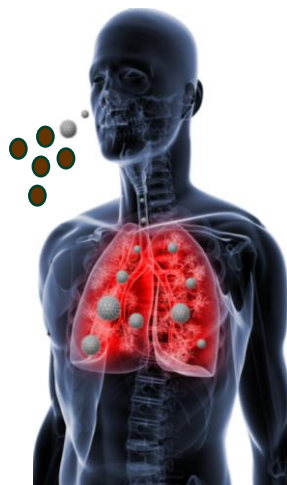
[1] China, S.; Mazzoleni, C.; Gorkowski, K.; Aiken, A. C.; Dubey, M. K. *Nature Comm.* 4 (2013) 2122.
[2] Yu, P.; Toon, O. B.; Bardeen, C. G.; Zhu, Y.; Rosenlof, K. H.; Portmann, R. W.; Thornberry, T. D.; et al. *Science* 365 (2019) 587-590.

Climate-Driven Wildfires and Health

Canadian Wildfires, June, 2023 (2/3)



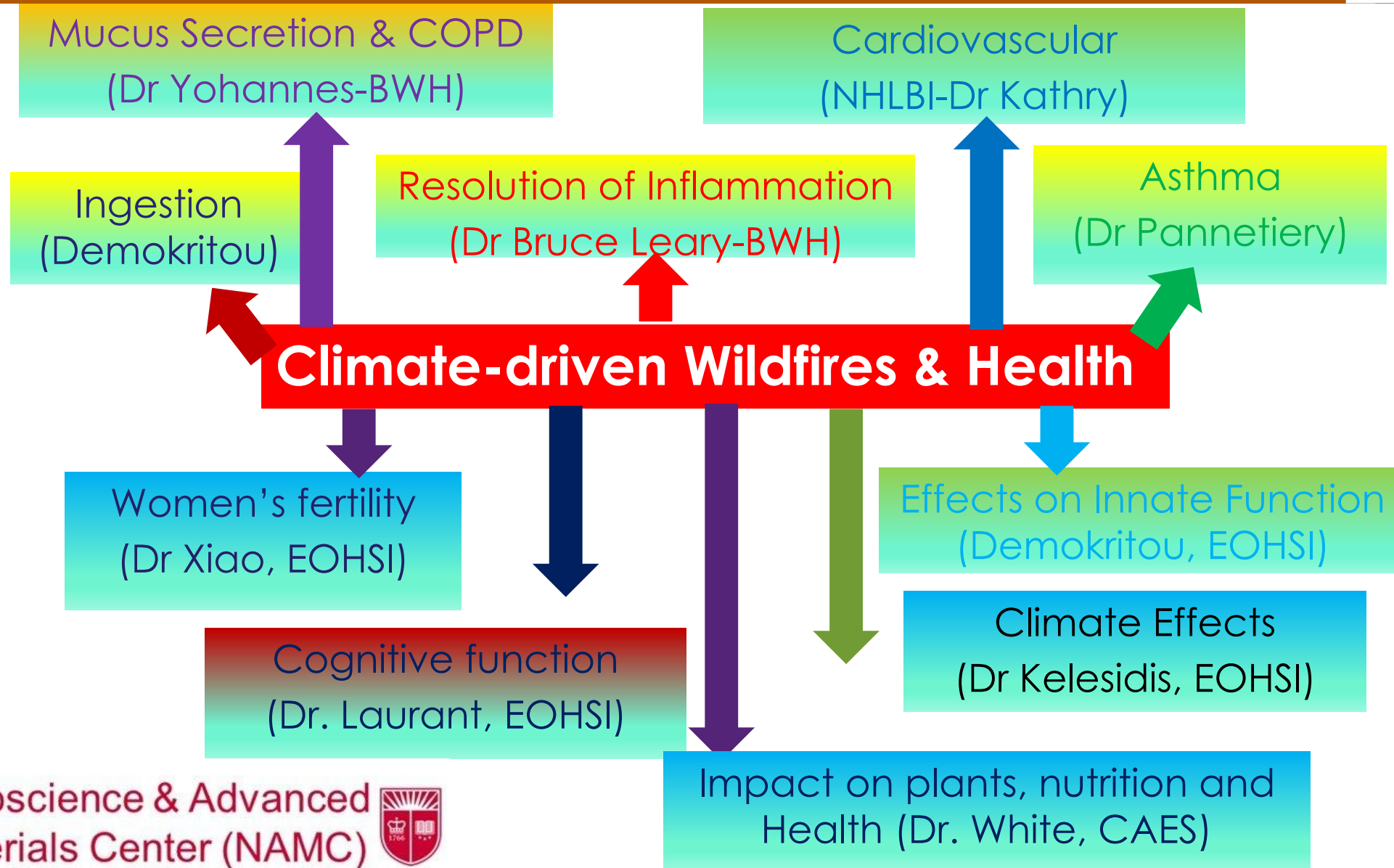
Nanoscience & Advanced Materials Center (NAMC)



[1] www.epa.gov/pm-pollution/national-ambient-air-quality-standards-naaq
 [3] Samburova; et al. *Sci. Total Environ.* 568 (2016) 391-401.

Climate-Driven Wildfires and Health"

Canadian Wildfires, June, 2023 (2/3)



Nanoscience & Advanced Materials Center (NAMC)





CLIMATE SUMMIT

WHAT IF IT'S
A BIG HOAX AND
WE CREATE A BETTER
WORLD FOR NOTHING?

- ENERGY INDEPENDENCE
- PRESERVE RAINFORESTS
- SUSTAINABILITY
- GREEN JOBS
- LIVABLE CITIES
- RENEWABLES
- CLEAN WATER, AIR
- HEALTHY CHILDREN
- etc. etc.





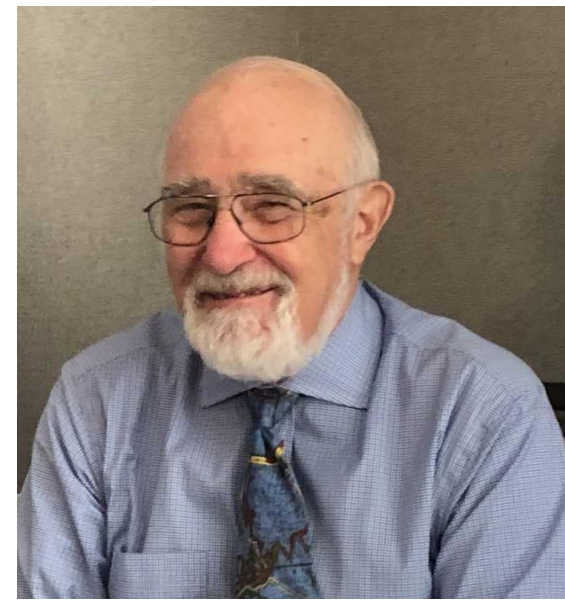
Environmental and Occupational Health Sciences Institute
(eohsi.rutgers.edu)

**The Role of Community-Based
Participatory Research and Engagement
in Environmental Health
and Sustainability**

[Prof. Helmut Zarbl, Rutgers University](#)

Brief History of EOHSI

- **Founded in 1987**
- **State appropriation for building**
- **Led to the first NIEHS funded Center grant, the [Center for Environmental Exposures and Disease](#), presently in its 36th year and just renewed for another 5 years. (ceed.rutgers.edu)**



Bernard Goldstein



EOHSI's Mission

**Advancing science and policy
to reduce health risks
where people live, work and play.**



Vision

To lead and help reshape the future of environmental and occupational health by supporting innovative, community-engaged, transdisciplinary research, intervention, training and clinical care to improve human health.

