# IMPLICATIONS OF CLIMATE CHANGE ON AMBIENT AND INDOOR AIR QUALITY

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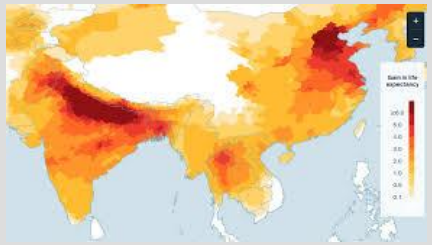
# WHY CONSIDER AMBIENT *AND* INDOOR AIR QUALITY?



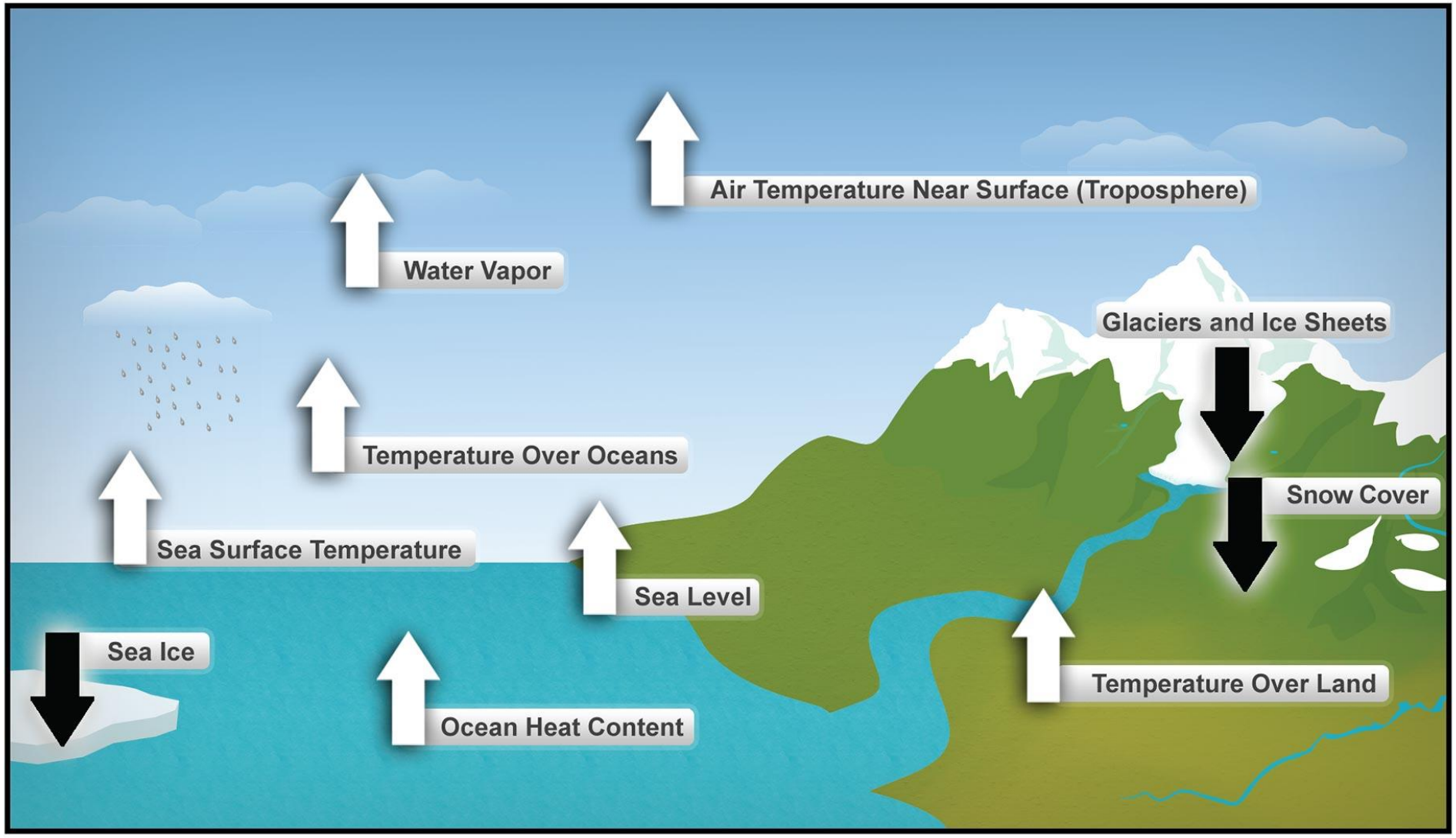
Changes in climate are generating higher and more sustained concentrations of ambient air pollution, *and*…

