



# Citizen Science at EPA's Office of Research and Development

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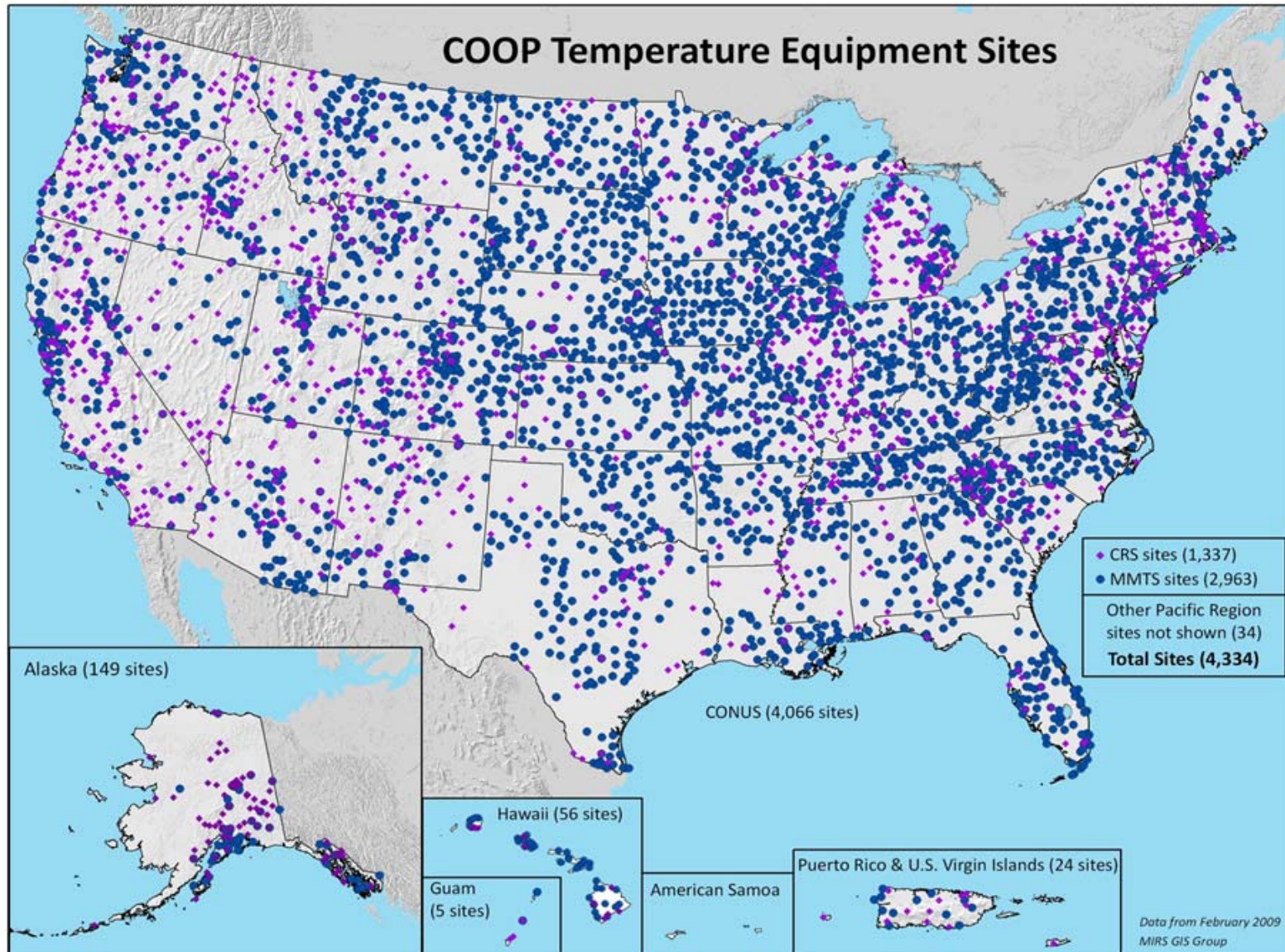
Director, EPA's Center for Public Health and  
Environmental Assessment



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# What is Citizen Science?