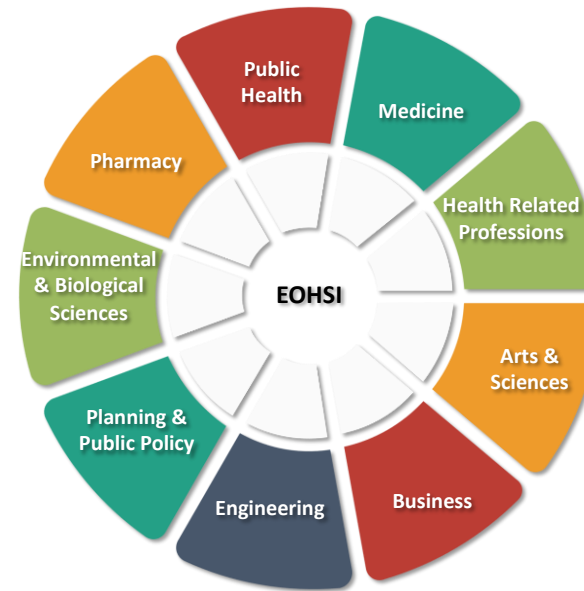
The EOHSI Faculty

EOHSI is comprised of 58 Research and Clinical Faculty representing

- ❖ 9 Schools Rutgers Schools (thr
- ❖ 12 Rutgers Institutes
- ❖ 12 Rutgers Centers
- ❖ Princeton and Lehigh U)

EOHSI Building Residents

- ❖ 17 Resident Faculty
- ❖ 18 Research and 40 Clinical Staff
- ❖ 14 Administrative and Support Staff



Climate change, deforestation and cumulative effects of pollution will have the greatest impact on those affected by racism, poverty, food deserts, disparities, inadequate access to healthcare , etc., especially those living in environmental justice communities.



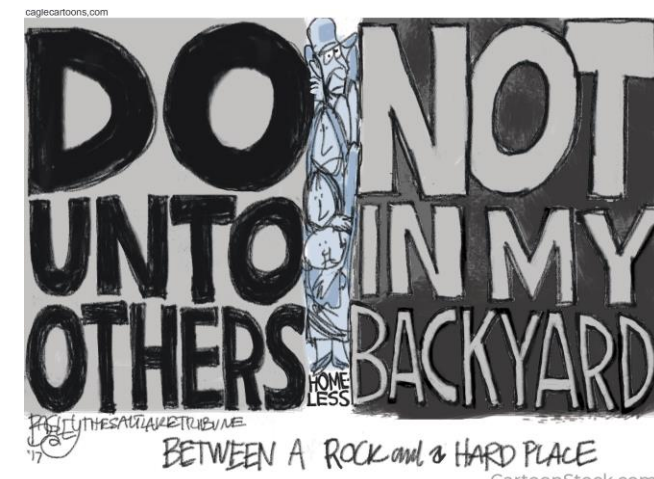
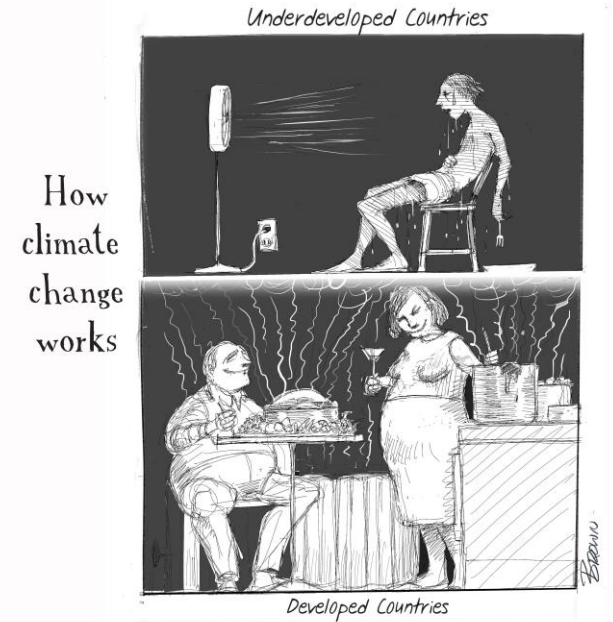
“ Climate change is the biggest global health threat of the 21st Century. Climate change will have its greatest impact on those who are already the poorest in the world: it will deepen inequities and the effects of global warming will shape the future of health among all peoples.

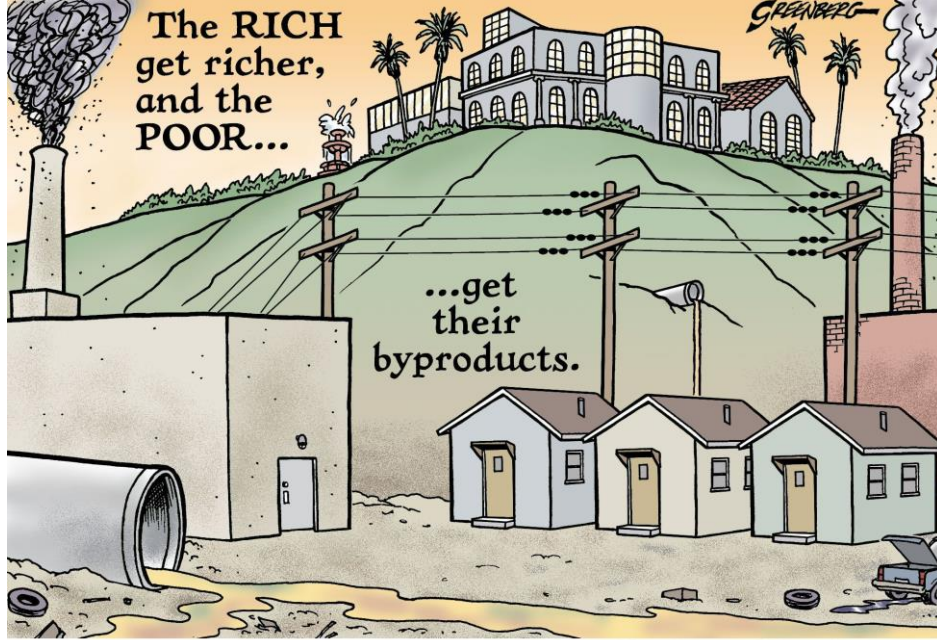
THE LANCET

May 2009

Since immediate impacts are delayed for those living in privileged countries and communities, the solution has been to export our pollution to underdeveloped countries and Environmental Justice (EJ) communities. A few examples include:

- manufacturing that produce hazardous by products
- electronic waste
- universal waste
- hazardous waste
- municipal waste dumps and incinerators
- recycling





