

EPA Tools and Resources Webinar: EPA's Air Sensor Loan Pilot Programs – *Successes, New Resources, and Lessons Learned*

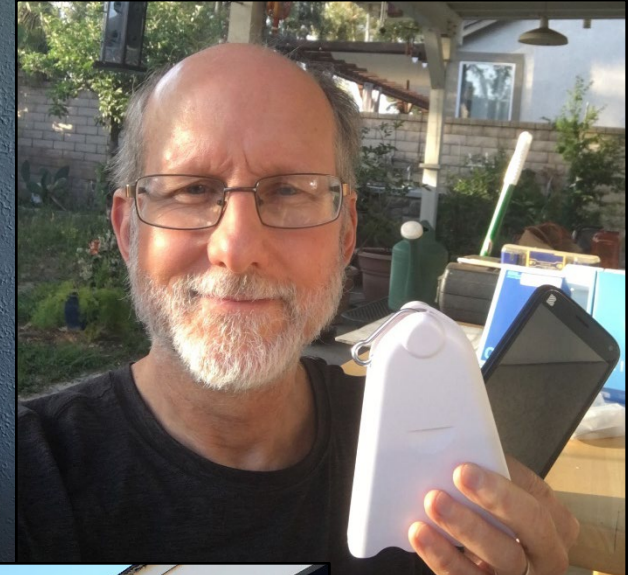
Andrea Clements and Rachelle Duvall
US EPA Office of Research and Development (ORD)

July 13, 2022



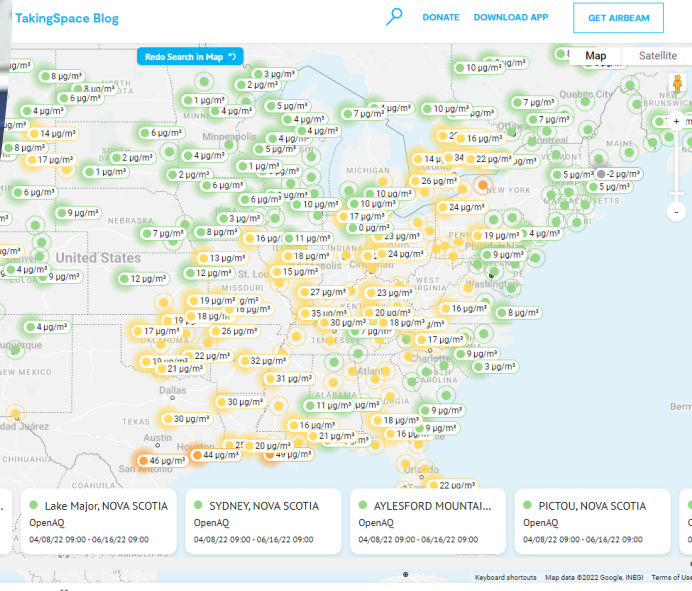
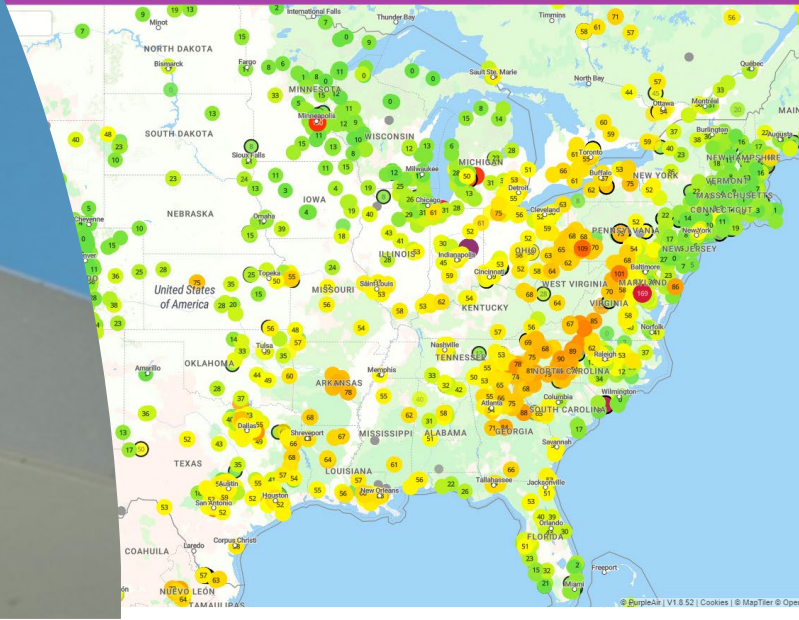
Presentation Outline

- Background
- Problem
- Benefits
- Goals
- Approach
- Results
- Outcomes
- Impact
- Take home messages
- Resources
- Contacts



Background

- Air sensors are non-regulatory technologies that measure air quality
- Sensors are often smaller, lower in cost, more portable, and easier to operate than regulatory air quality monitors
- Sensors may feature digital displays, data visualization, and crowdsourced maps
- The availability, demand for, and use of sensors continues to grow rapidly



Problem – *Why is there a need for air sensor loan programs?*

- **Air quality education and supplemental monitoring are popular applications for air sensors**
- **Air sensors are not always accessible to potential users**
 - Initial purchase cost typically ranges from \$100 to \$5,000 (USD)
 - Additional costs are often needed (*e.g., maintenance, replacement, data storage and access, data analysis and visualization*)
- **Potential sensor users need guidance and resources such as...**
 - Background information on air pollution, air quality, sensors, etc.
 - How to select, purchase, and use sensors
 - How to plan and conduct a study
 - How to evaluate and interpret data
 - Educational materials to facilitate classroom or individual instruction

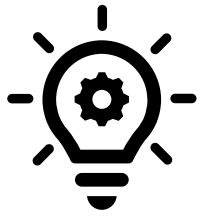


How can air sensor loan programs benefit or support state/local/tribal (SLT) governments?