## CitSci and the Federal Government



**“Through citizen science and crowdsourcing, the federal government and nongovernmental organizations can engage the American public in addressing societal needs and accelerating science, technology, and innovation.”**

Scope Your Problem



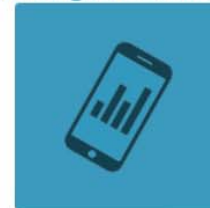
Design a Project



Build a Community



Manage Your Data



Sustain and Improve





## Intersection of CitSci and EPA Research

**EPA's Mission: Protect Human Health and the Environment**

### EPA's Research

ORD's leading-edge research informs Agency decisions and supports the emerging needs of stakeholders, including the state, tribal, and community partners.

### Citizen Science

Voluntary public participation in the scientific process, from problem identification through evaluation, to address real-world problems.





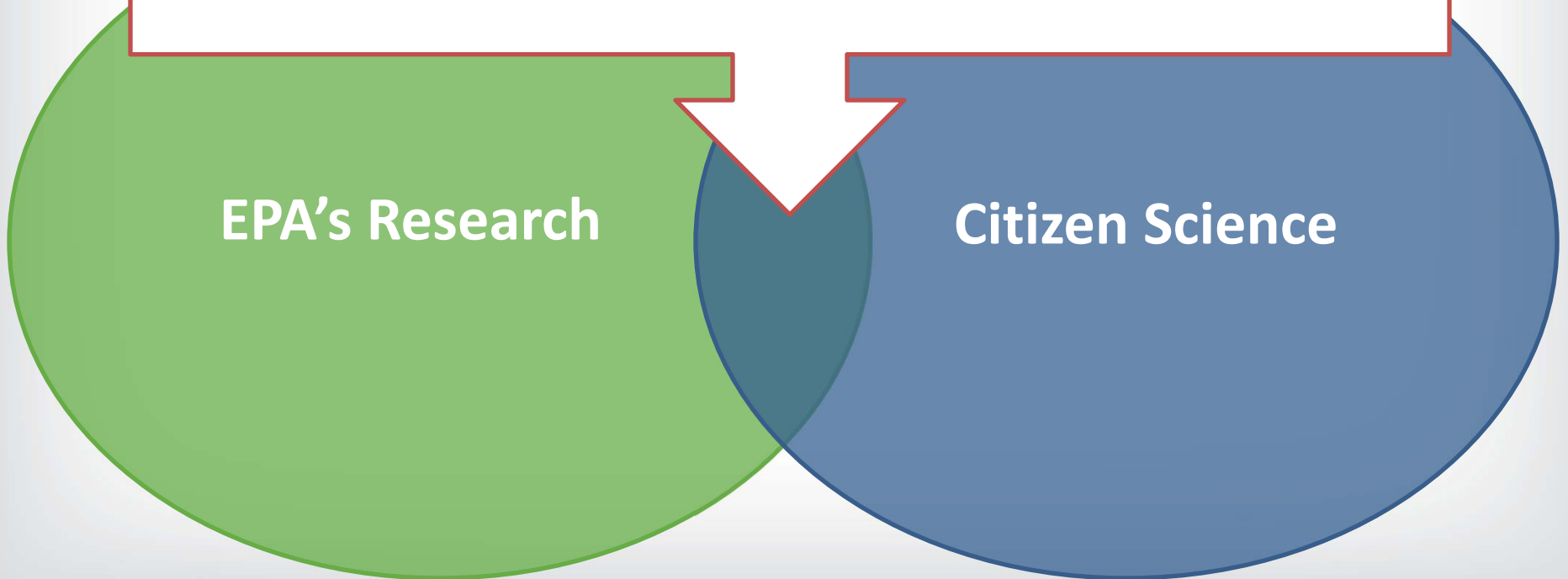
## Intersection of CitSci and EPA Research

### **EPA's Mission: Protect Human Health and the Environment**

Opportunities for citizen issue engagement, environmental awareness, environmental education, data/observation collection, etc.

**EPA's Research**

**Citizen Science**





## EPA Citizen Science and Air Quality



Smoke Sense



TracMyAir  
App



## Goals



Pictured above is a conceptual model

**To provide the public and communities with information previously not available about their local air quality and engage communities in air pollution awareness.**

**The project was conducted from 2013-2019.**



# Approaches



Local Pollution Levels

<a href="#">Low»</a>	23	Ozone ppb	
<a href="#">Low»</a>	29	PM <sub>2.5</sub> µg/m <sup>3</sup>	

67 °F      68 % humidity      1 mph NW

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[Current Area Air Quality Index »](#)

Moderate

observed Thu 8:17 AM EDT

[Explore Data »](#)

[More Information »](#)

## Welcome to the Village Green Project

a research effort to discover new ways of measuring air quality and weather conditions in community environments.