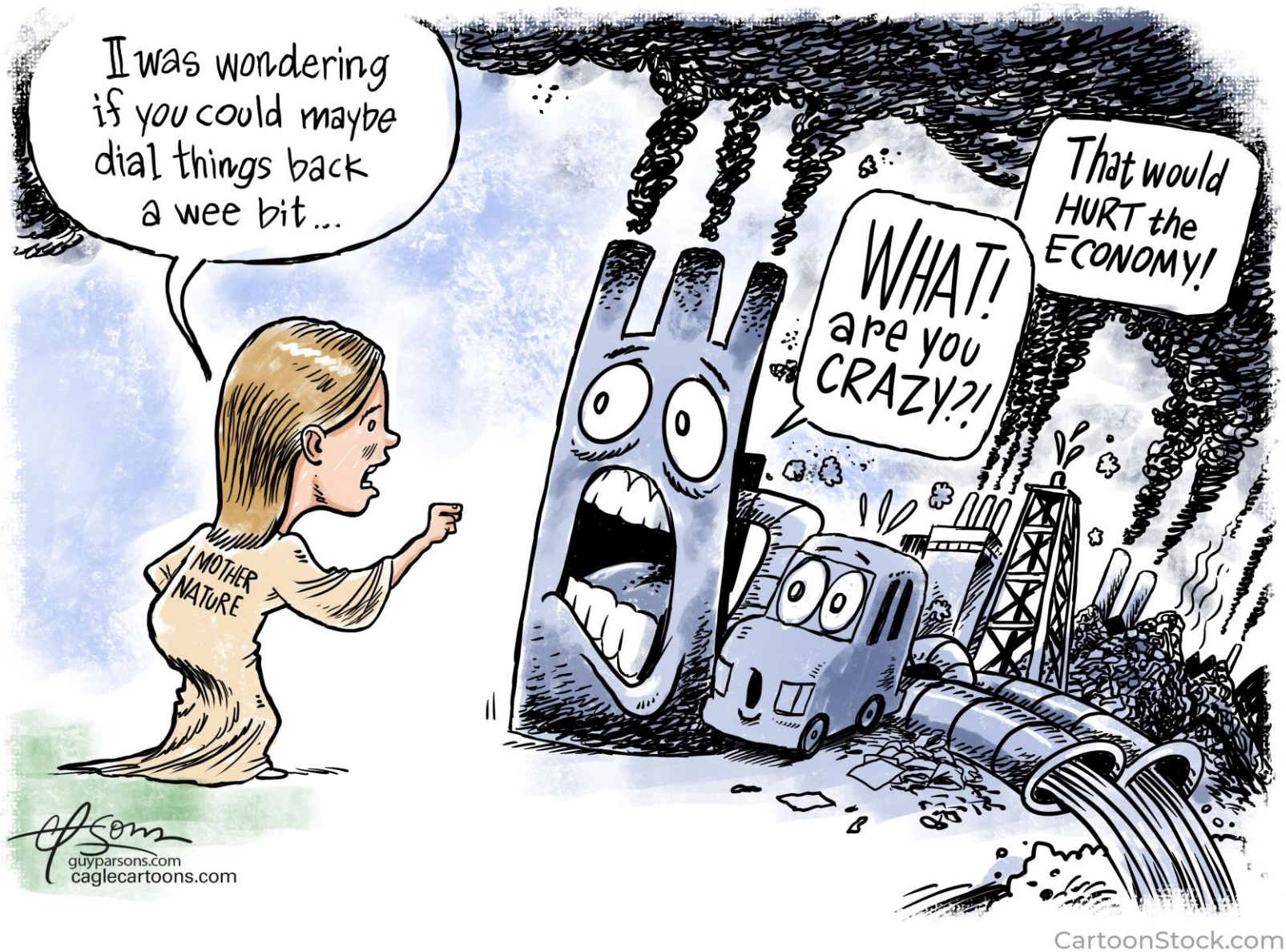
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Status quo for EJ communities and underdeveloped countries

The blame game

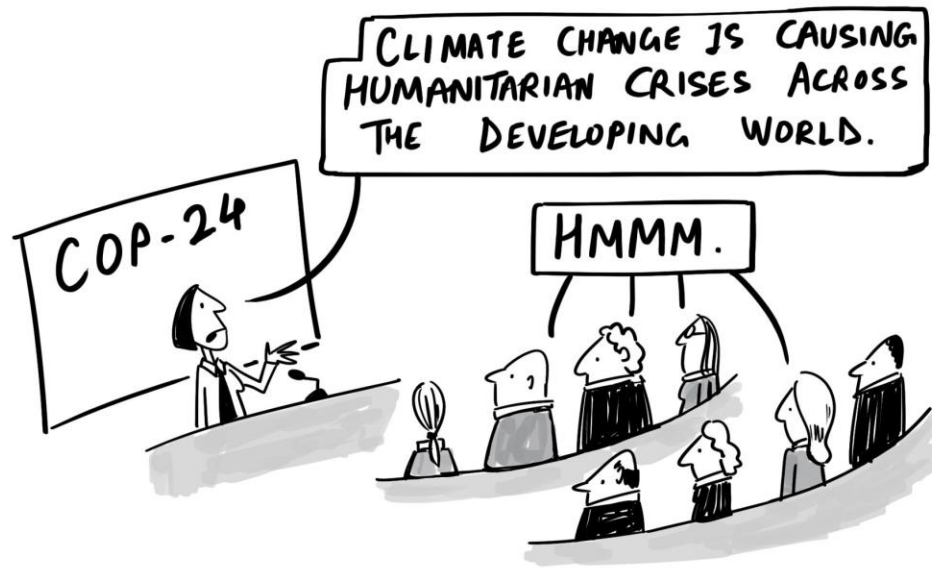


CartoonStock.com



Why should the rich pay?

Cost is too high!

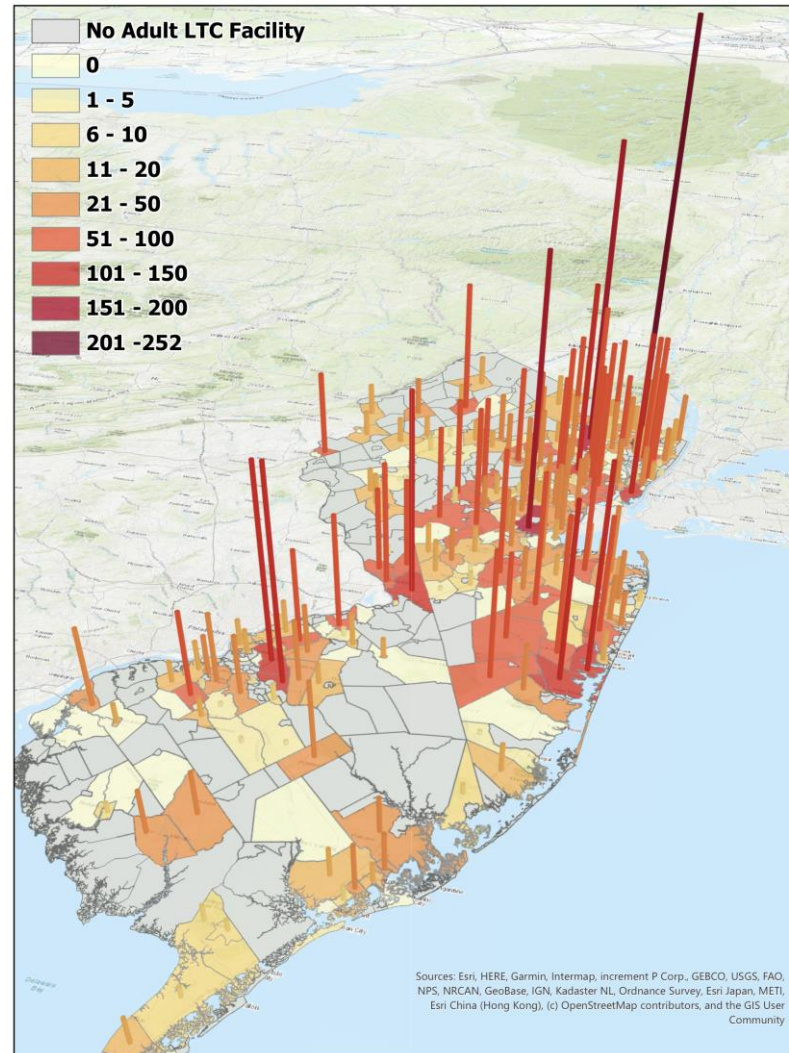


We must act, NOT react before it is too late !!!