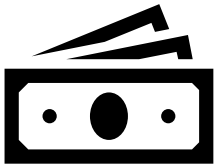
- **Help build public trust in government**

- Public may engage with a trusted partner to obtain resources/education needed
- SLTs may partner with trusted groups allowing them to build relationships and trust



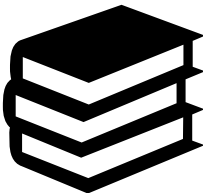
- **Develop SLTs expertise or knowledge on**

- What applications sensors can/cannot be used for
- How to set up and operate a loan program
- How to find and direct the public to existing loan programs



- **Reduce SLTs resources (staff time, money, etc.) to**

- Respond to interest in collecting air quality measurements
- Respond to equipment loan requests
- Manage all air quality complaints



- **Empower the public to collect data to demonstrate an actual or potential problem by providing**

- Access to equipment or resources
- Educating the public about air quality, sensors, and how sensors can/can't be used
- Educating the public about how to collect high quality data

Goals of the Pilot Air Sensor Loan Programs

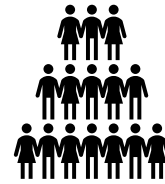


Approach



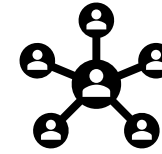
Start

- The Los Angeles Public Library (LAPL) contacted EPA Region 9 (R9) to discuss the idea of starting an air sensor loan program
- R9 applied for and received EPA internal RSTIP* funding to develop a pilot sensor loan program with LAPL



Expand

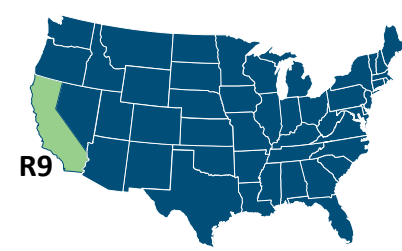
- EPA Region 5 (R5) and EPA Region 10 (R10) were interested in establishing similar sensor loan programs after learning about the LAPL program
- EPA Regions applied for and received RSTIP* funding to expand sensor loan programs to rural and remote libraries (R5) and Tribal communities (R10)



Summarize

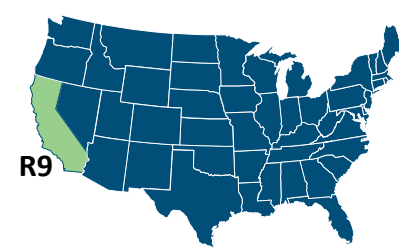
- All partners collaborated on summarizing the lessons learned from the pilot projects
- Summary includes recommendations for others considering starting new programs

EPA Region 9 (R9) – Los Angeles Public Library Air Sensor Loan Program



- **Air quality in the Los Angeles (LA) area has improved over the last four decades, but the area still struggles with air pollution**
 - Fine particulate matter (PM_{2.5}) is a concern due to health impacts
- **LA Public Library (LAPL) expressed an interest to R9 in**
 - Starting an air sensor loan program and community workshops to increase environmental literacy in the communities they serve
 - Adding sensors to their existing neighborhood science program allowing patrons to check out a sensor like they check out a book
 - Training neighborhood science librarians who would train other branch librarians
- **Sensor loan kits were placed at 21 of the 72 total branches within the LAPL system**





Loan Program Design Considerations

R9 and LAPL expressed an interest in measuring many different types of air pollutants

User-friendly and reliable sensors were not available for some of the pollutants of interest

Funds for sensor purchase and replacement were limited so an affordable sensor with reasonable performance, a long lifetime, and no or minimal data costs was preferred

LAPL staff had limited knowledge about air quality and air sensors

Background information and resource guides were needed to help librarians prepare

Focusing on one pollutant helped keep the volume of background material manageable

LAPL staff were interested in conducting educational programs at the library

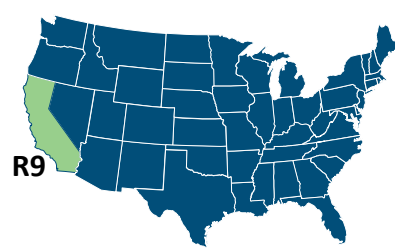
Hands-on activities were preferred that took 90 minutes or less and facilitated movement

Handheld sensors allowed for movement, however available options required a cell phone

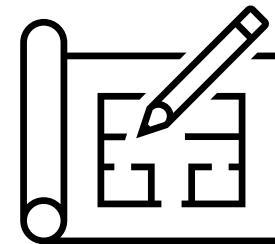
Sensors need to be supplied with a cell phone, however privacy concerns needed to be considered since personal and location information could be collected

R9 – LAPL

Loan Program Final Design

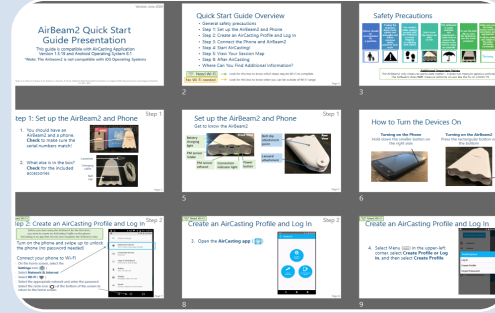
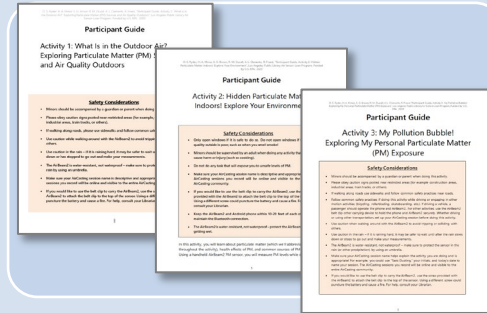


- Focus on measuring PM_{2.5}
- Offer a single hand-held sensor type
- Pair the sensor with an Android phone and public WiFi
- Library user accounts would be associated with each sensor/phone pair so that personal information would not be collected
- Educational support resources including lesson plans would be created
- Training would be provided to librarians



R9 – LAPL Air Sensor Loan Program

Program Components



Sensors Technologies

AirBeam2 Sensors
(paired with Android phones)

3 Lesson Plans

- Outdoor Air
- Indoor Air
- Personal Exposure

Support Materials

- Slides: Air Quality 101, Advanced Topics on Sensors
- AirBeam2 Quick Start Guide
- Resource Guide
- FAQs

Partner Training

8 hours of virtual training over 3 days for neighborhood science librarians

Contents of Lesson Plans

Activity-centered and adaptable for different audiences and age groups

Instructor & Participant Guide

© S. Ryder, H. A. Minor, S. G. Brown, R. Davall, A. L. Clements, R. Freed, "Instructor Guide, Activity 1: What is in the Outdoor Air? Exploring Particulate Matter (PM) Sources and Air Quality Outdoors", Los Angeles Public Library Air Sensor Loan Program, Funded by U.S. EPA, 2020

Instructor Guide

The Instructor Guide explains how to conduct this activity in a group or classroom setting and provides answers to all of the discussion questions.