## Impact



Durham, NC

Philadelphia,  
PA

Washington,  
DC

Kansas City,  
KS

Oklahoma  
City, OK

Hartford, CT

Chicago, IL

Houston, TX

### Key attributes that bring air quality information to citizens in a novel way:

- Transparent data collection
- Easy to deploy and lower cost
- Data useful for research purposes
- Visible, in public spaces, and information to engage community members
- Sustainable- it has a solar panel to provide electricity to the sampling instruments.



## Goals

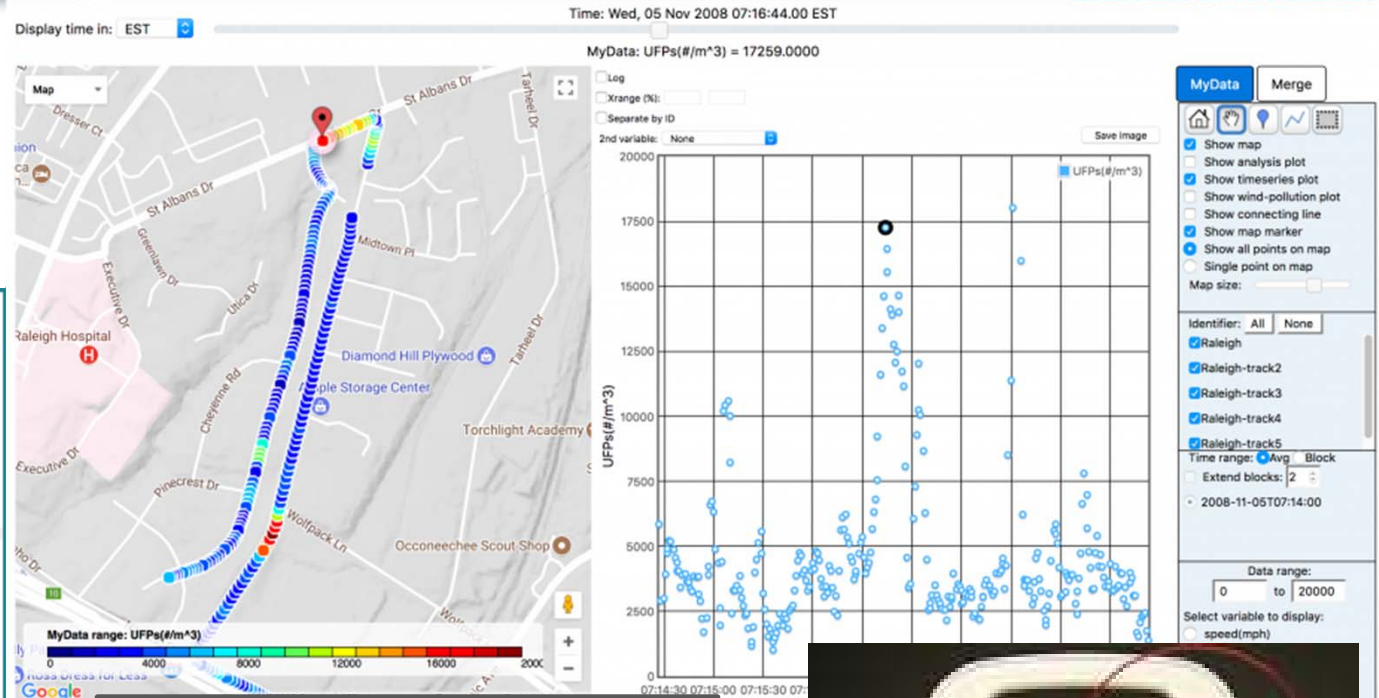
**AIR  
SENSOR  
TOOLBOX**



**The Air Sensor Toolbox provides the latest science on the performance, operation and use of air sensor monitoring systems for technology developers, air quality managers, citizen scientists and the public.**