Sustainability Investment **Now** Benefits ALL !

- Models such, as the **VULGAR** hypothesis, suggest that the cost of mitigating air quality in EJ communities is too high for the affluent who will receive little benefit.
- However, the more recent **NICE** model by Mark Budolfson, a philosopher/modeler formerly at EOHSI, suggests this is not the case.
- Nice was the first model to include the effects and costs of health inequities when assessing the benefit of climate interventions ([*Nature Climate Change*](#) 11:1111–1116 (2021)).
- Indicates that greenhouse gas (GHG) reductions can maximize health co-benefits for environmental justice communities through revenue recycling, thereby reducing overall costs.
- Importantly, the model predict that in the long-term, climate policies that focus on the most vulnerable will reduce costs and maximize benefits for all.

The Greater Newark Area of NJ as an Environmental Justice Community



Case Study 1:

Community Engaged Intervention to Reduce Exposure and Health Effects of Diesel in an EJ Community

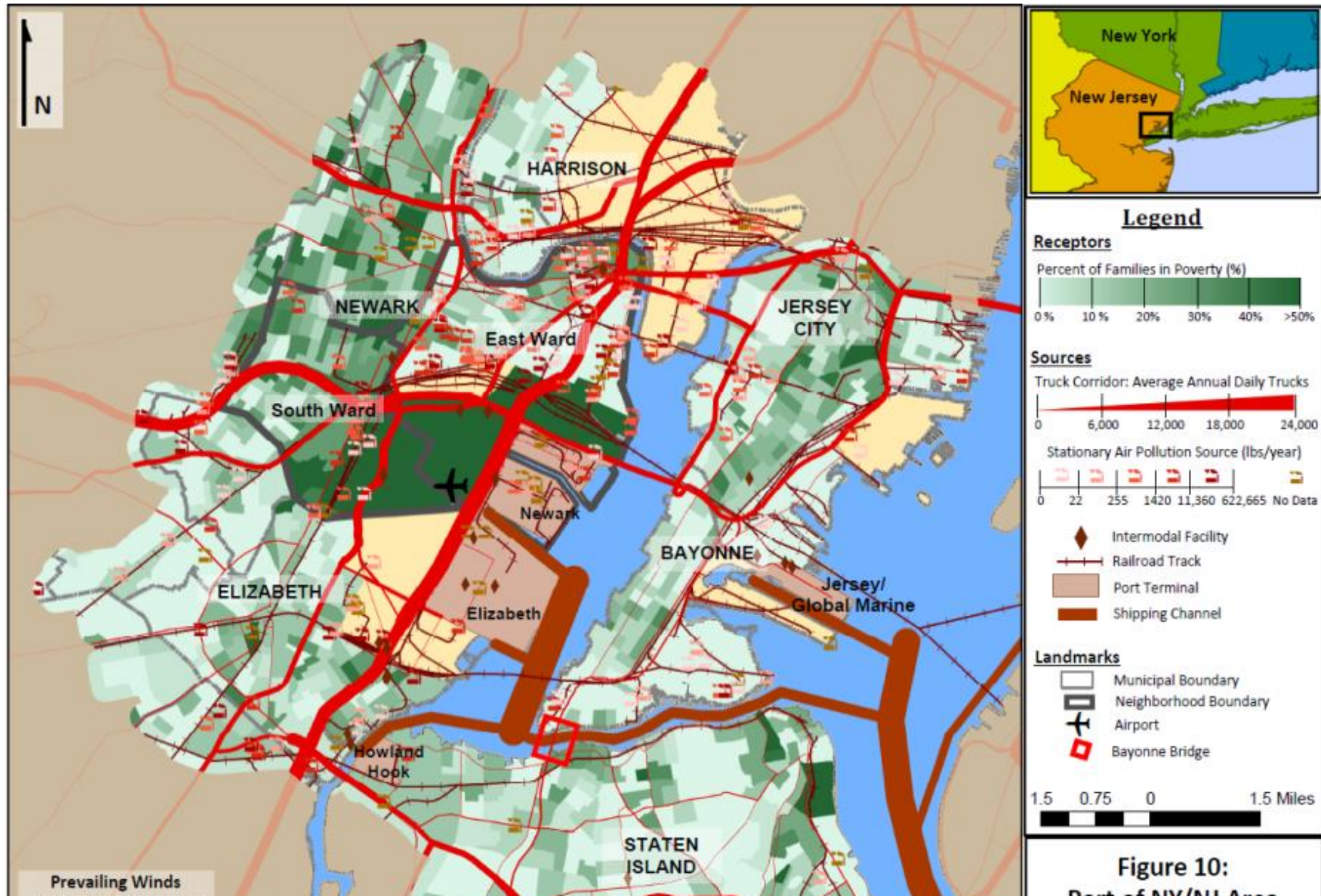


Figure 10:

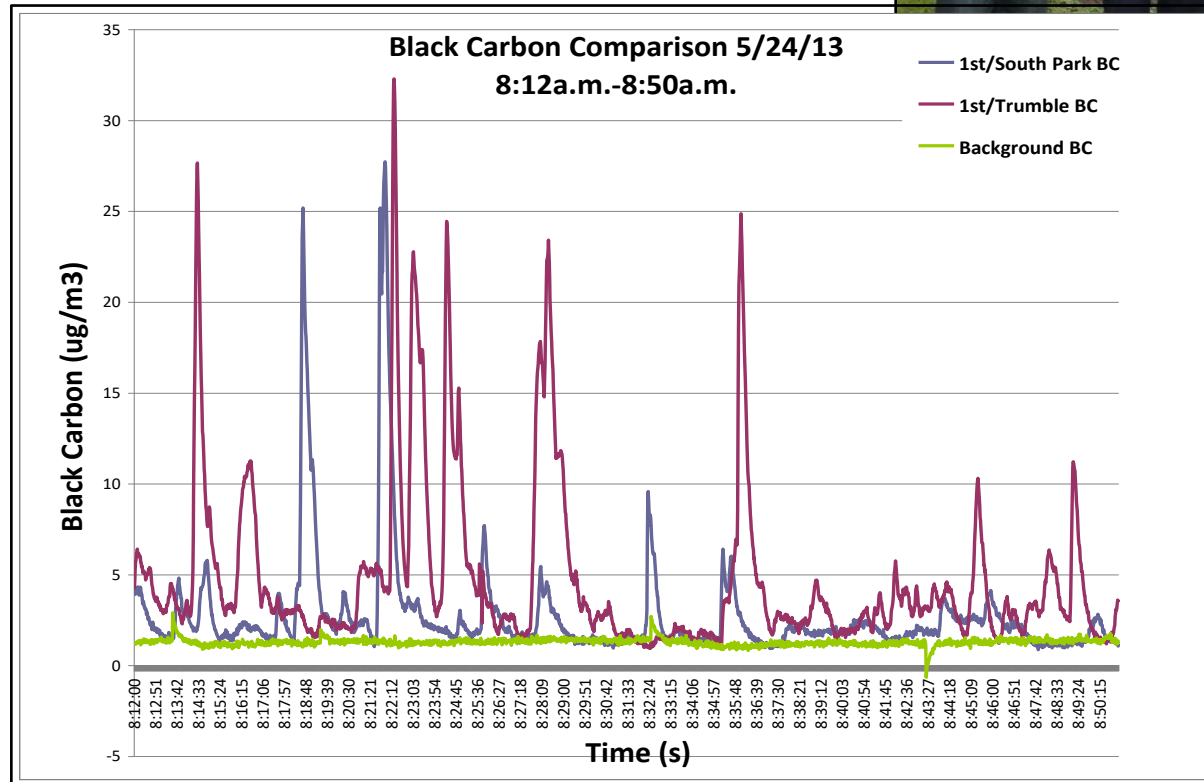
Part of NY/NJ Area

Multiple Stressors

- Air Pollution
 - Trucks, trains, airplanes
 - Point sources: eg. municipal waste incinerator, powerplants, Bayway refinery
- Noise
 - Planes, roadway
- Polluted waters: Passaic River PCBs, dioxin, Hg
- Low lying areas prone to flooding
- Psychosocial stress
- Inequity