Participant Guide

Activity 1: What Is in the Outdoor Air? Exploring Particulate Matter (PM) Sources and Air Quality Outdoors

Cautions and Considerations

- Minors should be accompanied by a guardian or parent when doing this activity
- Please obey caution signs posted near restricted areas (for example, construction areas, industrial areas, train tracks, or others)
- If walking along roads, please use sidewalks and follow common safety practices
- Use caution while walking around with the AirBeam2 to avoid tripping or colliding with others
- Use caution in the rain—if it is raining hard, it may be safer to wait until after the rain slows down or has stopped to go out and make your measurements
- The AirBeam2 is water-resistant, not waterproof—make sure to protect the sensor in the rain by using an umbrella
- Make sure your AirCasting session name is descriptive and appropriate! The AirCasting sessions you record will be online and visible to the entire AirCasting community.
- If you would like to use the belt clip to carry the AirBeam2, use the screw provided with the AirBeam2 to attach the belt clip to the top of the sensor. Using a different screw could puncture the battery and cause a fire. For help, consult your Librarian.

Introductory Slides

Activity 1: What Is in the Outdoor Air?

Exploring Particulate Matter (PM) Sources and Air Quality Outdoors

Goal: Go outside and measure particulate matter

In this activity you will learn about:

- Particulate matter (PM) and its sources
- How to use the handheld AirBeam2 sensor
- How to interpret your measurements
- Ways to reduce your exposure to PM

Safety Precautions:

- Minors should be accompanied by a guardian or parent
- Obey caution signs posted near restricted areas (for example, construction areas, industrial areas, train tracks, or others)
- If walking along roads, please use sidewalks and follow common safety practices near roads
- Pay attention to traffic, roads, and general surroundings!
- Use caution while walking around with the AirBeam2 to avoid tripping or colliding with others
- Use caution in the rain—if it is raining hard, it may be safer to wait until after the rain slows down
- Be aware of your surroundings, both for safety and to inform your results

Sources of Particulate Matter in the Environment

Particulate matter (PM) is any substance that is small enough to float in the air. It can come from both natural and man-made sources.

Sources of outdoor pollution are all around us in our everyday lives.

Air pollution includes gas pollutants and particulate pollutants.

Particulate Matter (PM) is the focus of this activity.

Let's Discuss:

What sources of PM do you come across each day?

What is Particulate Matter?

- PM can be made of soil, silt, dust, pollen, metals, and more
- PM can be solid or liquid
- PM is extremely small

How Does Particulate Matter Move in the Air?

PM can stay in the atmosphere for a few minutes or for weeks, depending on its size

- Smaller particles are lighter, so they can stay in the atmosphere longer
- Larger particles fall to the ground faster

Wind, Rain, Buildings

How Does Particulate Matter Affect Us?

Health Effects: Small particles, like PM_{2.5}, can travel deep into your lungs, causing breathing problems, aggravating asthma, bronchitis, and heart disease.

Environmental Effects: In the environment, PM can cause many issues. For example, PM can contribute to smog, haze, or haze which reduces "visibility," or our ability to see far away.

You Can Use Handheld PM Sensors Like the AirBeam2 to Measure PM Levels

You can carry the AirBeam2 sensor to map the PM_{2.5} where you walk.

The data is recorded and uploaded to the internet.

Let's see you can look at the data you collected on a website.

Participant Worksheet

Name: _____ Date: _____

What Is in the Outdoor Air? Exploring Particulate Matter (PM) Sources and Air Quality Outdoors

Pre-Lab Discussion Questions

P1 What PM_{2.5} sources do you think will be present during your walk?

P2 Based on what you've learned about PM sources and movement, what factors do you think will be important when measuring PM_{2.5} in the air?

Plan Your Walking Route – Bring your printed map!

1 Note the locations where you expect to find the highest and lowest PM_{2.5} levels on your walk.

Highest	Lowest

Worksheet answer key

Extension activity

NGSS alignment

12

NGSS = Next Generation Science Standards

Contents of Support Materials

Background information on air pollution, air quality, and air sensors



Background Slides

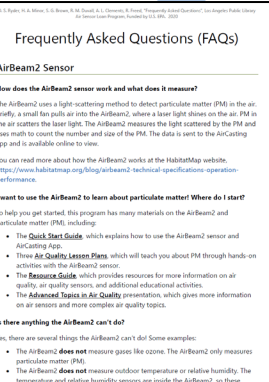
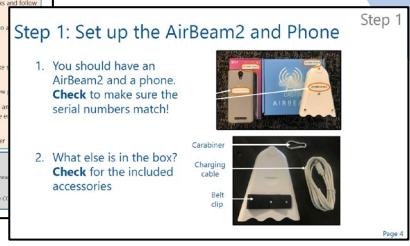
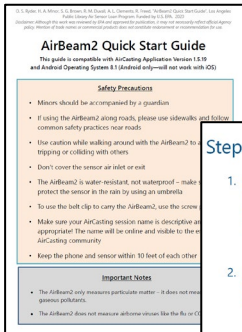


Covers topics such as interpreting evaluation results, collocation, data quality control, and data analysis

Support Materials

Quick Start Guide

Step-by-step instructions on how to set up and run a borrowed sensor. Also includes presentation slides.