# Approaches

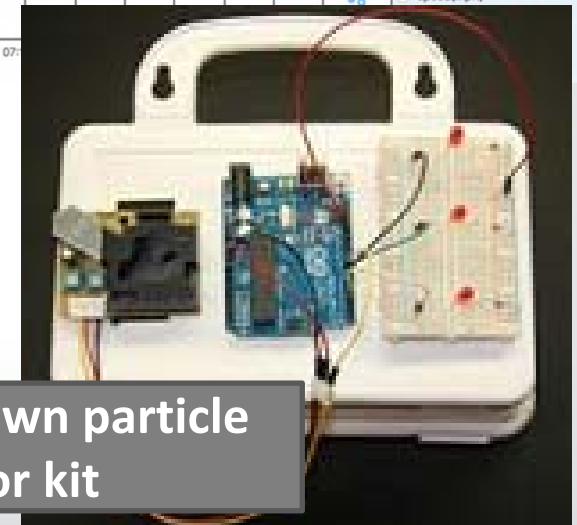


REal Time Geospatial Data Viewer (RETIGO)

**Air Sensor Guidebook**

EPA 600/R-14/101 | June 2014 | www.epa.gov/air

Office of Research and Development  
National Exposure Research Laboratory



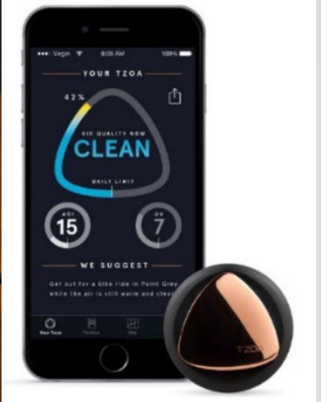
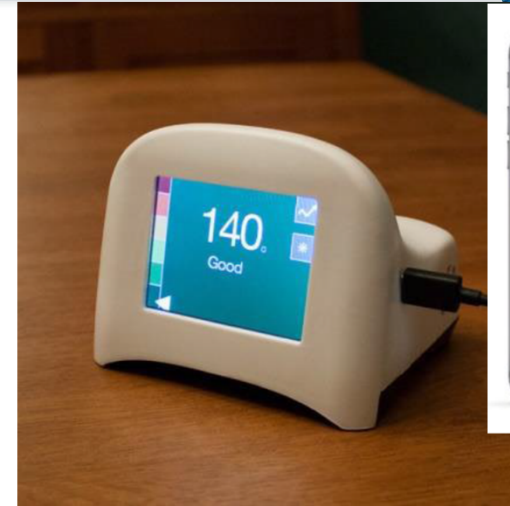
Build your own particle sensor kit

<https://www.epa.gov/air-sensor-toolbox>





# Impact



EPA and partners from the Eastern Band of Cherokee Indians review the assembly of a weather shelter for low-cost sensors.