Elizabeth Community Truck Count May 24, 2013

- Community members concerned about tractor trailer trucks on residential street passing 3 schools, residences, and community centers.
- And high rates of asthma in local schools
- Joined forces with Rutgers CEED scientists to count trucks and monitor roadside air



- Counted > 60 trucks per hour at two locations
- Air monitoring showed peaks of black carbon and particulate matter with passing trucks
- Along walking routes to 3 neighborhood schools

City Bans Large Trucks on First Street May 9, 2017

- Many trucks were bypassing the toll on the NJ Turnpike
- Local councilman attended presentation of the truck count results
- The CEED-Community truck count report was presented by the community at City Council meetings
- On May 9, 2017 an ordinance prohibiting trucks on a key portion of the residential route passed.
- Follow-up monitoring is planned



- New Truck Ban Ordinance affected Route
- Local Truck Route
- 🚏 K-8 School
- Site of truck count and air monitoring



CITY OF ELIZABETH

Great Business. Vibrant Communities. A New Energy

ORDINANCE NO. 4847

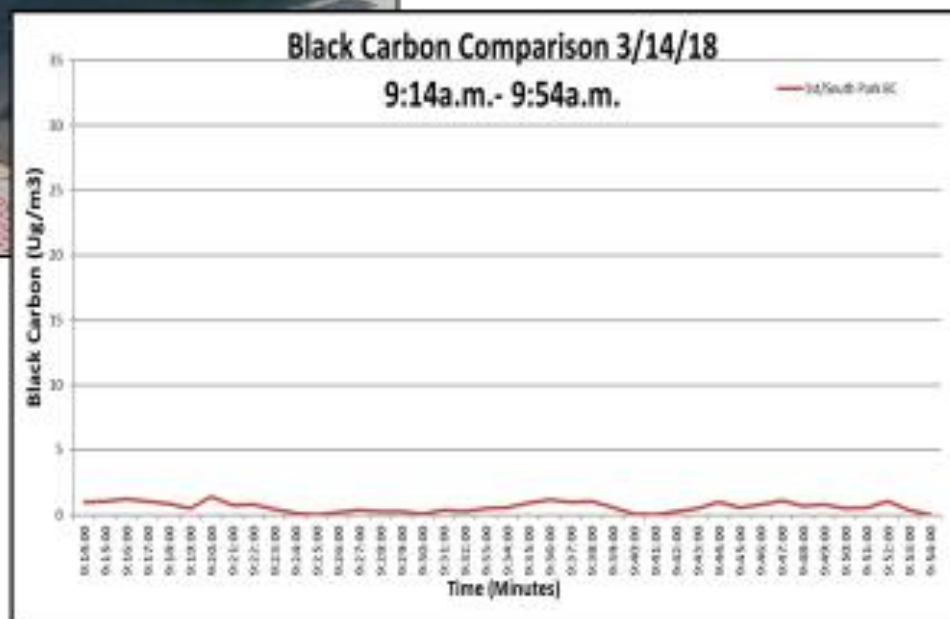
AN ORDINANCE TO AMEND ORDINANCE NO. 4809 AS CODIFIED IN CHAPTER 10.16.010 OF THE CODE OF THE CITY OF ELIZABETH "FOUR-TON WEIGHT LIMIT - STREETS AFFECTED" SPECIFICALLY TO ADD SOUTH FIRST STREET, BETWEEN THIRD AVENUE AND ELIZABETH AVENUE EXCEPT FOR THE PICKUP AND DELIVERY OF MATERIALS ON THESE STREETS.

Post-Ban Truck Re-Count in 2018

Recount showed 7 trucks per hour on 1st Street, most of them local delivery trucks



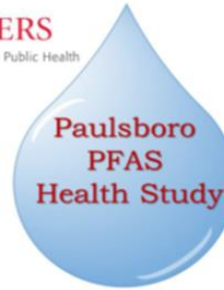
Black carbon is now
at background levels



Case Study 2: Community Engaged Research to Reduce PFAS Exposure in Drinking Water in a New Jersey EJ Community