FAQs

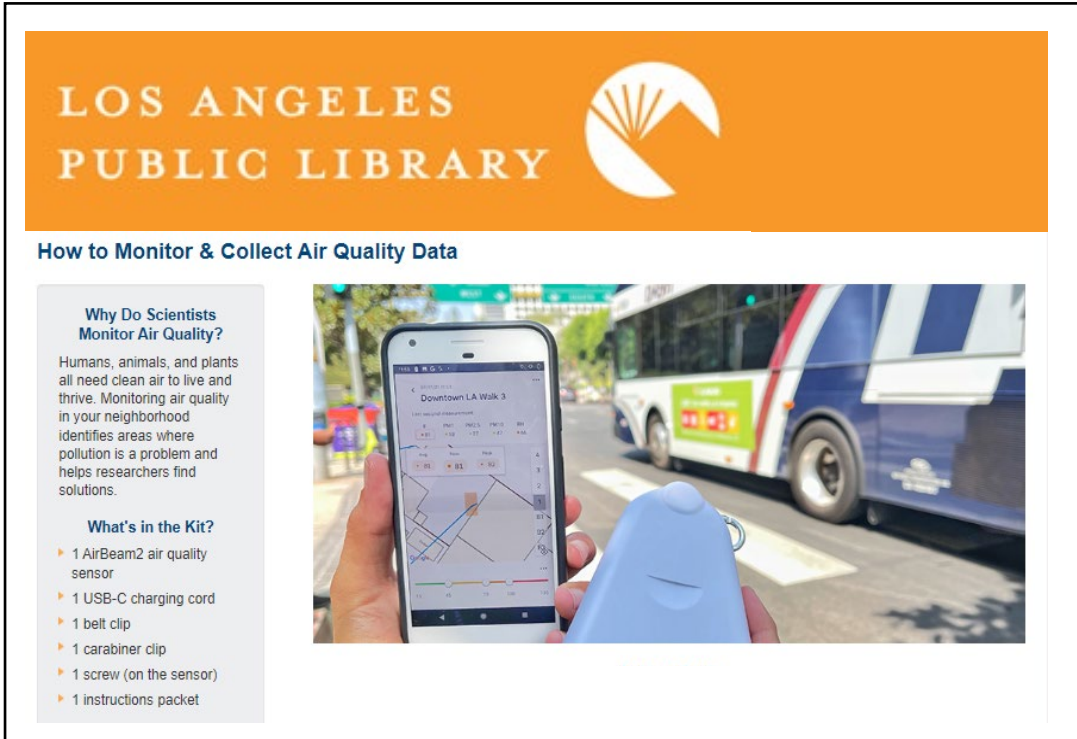
Resource Guide



Supplemental information on air sensors, air quality, and air pollution; other educational materials are included

Supplemental information with answers to common questions related to air sensors, data collection, and air quality

Case Study: R9 – LAPL Air Sensor Loan Program



The screenshot shows the LAPL Air Quality Kit website. At the top, there is an orange banner with the text "LOS ANGELES PUBLIC LIBRARY" and a logo. Below the banner, the title "How to Monitor & Collect Air Quality Data" is displayed. The main content area is divided into two columns. The left column contains text under the heading "Why Do Scientists Monitor Air Quality?" and a list of items included in the kit under "What's in the Kit?". The right column features a photograph of a person holding a smartphone displaying a map of Downtown LA with a data overlay, and a blue AirBeam2 sensor device.

LOS ANGELES PUBLIC LIBRARY


How to Monitor & Collect Air Quality Data

Why Do Scientists Monitor Air Quality?

Humans, animals, and plants all need clean air to live and thrive. Monitoring air quality in your neighborhood identifies areas where pollution is a problem and helps researchers find solutions.

What's in the Kit?

- ▶ 1 AirBeam2 air quality sensor
- ▶ 1 USB-C charging cord
- ▶ 1 belt clip
- ▶ 1 carabiner clip
- ▶ 1 screw (on the sensor)
- ▶ 1 instructions packet



Program Website: <https://lapl.org/neisci/kits/air-quality>

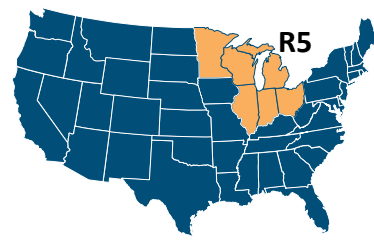
Program implementation

- LAPL integrated air sensor loans as part of their Neighborhood Science (NeiSci) DIY science kits program
- The kit includes an AirBeam2 sensor, necessary sensor accessories, and an instruction guide to help community members measure PM_{2.5}

Program expansion

- LAPL also incorporated the [Air Quality Flag Program](#) in some branches
- The Library Foundation of Los Angeles agreed to fund the purchase of additional sensors to expand the program to other branches
- Local educators expressed interest in incorporating air sensors into their classrooms and programs prompting LAPL to create a kit for longer-term loans

EPA Region 5 (R5) – Air Sensor Loan Programs for Remote and Rural Locations and an Arboretum



- Remote and rural locations may not have easy access to sensors and educational materials focusing on air quality
- Bayliss Public Library (*Sault Ste. Marie, Michigan*) which serves rural and remote communities, initially expressed interest in air quality education and sensor loans
- Program expanded to include other libraries and an arboretum



Superior Library District
Rural/remote libraries that serve the Eastern Upper Peninsula region of Michigan



**L'Anse Area School/
Public Library**
Small library in Michigan's Upper Peninsula serving residents in rural and remote communities; program is partnering with the Keweenaw Bay Indian community



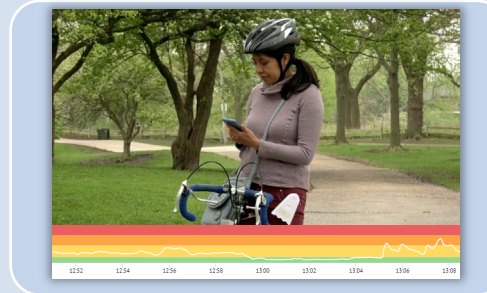
Evansville Vanderburgh Public Library
Large public library system in Indiana with multiple locations throughout Vanderburgh County serving urban and rural locations



Morton Arboretum
Provides education for teachers, families, and community members about the importance of trees and other plants; serves the greater Chicago region

R5 – Air Sensor Loan Programs for Remote and Rural Locations and an Arboretum

Program Components



Sensor Technologies

- AirBeam2 Sensors (paired with Android phones)
- PurpleAir Sensors

1 Lesson Plan*

The Power of Plants!
How Vegetation can Help Protect Us from Air Pollution

Support Materials

- Slides: Air Quality 101, Advanced Topics on Sensors
- AirBeam2 video*
- AirBeam2 and PurpleAir Quick Start Guide*
- Resource Guide
- FAQs

Partner Training

4 hours of virtual training over 2-days (repeated once to accommodate all partners)

Case Study: R5 – Bayliss Public Library



Curious about the

Air Quality

in Pickford?

Who: Students grades 6-12

What: Measure air quality using air sensors (training and snacks provided)

When: 3:30-4:30 PM September 23, 30, and October 7 (Thursdays)

Where:
Pickford Community Library

Why: Be a part of a country-wide program to test our air quality!