- Generating new impacts on our built environments *(stress on the integrity of our structures).*
- Placing greater demands on our indoor environments *(more time indoors, more protection from hazards)*

# THE BIG PICTURE

General patterns and processes we are witnessing…

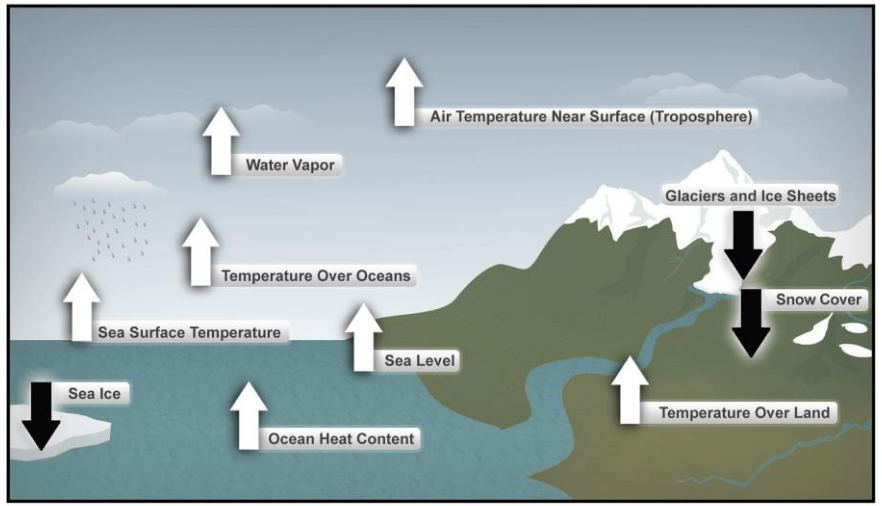
# Ten Indicators of a Warming World




https://www.globalchange.gov/

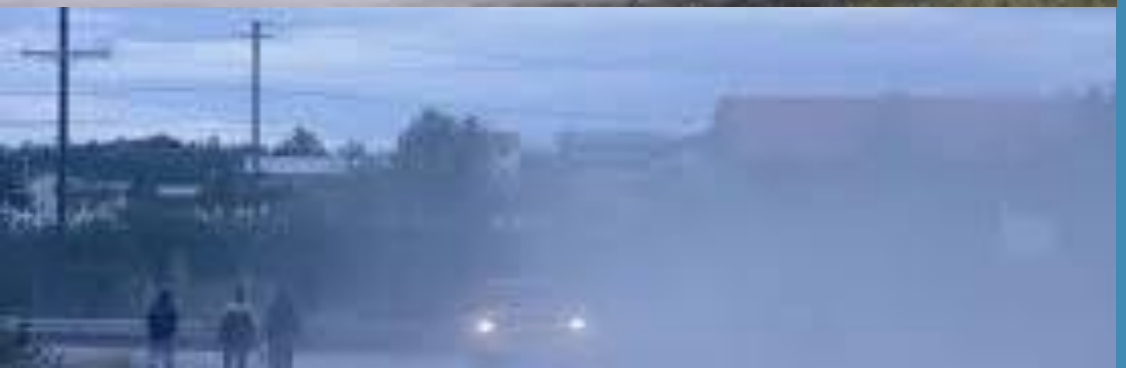
**ALTERED WEATHER PATTERNS** THAT DIRECTLY IMPACT AMBIENT AND INDOOR AIR QUALITY