RUTGERS
School of Public Health



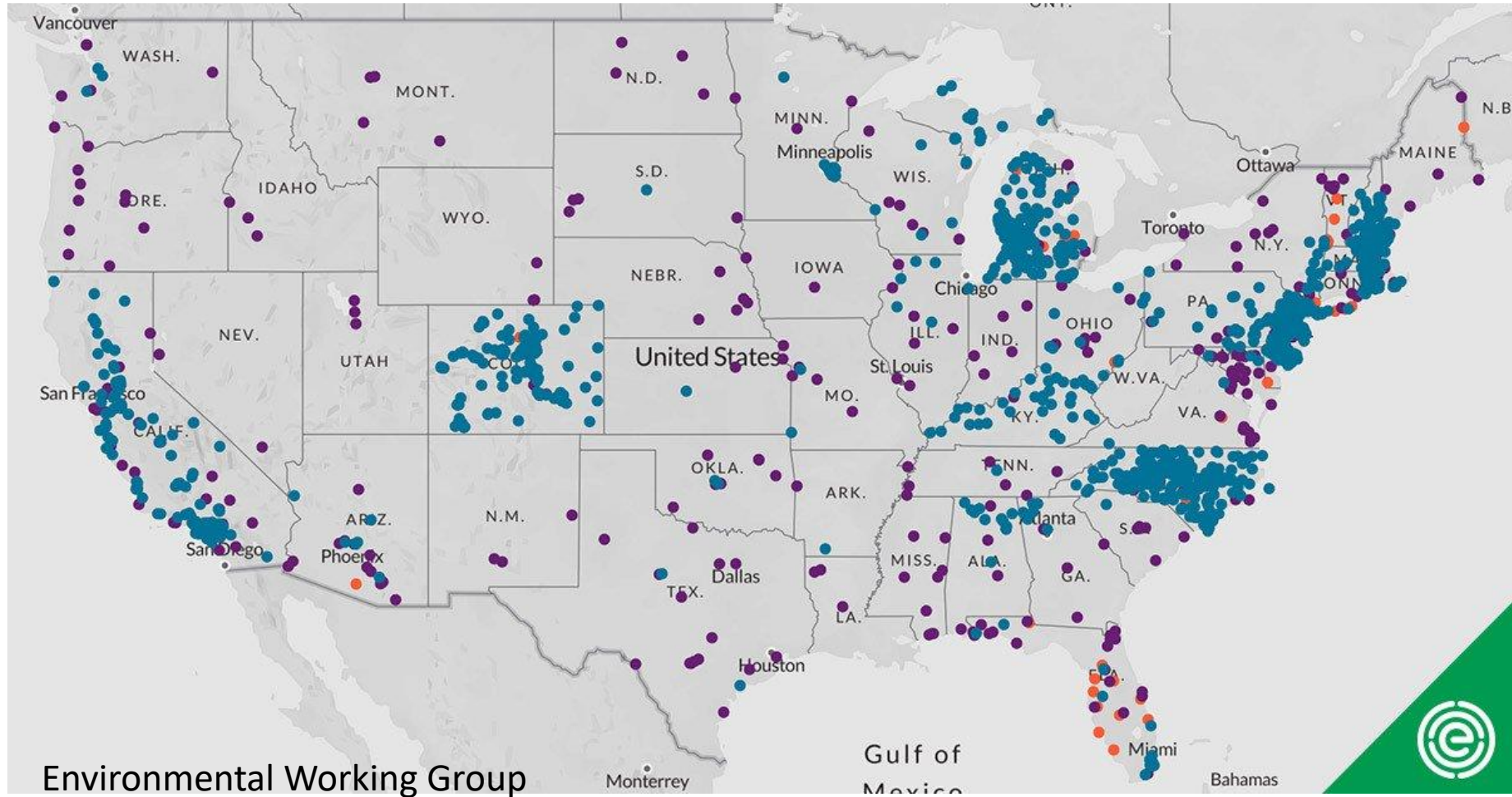
The Paulsboro PFAS Health Study

Part of the CDC/ATSDR Multi-Site PFAS Health Study

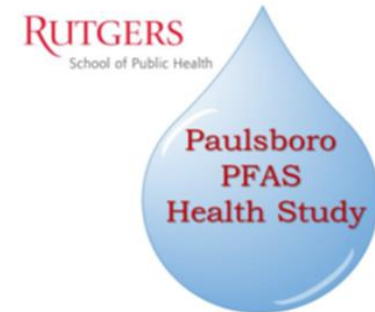
PFAS (Per- and Polyfluoroalkyl Substances):

- Over 5,000 different PFAS chemicals
- First produced in the 1940s
- Repel both water and oil
 - Water repellents, oil repellents, fire-fighting foams, many other uses
- Most common are PFOS, PFHxS, PFOA, and PFNA
- A huge problem around the world
 - Found in everyone's blood, young and old
- Contaminated drinking water is a major source of exposure to PFAS
 - Military bases using firefighting foam
 - Industry

Sites with PFAS contamination across the country

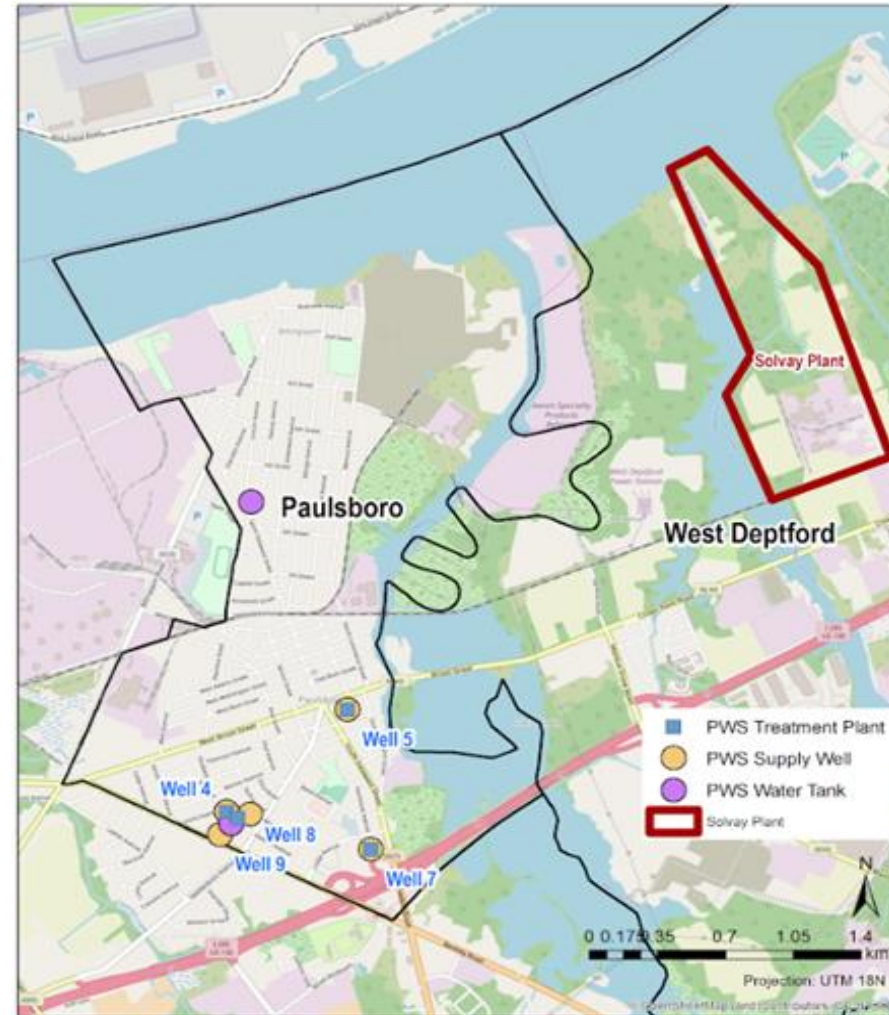


- High levels of PFNA in Paulsboro drinking water until 2014
 - PFNA not used in consumer products, unlike PFOA and PFOS
 - Not in firefighting foams.
 - Used in manufacturing plastics as a processing aid
 - Still, 98% of people in US have detectable levels of PFNA in their blood
- Paulsboro has one public water system with no mixing with other systems

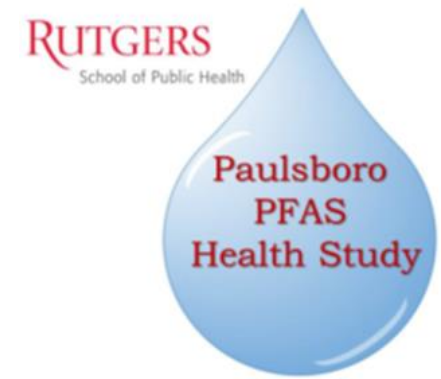


History of PFNA in Paulsboro's Water

- **2009:**
 - PFNA found in Well #7 at 96 ppt.
- **September 2013:**
 - PFNA up to 150 ppt in drinking water
- **January 2014:**
 - NJDEP advisory: infants <1 year should not drink the town water
- **April 2014:**
 - Well #7 shut down
- **June 2016:**
 - Well #7 re-opened with filtration



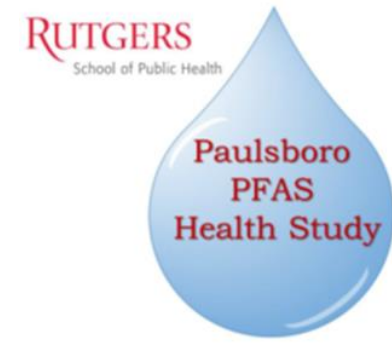
Community Advisory Panel (CAP) members



- The CAP members:
 - Support the mission of the study
 - Advise researchers on community environmental health concerns
 - Assist in translating research to be understood by the community