Sign up at
www.pickfordlibrary.org or
contact the library to sign up:
(906) 647-1288
ehyde@uproc.lib.mi.us



Program implementation

- The project initially engaged Bayliss Public Library and the Superior District library, but they quickly recruited other district libraries onto their team
- The program launched at some libraries in the fall of 2021 and others around Earth Day in 2022
- Librarians will lead activities and sensors will be available for check-out
- Libraries have placed special emphasis on programming for children and teens

Program expansion

- The Friends of the Library funded the purchase of additional sensors to expand access

Case Study: R5 – Morton Arboretum



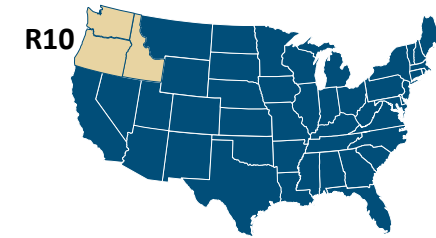
Program implementation

- The Morton Arboretum incorporated their air sensor loans into an existing program that trains educators and lends kits to teachers for classroom use

Program expansion

- The Arboretum created the [Vegetative Barrier Toolkit for Schools and Communities](#) by adapting EPA's vegetative barrier lesson plan and created additional curriculum incorporating more information about the types of vegetation that can be used for effective barriers and soil science
- In March 2022, the Arboretum offered a teacher [workshop](#) and filled the program to capacity with ~40 educators

EPA Region 10 (R10) – Air Sensor Loan Program in Tribal Communities



- Air quality can be impacted by smoke events such as wildfires, outdoor burning, and residential wood heating
- The public within and near tribal reservations need
 - Access to air sensors to increase spatial coverage and real-time air quality data during periods of smoke
 - Education about air quality and the health impacts of smoke
- Partners include:



Heritage University

Private university located on the Yakama Indian reservation in Washington serving approximately 1,000 students and surrounding community



Institute for Tribal Environmental Professionals (ITEP)

Established in 1992 at Northern Arizona University to strengthen tribal capacity and sovereignty in environmental and natural resource management

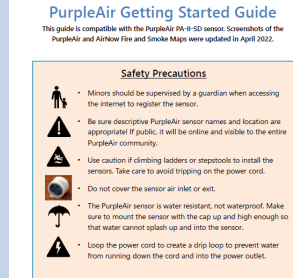


Nez Perce Tribe

Federally recognized tribal nation located in north-central Idaho with more than 3,500 members

R10 – Air Sensor Loan Program in Tribal Communities

Program Components



Sensor Technologies

PurpleAir Sensors

1 Lesson Plan*

Is that Smoke Affecting Me? Using crowdsourced public data to explore air quality during smoke events

Support Materials

- Slides: Air Quality 101, Advanced Topics on Sensors
- PurpleAir Quick Start Guide*
- Resource Guide
- FAQs

Partner Training

4 hours of virtual training over 2-days

Case Study: R10 – Libraries on the Nez Perce Reservation



SUMMER IS HERE!
PREPARE FOR WILDFIRE SMOKE
QIITINKIN'IX 'IMÁAHINAQ'I
GET YOURSELF READY FOR THE SMOKE

Join the Nez Perce Tribe ERWM Air Quality Program and Housing Authority for a **DIY Box Fan Filter Class!** Filter fans are low cost, simple to make, and help keep the air inside your home clean and healthy.

JULY 13, 2021 TUESDAY
12PM – 1PM AT LAPWAI HOUSING CLASSROOM

LUNCH & MATERIALS WILL BE PROVIDED

DIY BOX FAN FILTER CLASS!

To Register Contact at 208.843.2229 or Anna Lawrence anna@nezperce.org

Program implementation

- PurpleAir sensors were installed at 10 libraries on the Nez Perce Reservation
- Librarians were trained as air sensor and air quality educators for their local communities

Program expansion

- Librarians also voluntarily incorporated the Air Quality Flag Program, do-it-yourself box fan air filter demonstrations and kits, and a moisture meter loan program for firewood testing
- The Tribe plans to expand their program by incorporating portable PM_{2.5}, and possibly radon, sensor loans for more hands-on outreach
- The Tribe produced smoke ready guidance tailored to the community in Nimipuutimt, the Nez Perce language

Challenges



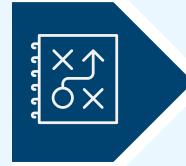
Pivots

Launch of the programs began during COVID making in-person training impossible



Training plans were changed and conducted virtually, spaced out over several days

Difficult to virtually show people how to use a sensor and troubleshoot problems



Sensors were shipped before training and a data collection walk was added to the schedule

Some equipment failed (e.g., did not respond or just reported zeros) out of the box



Failures were covered under manufacturers warranty and were replaced

The budget for the LAPL program did not include accessories (e.g., screen protectors)



LAPL purchased some supplies and similar expenses were added to future budgets

Patron surveys required several layers of approval which took a long time



Feedback and user stories were informally collected (e.g., conversations, focus groups)

Results: Summary of Partnerships

Urban libraries

- Los Angeles Public Library, CA

Rural & remote libraries

- Bayliss Public Library & Superior District Library System, MI
- Evansville Vanderburgh Public Library, IN
- L'Anse Area School/Public Library, MI

Tribal communities

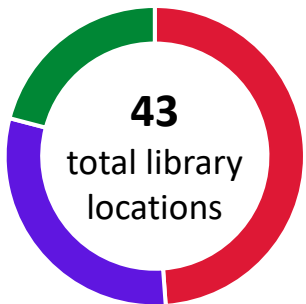
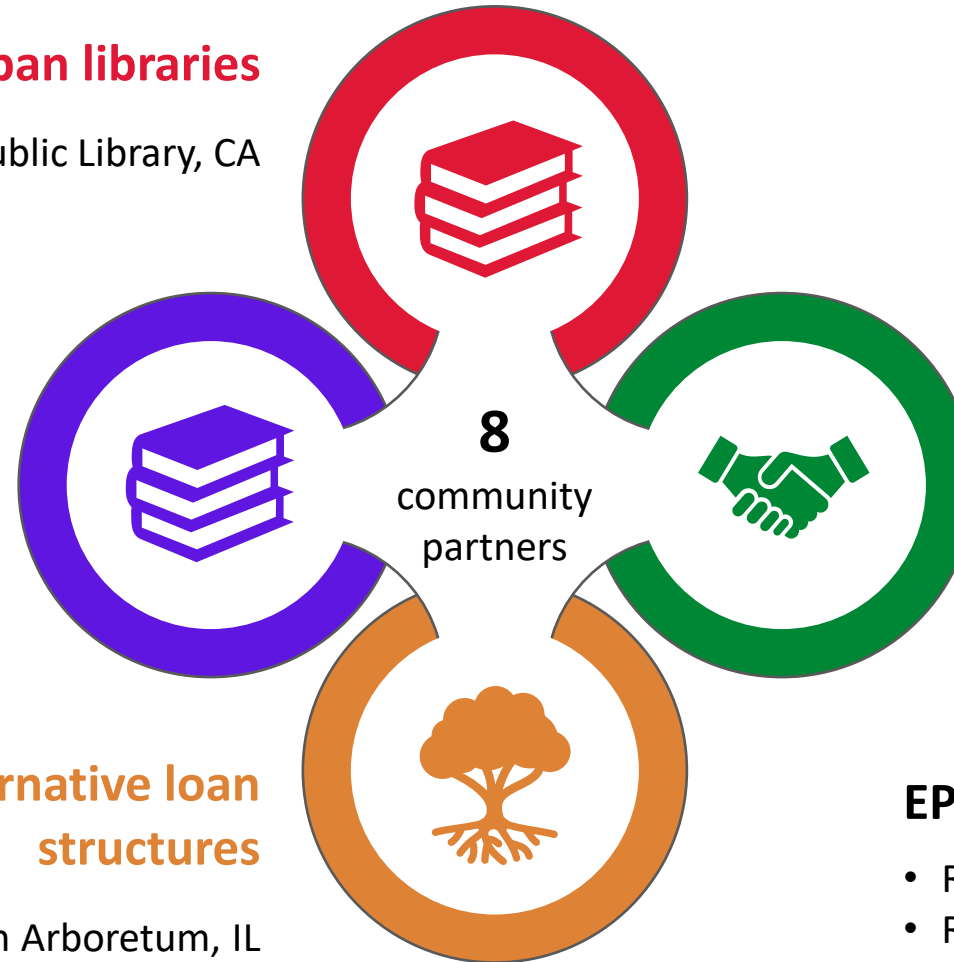
- Nez Perce Tribe, ID
- Heritage University on Yakama Reservation, WA
- Institute for Tribal Environmental Professionals (ITEP), AZ