- ✓ Increased Precipitation (Flooding)
- ✓ Decreased Precipitation (Drought)
- ✓ Increased Heat
- ✓ Increased Wildfires



# PRECIPITATION

- Increased incidence of flooding
- Damage to and degradation of building materials; water damage; displacement
- Dampness, mold – microbial contamination; water and vectorborne diseases



# DROUGHT

- Increased incidence of drought
- Increased airborne particles from crustal dust and combustion
- Respiratory distress and illness



# HEAT

- Increased incidence of higher temperatures
- Increased ozone levels and other pollutants from ozone-initiated chemistry
- Respiratory distress and illness; COPD population directly impacted

# WILDFIRES

- Increased incidence, severity and duration of wildfires
- Increased airborne particles, combustion gases and PAHs
- Immunologic, neurologic, respiratory, cardiovascular, carcinogenic, mutagenic impacts

# *AMBIENT* AIR QUALITY IMPACTS ASSOCIATED WITH CLIMATE CHANGE:

- Ozone → High heat
- Particulate Matter (PM)
- Ultrafine Particulate Matter
- Carbon Monoxide
- Volatile Organic Compounds (VOC's)

  → Wildfires
- Allergens → Weather changes

# *INDOOR* AIR QUALITY IMPACTS ASSOCIATED WITH CLIMATE CHANGE:

- Microbial Contamination → Flooding
- Allergen-Induced Illness → Flooding, Weather
- Indoor Ozone
- VOC Emissions

  } Heat

- Particulate Matter
- Carbon Monoxide; Combustion Gases

  } Wildfires

# THE CONSEQUENCES

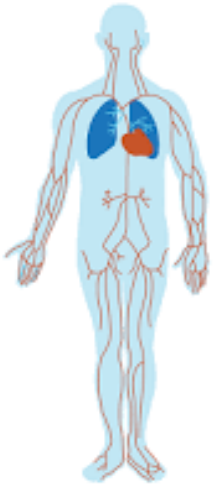
What these changes mean on a population scale…

# Human Health Consequences of Climate Change

1. Asthma, Respiratory Allergies, and Airway Diseases
2. Cancer
3. Cardiovascular Disease and Stroke
4. Foodborne Diseases and Nutrition
5. Heat-Related Morbidity and Mortality
6. Human Developmental Effects
7. Mental Health and Stress-Related Disorders
8. Neurological Diseases and Disorders
9. Vectorborne and Zoonotic Diseases
10. Waterborne Diseases
11. Weather-Related Morbidity and Mortality

Note that three of the top health impacts of climate change have a correlation specifically with air quality.