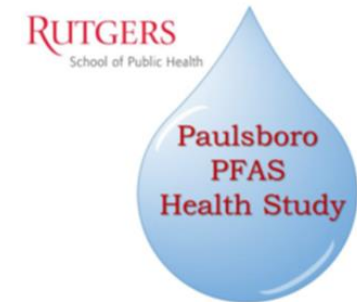
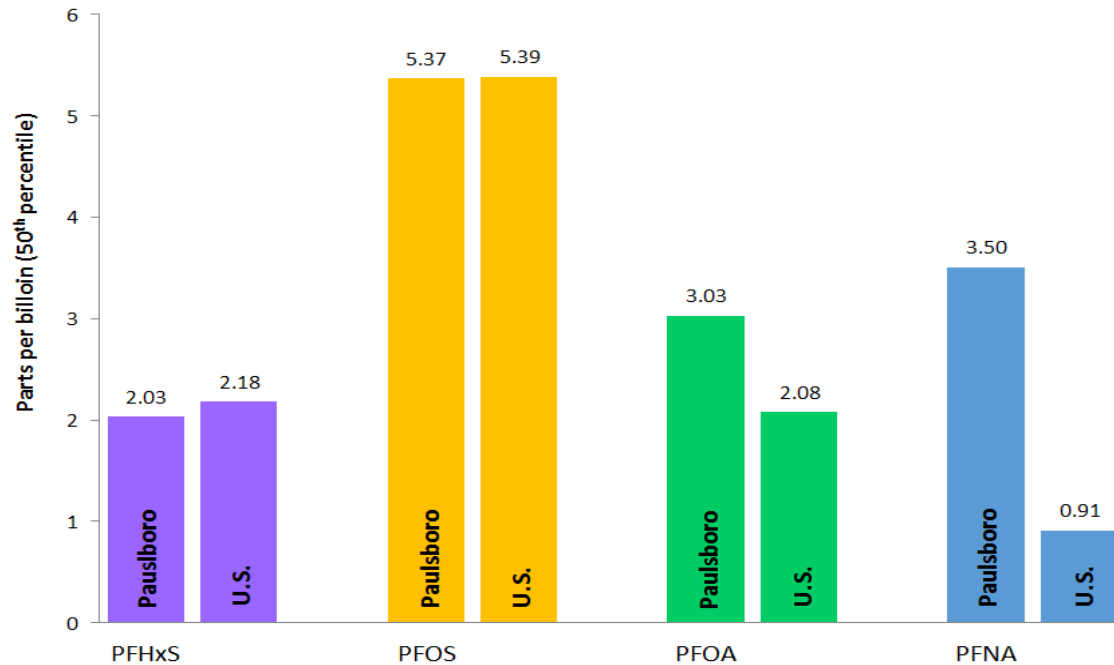
PFAS in the Environment

- Measured in parts per trillion in drinking water
 - “Nanograms per liter” of water “(ng/L)”
 - One grain of sand in an Olympic-size swimming pool
- Don’t break down in the environment (“forever chemicals”)
- Are concentrated in our bodies
 - “Micrograms per liter” in blood “(μg/L)”
- Stay in our bodies for many years



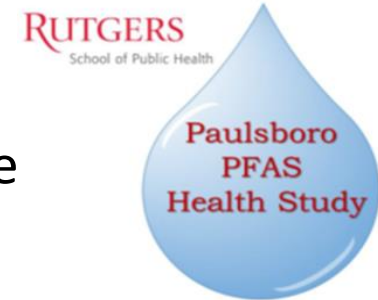
PFAS levels in blood of Paulsboro residents

- Over 1,300 residents had blood tests in 2016 as part of legal settlement
- In a 2018 study, Dr. Graber examined results of 194 volunteers



Possible Health Effects

- Research in people suggests that high levels of certain PFAS may lead to:
 - Increased cholesterol levels
 - Changes in liver enzymes
 - Decreased vaccine response in children
 - Increased risk of high blood pressure or pre-eclampsia in pregnant women
 - Small decreases in infant birth weights
 - Increased risk of kidney or testicular cancer
 - Decreased fertility
- Less is known specifically about the long-term health effects
 - More research is needed, especially in humans

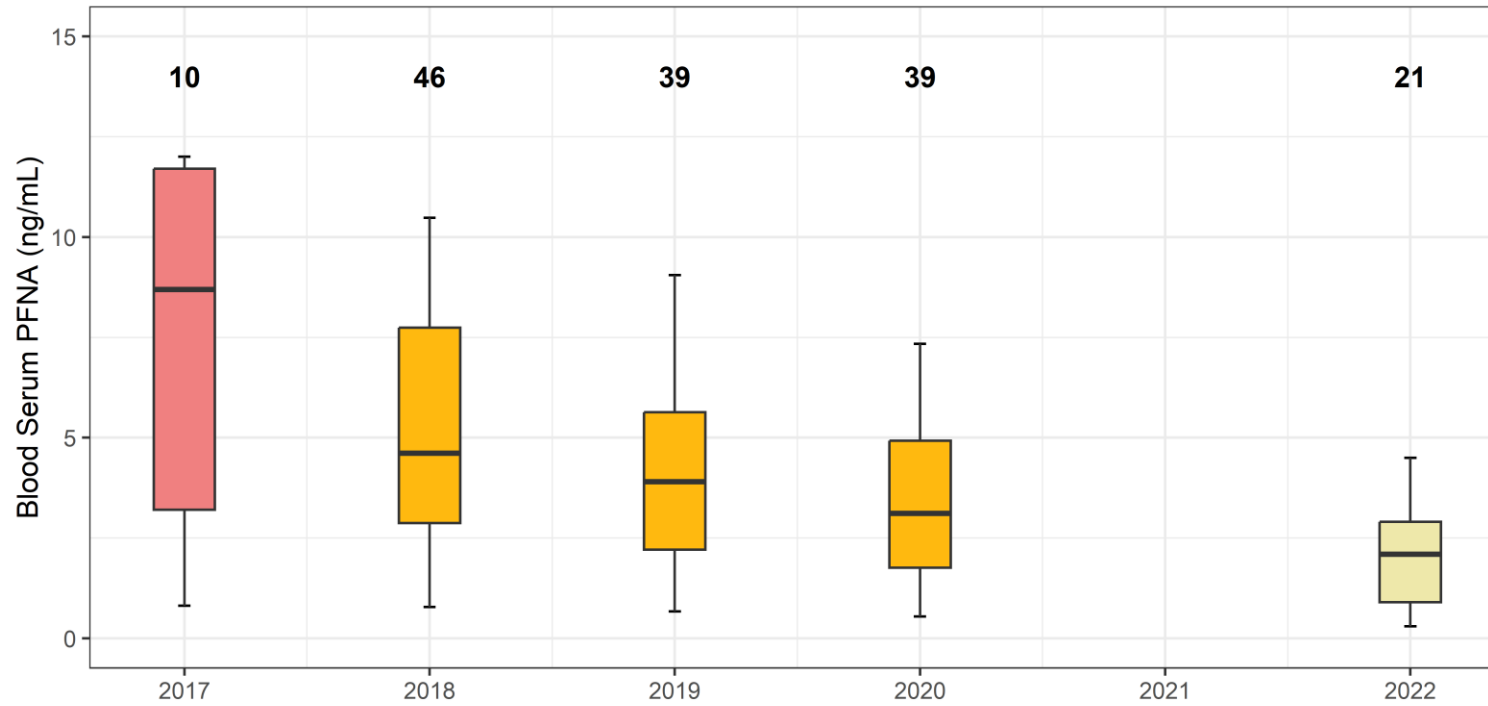


Filtration through Granulated Activate Charcoal



Rutgers partnered with the NJDOH to look at how blood levels have fallen now that PFAS is being filtered

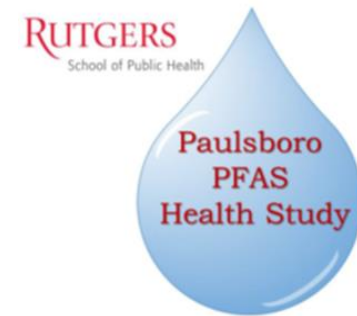
Declining PFNA Blood Concentrations over time



The Paulsboro PFAS Health Study is part of the ATSDR/CDC Multisite Health Study

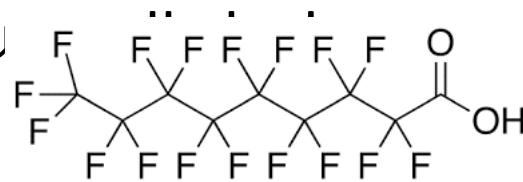
- One of 8 sites in the US selected for this study, including New York, Pennsylvania, Massachusetts, New Hampshire, Michigan, Colorado, California
- Goal: to enroll 1,000 adults and 300 children at each site

What we learn may help to save the health, wellbeing, and lives of many people around the world.