Alternative loan structures

- The Morton Arboretum, IL

EPA participants

- Region 5
- Region 9
- Region 10
- Office of Research and Development



Results: Benefits

All programs have either launched are in the process of launching soon*

User Benefits

- Increased access to
 - Sensor technologies
 - Educational materials to learn and teach about air quality and air sensors

Partner Benefits

- Established loan programs in urban, rural, and tribal communities
- Built capacity to be community resource about air quality and air sensors

EPA Benefits

- Advanced understanding of air sensors for public engagement
- Fostered positive connections within EPA and with partners and their wider communities

Impact: Partner Quotes



R9 Program: “Serving the largest city in a state threatened by more and more intense wildfires, Los Angeles Public Library is grateful for this important partnership with EPA. This critical and timely collaboration not only empowered our librarians with the knowledge needed to develop effective air quality educational programs, but also provided the library system with low-cost air quality sensor loaning kits for patrons to check out for free. By combining information learned at library programs with firsthand experience of monitoring and interpreting air quality in and outside of their homes, **Angelenos will be able to make informed decisions for their health and well-being.**” – *Los Angeles Public Library, Neighborhood Science Program Lead Vivienne Byrd*

R5 Program: “We launched the Airbeam2 sensors on April 22nd at Howell Wetlands’ Earth Day celebration. I did a session along the wetland paths prior to the event so that I could show individuals what the finished product looked like and what the current quality of air ratings were. This was very helpful and **people found the readings fascinating.** Some expressed worry about damaging the sensors or not being able to work them correctly. I directed them to the information that comes with the kits. Four of the five sensors I took with me to the event got checked out.” – *Evansville Vandenburg Public Library Katie Reineke*

R10 Program: “We are really honored and so thankful that you all reached out to us last fall. Synergy! This project has allowed us to take our library partnership deeper and really **support communities across the Reservation to increase awareness and action around smoke.** It’s one of the best things to come from 2020 in my book.” – *Nez Perce Tribe Air Quality Program, Environmental Outreach Specialist Johna Boulafentis*

Outcome: New Resources

Five Hands-On Lesson Plans

1. [What is in the Outdoor Air?](#)
2. [Hidden Particulate Matter Indoors!](#)
3. [My Pollution Bubble!](#)
4. **The Power of Plants! (*coming soon*)**
5. **Is that Smoke Affecting Me? (*coming soon*)**

Participant Guide

Activity 1: What is in the Outdoor Air?
Exploring Particulate Matter (PM) Sources and Air Quality Outdoors

Safety Considerations

- Monitor should be accompanied by a supervisor or parent when using this activity.
- Monitor only monitor when properly set up and used in accordance with the manufacturer's instructions, including avoid, heat, smoke, or other.
- Handling the monitor should be done in a clean, dry, and well-ventilated area.
- Use caution when walking around with the monitor to avoid tripping or falling with it.
- Use caution in the rain - if it is raining hard, it may be safer to wait until after the rain has cleared than to attempt to go out and make your measurements.
- The AirBeam2 is water-resistant, not waterproof - monitor users should avoid the monitor in the rain to avoid an accident.
- Make sure your monitoring station is clean and organized and organized the AirCasting software should be used to make your data and the monitor's readings accessible.
- If you would like to use the AirCasting app to collect your data, you should read the user manual and the safety and health information for the AirCasting app.

Activity 1: What is in the Outdoor Air?
Exploring Particulate Matter (PM) Sources and Air Quality Outdoors

Sources of Particulate Matter in the Environment

Let's Discuss:
What sources of PM do you come across every day?

What is Particulate Matter?

How Does Particulate Matter Make us Sick?

Participant Worksheet

Printable pages with space for participants to fill in their answers to questions

Instructor & Participant Guide

- Information to help instructors lead the lesson
- Answers to questions
- Additional tips for participants

Introductory Slides

- Slides instructors can use to introduce the lesson and key concepts
- Useful for independent learners to review prior to the lesson

Participant Worksheet

Printable pages with space for participants to fill in their answers to questions

Technology Resources

Quick Start Guide

Step-by-step instructions on how to set up and run a borrowed AirBeam2 or PurpleAir sensor

Quick Start Guide Presentation

- Slides on how to set up and run a borrowed AirBeam2 or PurpleAir sensor
- A video on the AirBeam2

FAQ Document

Supplemental information with answers to common questions related to air sensors, data collection, and air quality

Additional Resources

Resource Guide

Supplemental information on air sensors, air quality, and air pollution; other educational materials are included