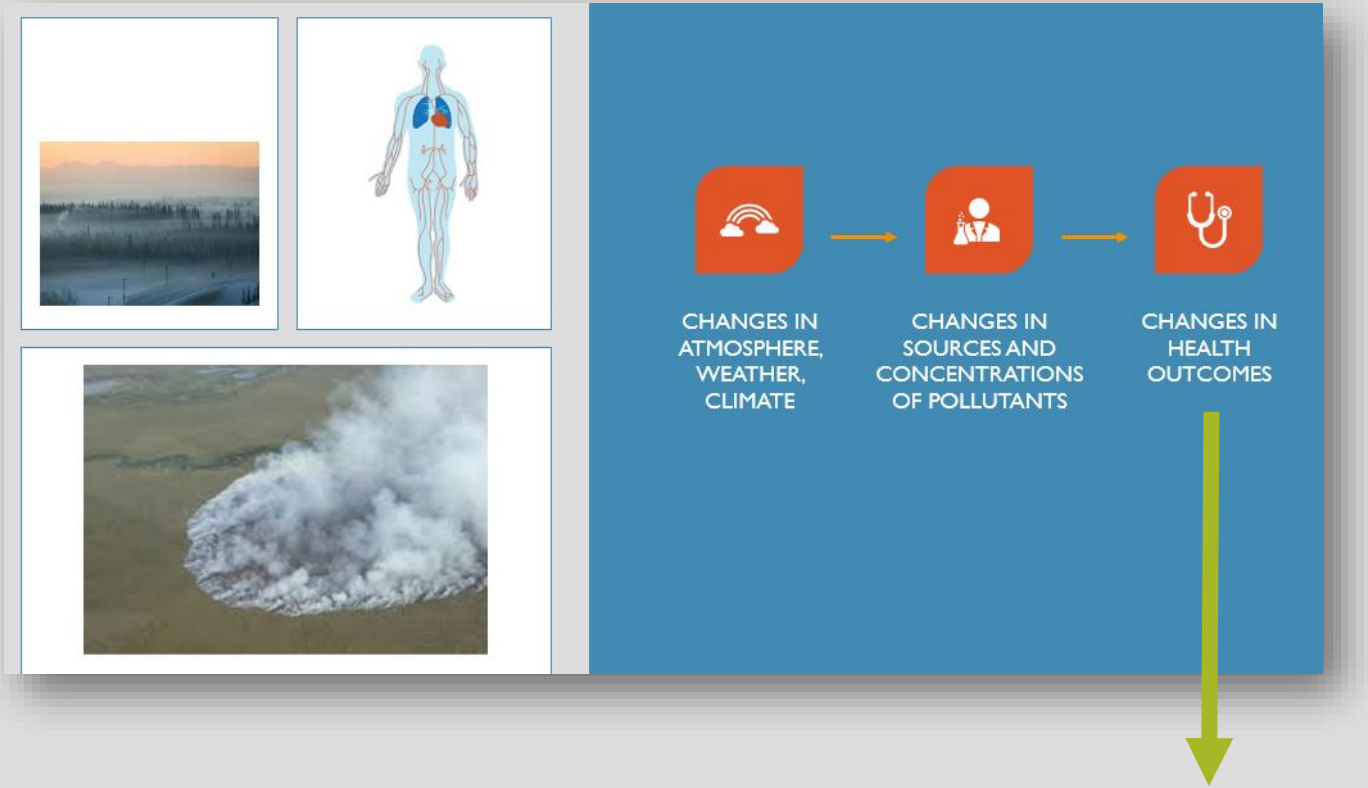
*A Human Health Perspective On Climate Change A Report Outlining the Research Needs on the Human Health Effects of Climate Change*. The Interagency Working Group on Climate Change and Health. April 2010



CHANGES IN ATMOSPHERE, WEATHER, CLIMATE

CHANGES IN SOURCES, PROPERTIES AND CONCENTRATIONS OF AIRBORNE POLLUTANTS

CHANGES IN HEALTH OUTCOMES




Changes in physical activity levels, mental health, well-being, tradition, culture, community structure, and self-sufficiency.

How we are impacted by climate change can't be measured in clinically-detectable symptoms only.

# LOW-COST PROTECTIVE MEASURES

Things you can do with limited budget and resources that will have a measurable impact…