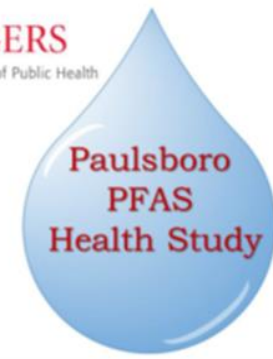


- Current Events: PFAS Contamination

- PFAS: per- and polyfluorinated substances (eg. PFOA, PFAS, PFNA, etc.)



- New Jersey set strict MCLs for these 3 PFAS. 14, 14, and 13 parts per trillion (ppt) in the past few years
- Now public water systems in NJ are required to test
- Many are finding that they exceed the MCL for one or more of these PFAS compound
- Perfluorononanoic Acid or PFNAPFNA



For More Information

- The Rutgers Study Website
 - <https://eohsi.rutgers.edu/paulsborohealthstudy>
- CDC/ATSDR Multisite Health Study
 - <https://www.atsdr.cdc.gov/pfas/activities/studies/multi-site.html>
- CDC/ATSDR PFAS and Your Health
 - <https://www.atsdr.cdc.gov/pfas/index.html>
- Northeastern University PFAS Project Lab
 - <https://pfasproject.com/>
- NJ Department of Environmental Protection Fact Sheet on PFAS
 - https://www.nj.gov/health/ceohs/documents/pfas_drinking%20water.pdf
- US Environmental Protection Agency (US EPA)
 - https://www.nj.gov/health/ceohs/documents/pfas_drinking%20water.pdf
- Rutgers Study: 1- 856-599-1205

Case Study 3: Community Led Legislative Change to Reduce Impacts of Cumulative Exposures in New Jersey EJ Communities

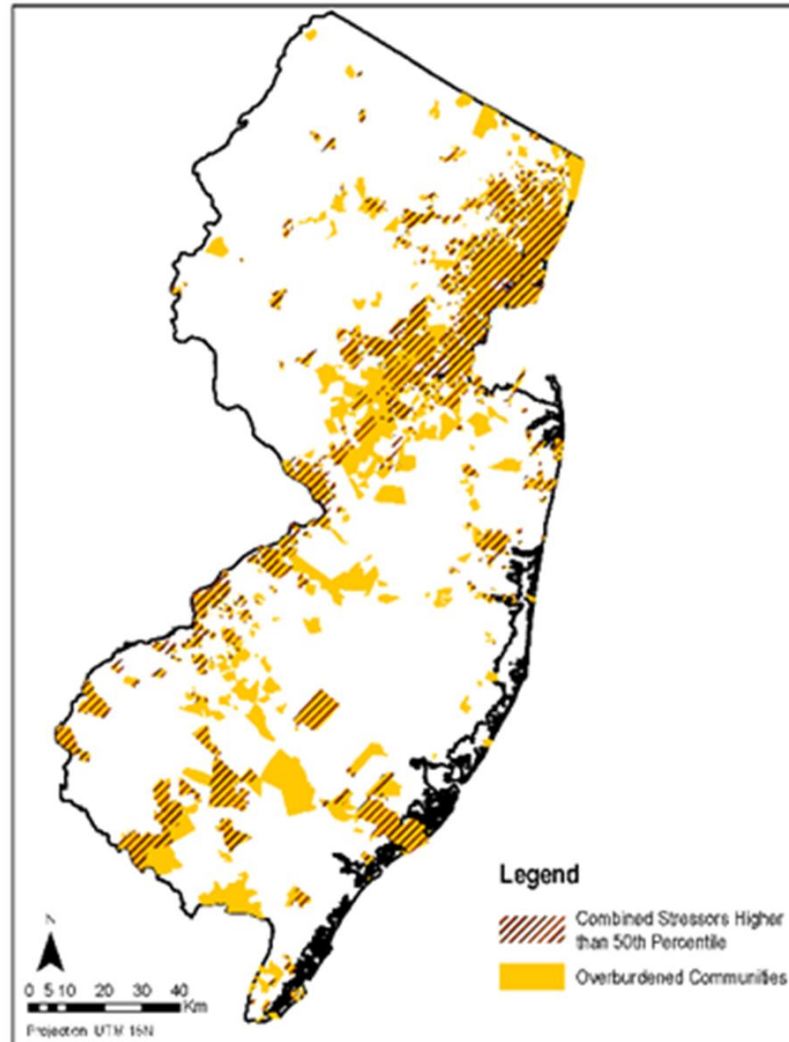


Governor Murphy signing First in the Nation EJ Law
New Jersey, September 18, 2020

NJ Environmental Justice Law and Regulations

- Defines overburdened communities as census block groups with
 - ≥ 35 percent low-income households;
 - ≥ 40 percent of the residents identifying as minority
 - ≥ 40 percent of limited English proficiency
- Legislation authorizes NJDEP to deny new permits when a facility creates adverse cumulative stressors OR contributes to existing adverse cumulative stressors in overburdened communities
- 26 stressors in each overburdened community (“OBC”) compared to median for non-overburdened block groups.
- Score of total stressors greater than median is then compared to the median score of total stressors in the county or state, whichever is lower.
- Requires EJ Impact Statements and “meaningful public participation.”

NJ's Overburdened
Communities and
Communities with
Adverse Cumulative
Stressors



NIEHS CEED's roles in action on cumulative impacts in NJ

- 2011 NJ Clean Air Council public hearing and report on *Cumulative Impacts of Multiple Air Pollutants*.
- Spoke at hearings and press conferences on major air permits
- Stepped aside for NJ EJ advocates and activists to take the lead on advocacy
- Acknowledged the current limitations of the science of cumulative risk assessment
- Supported the comparative approach with focus on fairness and justice, rather than quantitative risk assessment.
- Met monthly with NJDEP and EJ advocates over 2 years on rulemaking
- Provided public comment on the proposed rules
- Awaiting test cases

Take Home Messages from EOHSI Experiences

- Effective environmental health research and interventions to develop sustainability require community engagement.
- Build trust and buy-in by promoting Community-Based Participatory Research (CBPR) that supports efforts in planning, development and implementation of sustainable practices and lifestyles.
- Take reduced cost recycling and impact of health benefits into account when assessing the overall costs and benefits of implementing climate change policies targeted to poor and EJ communities.
- Work with citizens to develop and pass legislation that protect against licensing of projects are unwanted and/or that will increase cumulative impacts in already overburdened communities.
- The time to **take remedial and preventive action** is now, and small steps matter.



QUESTIONS?

Session 3: Economic Development, Globalization (Trade) & Sustainability

Prof. N. Ashford, MIT



INSERT SLIDES

Session 4: Global Megatrends, Sustainability, & the UN SDGs

Prof. W. Purcell, Rutgers