Air Quality 101 Presentation

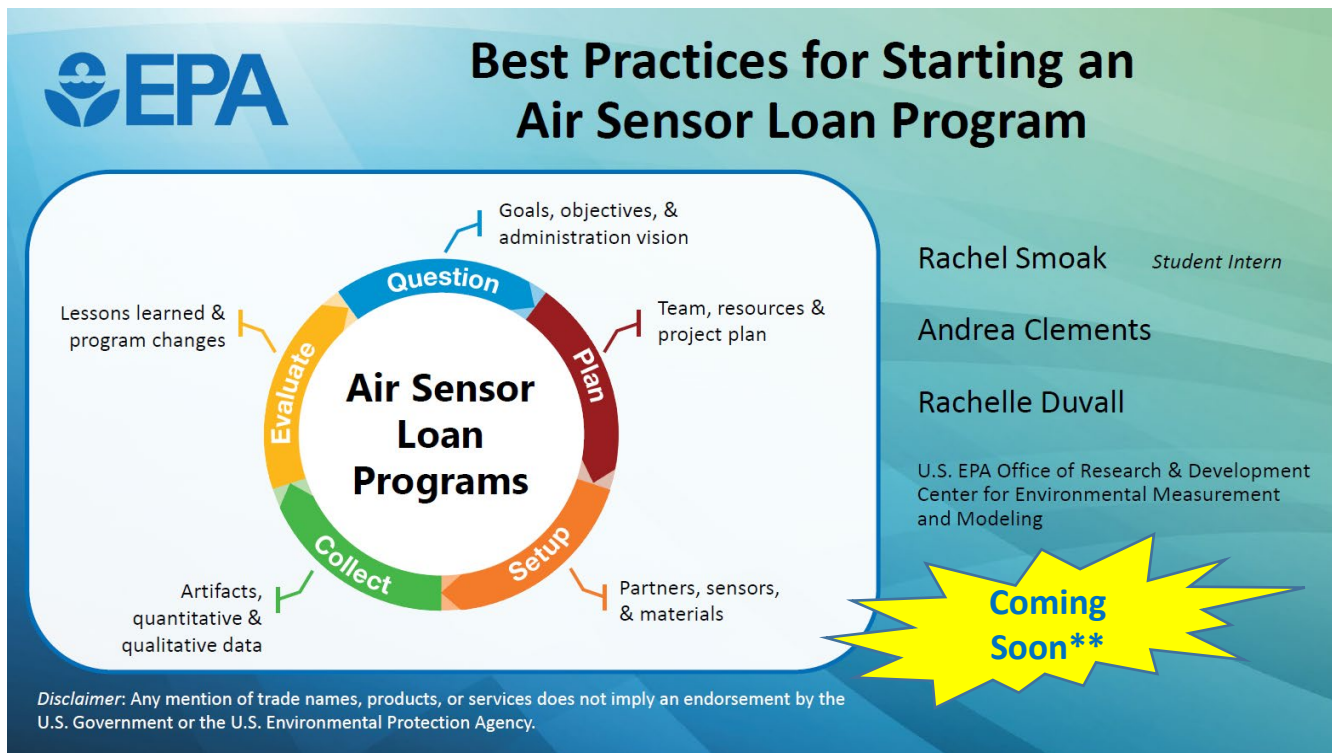
Background information on air pollution, air quality, and air sensors

Advanced Topics in Air Sensor Use

Slides on interpreting evaluation results, collocation, data quality control, and data analysis

Outcome: Best Practices for Starting an Air Sensor Loan Program

- ✓ Walks through how to establish an air sensor loan program using EPA's Air Sensor Guidebook planning wheel
- ✓ Includes important topics such as identifying the project purpose, building a team, developing a project plan, selecting equipment, collecting data, sharing findings and resources, and more!



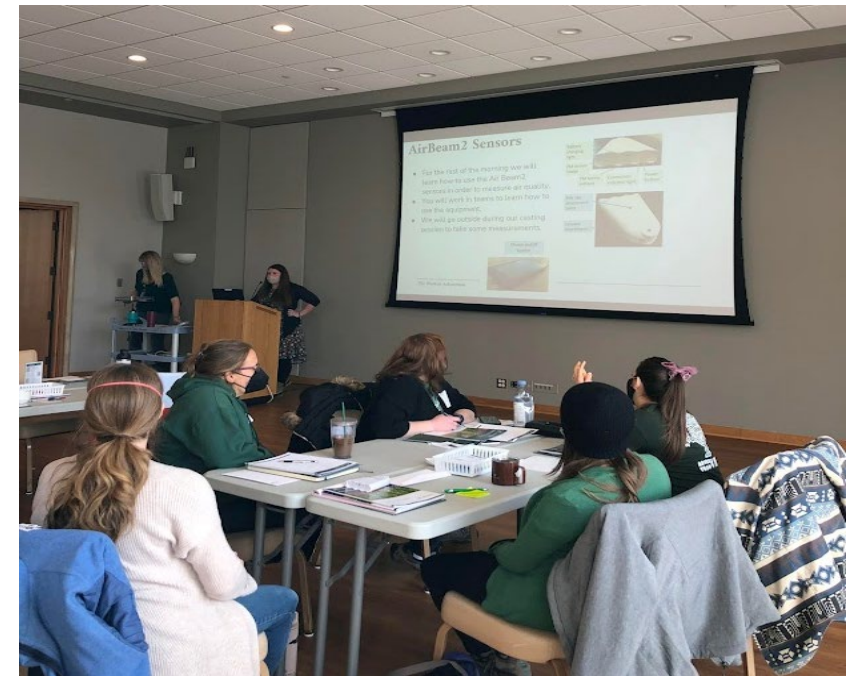
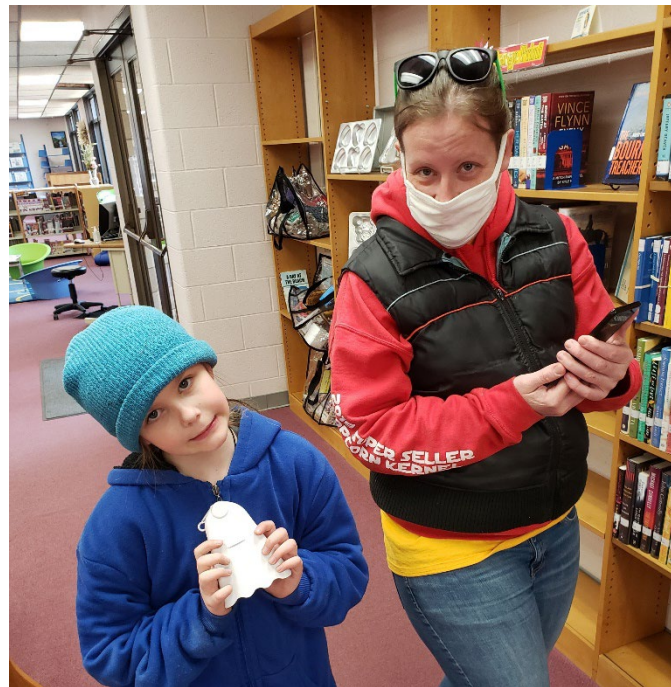
Target Audience