**Over 50k visits to Toolbox webpage this past year**





## Smoke Sense: Goals

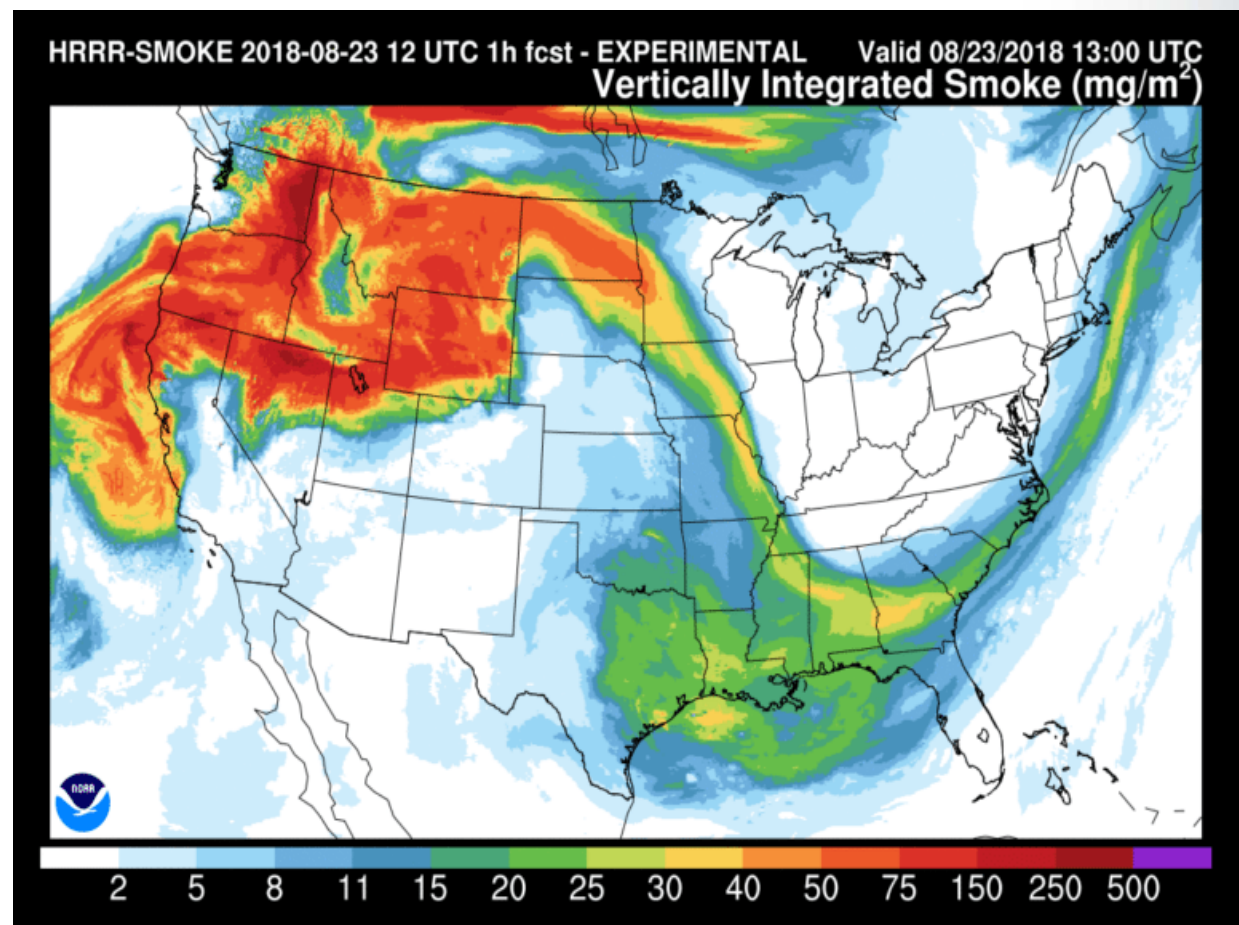


Smoke Sense

Understand the gap between what we know about risk and ways to protect our health and the observed public health outcomes

Increase issue engagement so people can take action to protect health

Inform ways to improve effectiveness of health risk messaging and communication strategies





# Smoke Sense: Approaches



Smoke Sense

Smoke Sense

Air Quality Index *i* 27514

Current AQI AQI Tomorrow

Moderate Good

Particle **53** Particle **NA**

Ozone **31** Ozone **NA**

Symptom & Smoke Observations

Fire & Smoke Near Me

Smoke Smarts

Air Quality 101

Home About My Profile Badges Weekly Summary

Back Near Me

Now Future

Legal

Weekly Summary

Percent of users reporting symptoms while experiencing smoke

Category	Percent of Users
1: Cardiovascular	78%
2: Eyes And Ears	22%
3: Upper Respiratory	22%
4: Respiratory	33%
5: Other	56%

1: Cardiovascular 78%

2: Eyes And Ears 22%

3: Upper Respiratory 22%

4: Respiratory 33%

5: Other 56%

Home About My Profile Badges Weekly Summary

[www.epa.gov/air-research/smoke-sense](http://www.epa.gov/air-research/smoke-sense)



## Smoke Sense: Impact



Smoke Sense

Over 31K users  
in all 50 States

- Develops entry points for members of the public to contribute to *research, engage and access data*
- *Mutually beneficial* – it helps EPA answer questions, and it also serves as a educational/data resource that communities can leverage to address issues related to air quality and health in their communities
- Allows for *two-way communication* framework in problem formulation and dissemination of knowledge
- *Data sharing and fostering change*





## TracMyAir: Goals

TracMyAir  
App

Develop smartphone exposure model to estimate real-time individual-level exposures and inhaled doses to PM<sub>2.5</sub> and ozone

Facilitate and expand use of exposure metrics for epidemiological studies and public health applications

Inform ways to reduce exposures so people can take action to protect health



[www.epa.gov/research](http://www.epa.gov/research)

### science in ACTION

INNOVATIVE RESEARCH FOR A SUSTAINABLE FUTURE

#### EPA's TracMyAir App: Using smart phones to predict near real-time air pollution exposures

##### Background

To better understand people's contact with air pollutants and their potential for adverse health effects, it's important to estimate how much time they spend in different locations and what the air pollutant concentrations are in those locations. Using currently available personal air monitors to collect this information has several limitations, including burden on participants, cost, and need for substantial technical expertise.