# THREE EVIDENCE-BASED MEASURES

1. Education
2. Filtration
3. Collaboration

*(…there are many more interventions and approaches)*

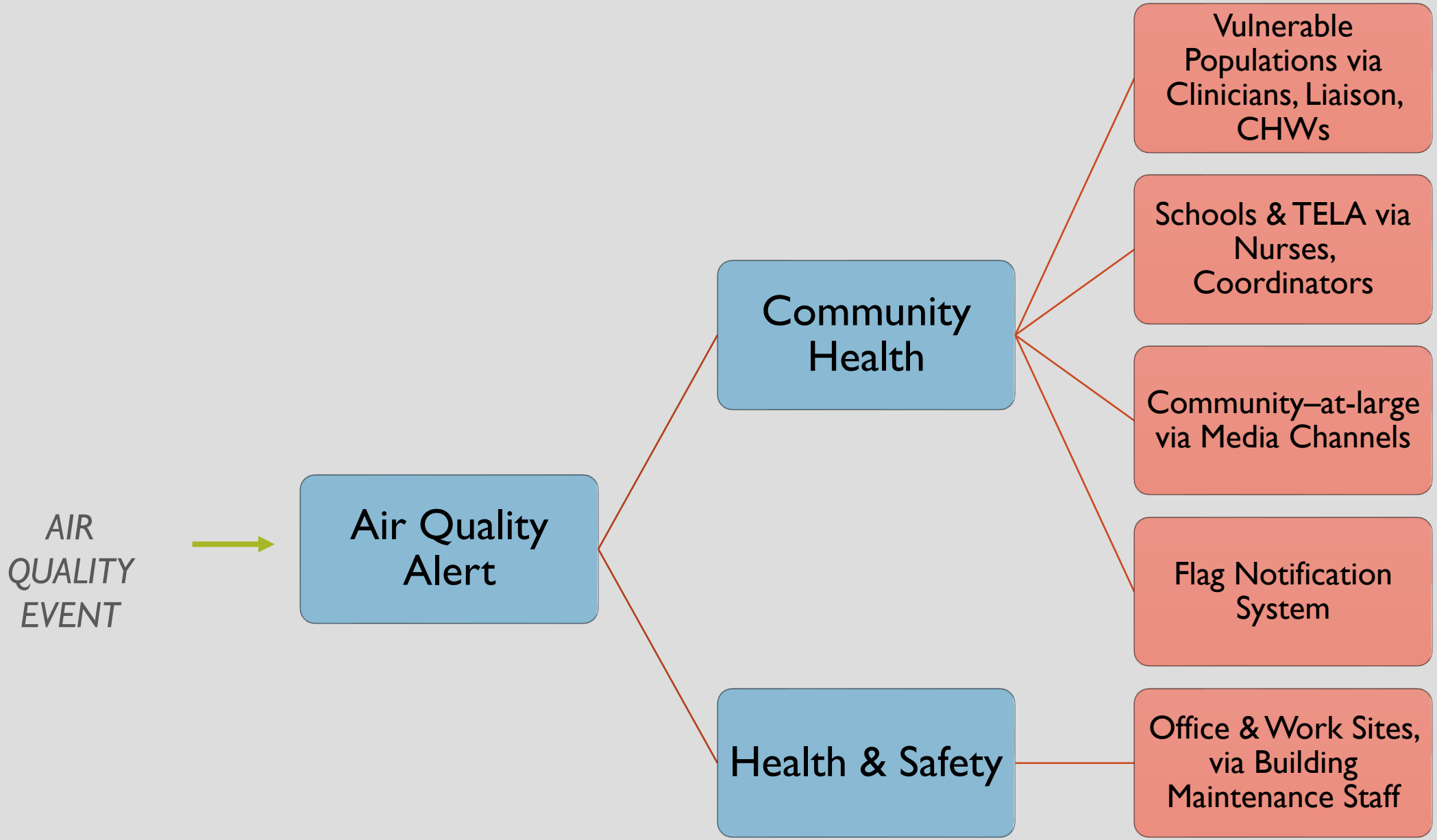
# EDUCATION

- ***Inform*** by helping shift perception of smoke *(emphasis on elders, pregnant women, cardiovascular disease, immune compromised)* to promote adherence to protective measures (e.g., mask, reduced activity, filtration)
- ***Engage and empower*** with visible tools (Purple Air/low-cost sensors – real-time, local data), Air Matters toolkits, filters