- Educators – schools, libraries, after-school programs, community organizations, etc.
- State/local/tribal air quality agencies
- Government agencies
- Academia
- Any group interested in starting an air sensor loan program

**Slides will be shared on the [Air Sensor Toolbox Webpage](#)

Impact: General

- Loan programs **put sensors in the hands of individuals** who might not know about or otherwise have the opportunity to access this technology
- The resources developed to support these programs have **improved the environmental literacy** of our partners helping them to offer education and programming within their communities



Impact: General

- Programs allow groups or individuals to
 - **Learn** about air quality and sensors
 - **Explore pollution sources** within their communities or homes
 - Explore ways in which they can **reduce exposure to air pollution**
- The **lesson plans are publicly available** and can be used and adapted by educators
- The lessons learned and resources will **make it easier for others to develop similar programs**



The screenshot shows the EPA website's 'Air Sensor Toolbox' page. At the top left is the EPA logo and 'United States Environmental Protection Agency'. A search bar is on the top right. A blue navigation bar contains 'Environmental Topics', 'Laws & Regulations', 'Report a Violation', and 'About EPA'. The main content area has 'Air Sensor Toolbox' on the left and 'CONTACT US' on the right. The main heading is 'Educational Resources Related to Air Sensor Technology'. Below this is a paragraph: 'Air sensor technologies provide many opportunities for educational enrichment on topics ranging from air quality, pollution sources, and the sensors themselves. The educational activities and curriculum available on this web page were developed by EPA and collaborators and are available for use by the public. The resources may be used in group settings such as classrooms or community workshops, in other educational settings, or by individuals exploring on their own. These materials may also be adaptable for a variety of age groups from elementary school students to adults.'

<https://www.epa.gov/air-sensor-toolbox/educational-resources-related-air-sensor-technology>

Impact: Partners

- The positive connections developed with partners will ensure the **programs are sustainable** over time
- **Partners have tailored resources** for their own needs (e.g., translations into native languages, supplementing with more in-depth information)
- Partners have **implemented additional programming** (e.g., educator training sessions, air quality flag program) where they saw opportunity and need



*Translation of Air Quality Index (AQI)
chart by the Nez Perce Tribe*



*New curriculum by the Morton
Arboretum*

Impact: EPA

- Programs have **informed the development and design** of ARP* funded loan programs currently being established by EPA regions
- Efforts have **advanced EPA's research priorities** in the areas of air quality, environmental justice, and participatory science

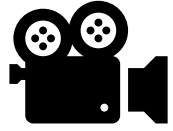


Take Home Messages

- ORD, in conjunction with EPA Regions 5, 9, and 10, and a variety of local partners, have established air sensor loan pilot programs which have
 - Facilitated access to sensor technologies
 - Increased environmental awareness and literacy
 - Generated numerous resources
 - Inspired program expansion and additional programming
 - Provided a model for similar programs to be established
- Air sensor loan programs are currently available in select locations around the U.S., and we anticipate new programs will be established in the future



Resources: General Air Sensor Information



[Air Sensor Video Series](#)



[Air Sensor Guidebook](#)



[Frequently Asked Questions](#)



[Introduction to Air Sensors Presentation](#)

Air Sensor Toolbox: www.epa.gov/air-sensor-toolbox

Air Sensor Toolbox

Sensor Performance, Evaluation and Use



- [Sensor Evaluation Results](#)
- [Standard Operating Procedures for Sensors](#)
- [Sensor Collocation Guide](#)
- [Sensor Performance Targets and Test Protocols](#)
- [Air Sensor Guidebook](#)
- [A Guide to Siting and Installing Air Sensors](#)

Research Projects



- [Overview of Current Research](#)
- [Collaborative Agreements](#)
- [Grants](#)
- [Reports and Publications](#)
- [Past Projects](#)

Understanding Your Sensor Data Readings



- [Technical Approaches for the Sensor Data on the AirNow Fire and Smoke Map](#)
- [Videos on Air Sensor Measurement, Data Quality and Interpretation](#)
- [RETIGO: Visualize Your Field Data](#)
- [Sensor Collocation Macro Analysis Tool](#)
- [Air Quality Information Exchange Workgroup Meeting Summaries](#)

Additional Resources



- [Frequently Asked Questions](#)
- [Air Sensor Loan Programs](#)
- [Newsletter Articles, Fact Sheets and Infographics](#)
- [Educational Resources](#)
- [Conferences, Workshops, and Webinars](#)
- [Sensor Evaluations by Other Organizations](#)
- [Quality Assurance Handbook and Guidance Documents for Citizen Science Projects](#)

Resources: Air Sensor Loan Programs

Air Sensor Toolbox

www.epa.gov/air-sensor-toolbox

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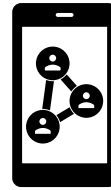


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[Air Sensor Loan Programs](#)



[Educational Resources](#)

- [Hands-On Lesson Plans](#)
- Quick Start Guides
 - [AirBeam2](#)
 - PurpleAir (*posting soon*)
- [AirBeam2 Video](#)
- [Air Quality 101 Presentation](#)
- [Air Sensor Advanced Topics Presentation](#)
- Resource Guide (*posting soon*)
- FAQs (*posting soon*)

Acknowledgements

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R5 – Sheila Batka, Megan Gavin, Ben Weiss

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R10 – Christi Duboiski, India Young, Sarah Waldo

ORD – Rachel Smoak (*student intern*)

Contractor

Sonoma Technology – Olivia Ryder, Hilary Minor, Steve Brown

Urban Libraries

Los Angeles Public Library – Vivienne Byrd

Rural and Remote Libraries

Bayliss Public Library and Superior District Library System –

Lisa Waskin (Superior District); Pam Flood, Sabrina Neveu (Bayliss); Emily Hyde (Pickford); Jane French (Les Cheneaux); Megan Stefanski (DeTour)

Evansville Vanderburgh Public Library – Charles Sutton, Andrea Kappler, Katie Reineke

L'Anse Area School/Public Library – Sonya Evans, Susan Tollefson (L'Anse); Jane Kahkonen (Keweenaw Bay Indian Community)

Alternative Loan Structures

The Morton Arboretum – Meghan Wiesbrock

Tribal Communities

Institute for Tribal Environmental Professionals at Northern Arizona University

Mansel A. Nelson, Josie Kamkoff

Heritage University

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