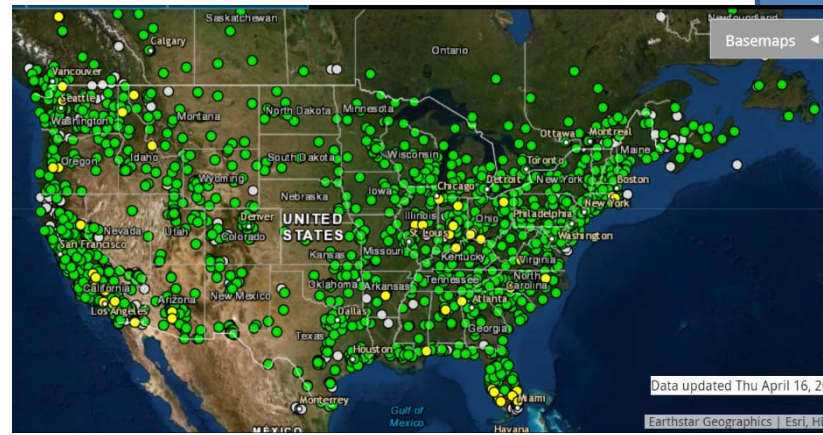




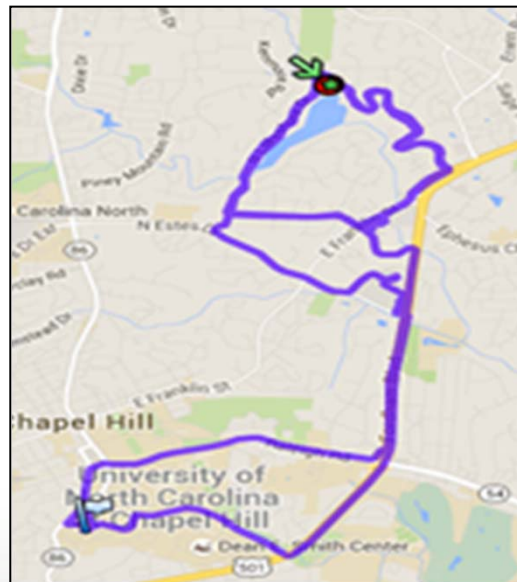
# TracMyAir: Approaches

TracMyAir  
App

- Tracks user's nearest PM<sub>2.5</sub> and ozone monitors to determine outdoor levels
- Estimates building-specific infiltration of PM<sub>2.5</sub> and ozone to determine indoor levels (accounts for open windows, window fans, home air cleaners)
- Tracks user's location and corresponding microenvironment (e.g., outdoors, in-vehicle, indoors at home, work) to determine exposure
- Tracks user's physical activity level (e.g., step counts) to determine inhaled dose