# VISUAL TOOLS

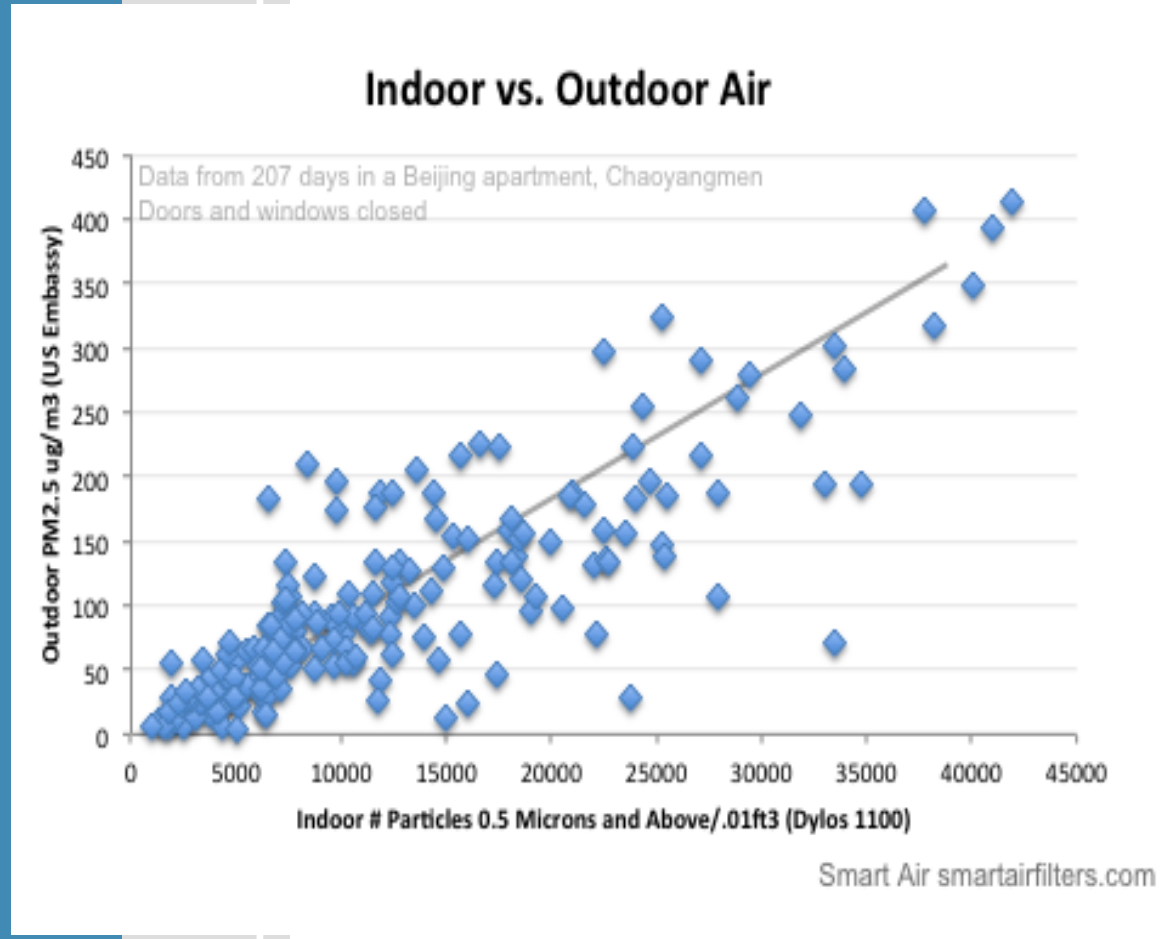


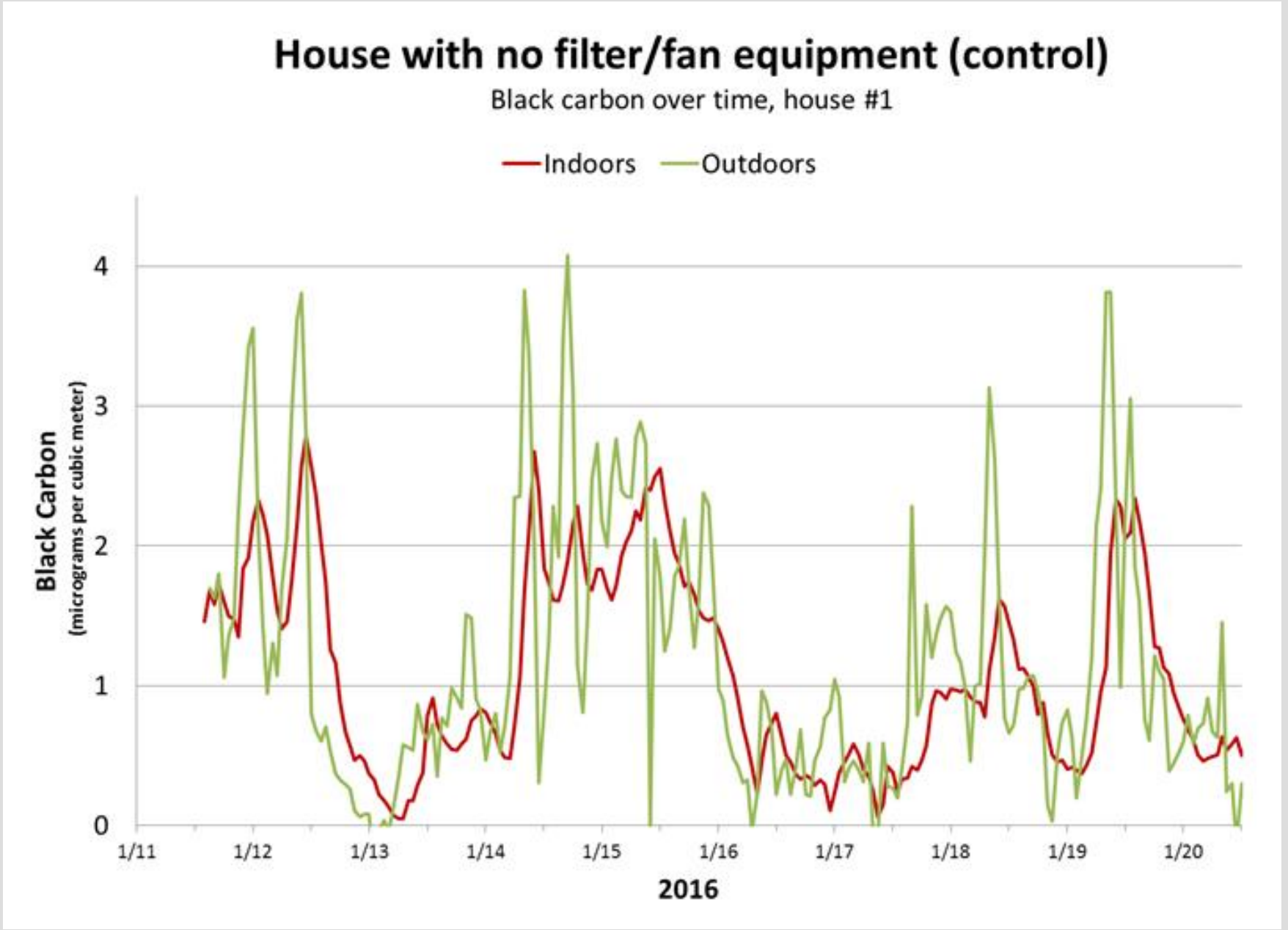
33
4
38


AIR QUALITY EVENT
Air Quality Alert
Community Health
Health & Safety
Vulnerable Populations via Clinicians, Liaison, CHWs
Schools & TELA via Nurses, Coordinators
Community–at-large via Media Channels
Flag Notification System
Office & Work Sites, via Building Maintenance Staff