AirNow  
PM<sub>2.5</sub>,  
ozone  
monitors



User's location tracks



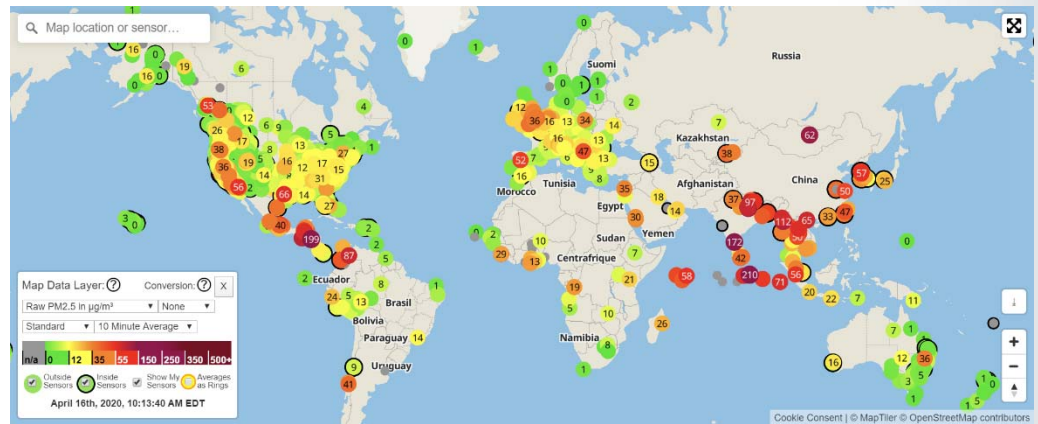
User's step counts



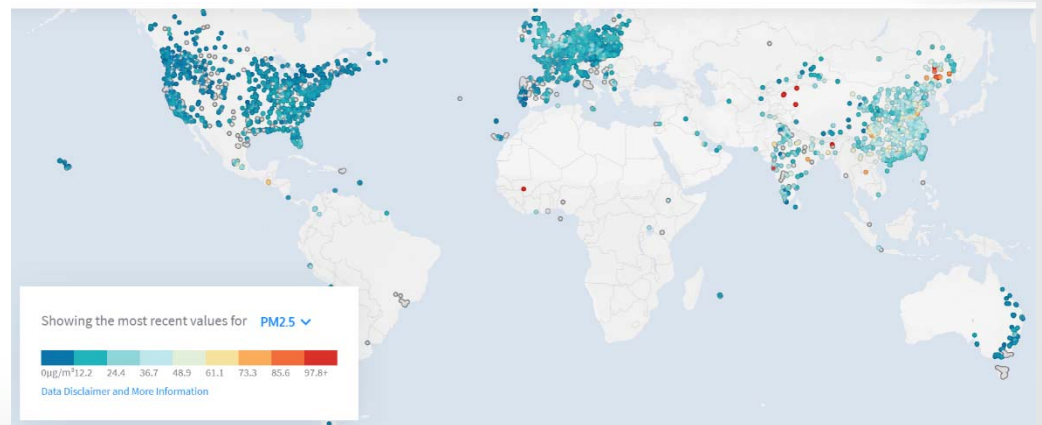
# TracMyAir: Impact



- Integrates with network of low-cost PM<sub>2.5</sub> monitors (PurpleAir) for community applications
- Integrates with global network of ambient monitors (OpenAQ) for international applications
- Integrates with real-time air quality models for exposures to additional air pollutants (e.g., NO<sub>2</sub>)
- Determines microenvironment-specific exposures and dose to help identify strategies to reduce levels (e.g., scheduling time spent outdoors and at higher physical activity levels, closing home windows, operating home air cleaners)



**PurpleAir – network of low-cost PM<sub>2.5</sub> monitors**



**OpenAQ – global network of PM<sub>2.5</sub>, O<sub>3</sub> monitors**



## Conclusion

- Village Green, the Air Sensor Toolbox, the Smoke Sense project, and TracMyAir are excellent examples of efforts intended to help individuals collect, report, interpret and act upon air quality data to protect public health.
- EPA's citizen science efforts are mutually beneficial for citizens, our research, and States, Regions, Tribes, and Communities.
- Citizen science approaches help us build meaningful relationships
- There are various citizen science efforts across EPA, which can be found at: [www.epa.gov/citizen-science](http://www.epa.gov/citizen-science)

### Information to Action

Strengthening EPA Citizen Science  
Partnerships for Environmental Protection



National Advisory Council for Environmental Policy  
and Technology (NACEPT)  
April 2018

EPA 220-R-18-001





## Points of Contact

### Air Sensor Toolbox

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### Village Green Project

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### Smoke Sense Project

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Mary Clare Hano ([Hano.MaryClare@epa.gov](mailto:Hano.MaryClare@epa.gov))



Smoke Sense

### TracMyAir App

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TracMyAir  
App





## Thank you- and stay engaged!

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- CitizenScience.gov: [www.citizenscience.gov/#](http://www.citizenscience.gov/#)
- Village Green Project: [www.epa.gov/air-research/village-green-project](http://www.epa.gov/air-research/village-green-project)
- Smoke Sense Project: [www.epa.gov/air-research/smoke-sense](http://www.epa.gov/air-research/smoke-sense)
- EPA's Air Research: [www.epa.gov/air-research](http://www.epa.gov/air-research)
- EPA's Healthy Heart Toolkit: [www.epa.gov/air-research/healthy-heart-toolkit-and-research](http://www.epa.gov/air-research/healthy-heart-toolkit-and-research)