***Example – inform residents about the indoor/outdoor correlation***

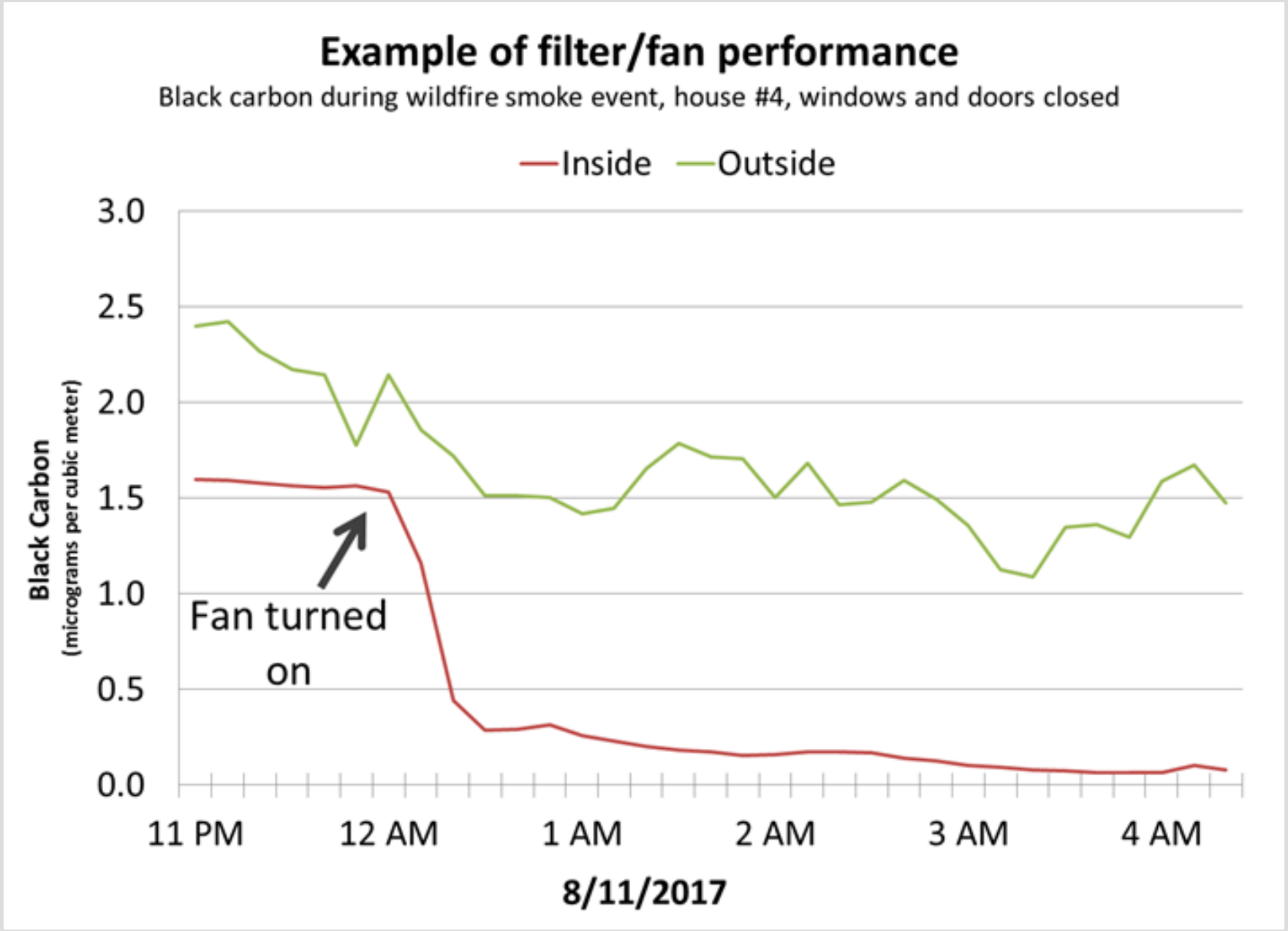
***…Positive correlation*** usually present between ambient and indoor concentrations.



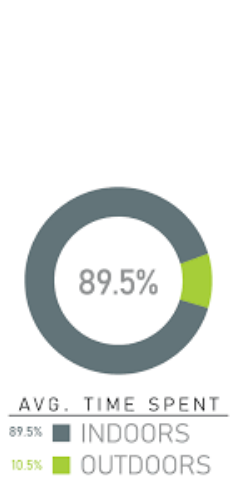

House with no filter/fan equipment (control)
Black carbon over time, house #1
Indoors
Outdoors
Black Carbon
(micrograms per cubic meter)
4
3
2
1
0
1/11
1/12
1/13
1/14
1/15
1/16
1/17
1/18
1/19
1/20
2016

# FILTRATION

- ***HEPA filtration*** – mechanical air cleaners
- ***Filter-a-Fan*** – low-cost fans coupled with furnace filters
- All households should consider, but particularly those with at-risk individuals due to increased time indoors

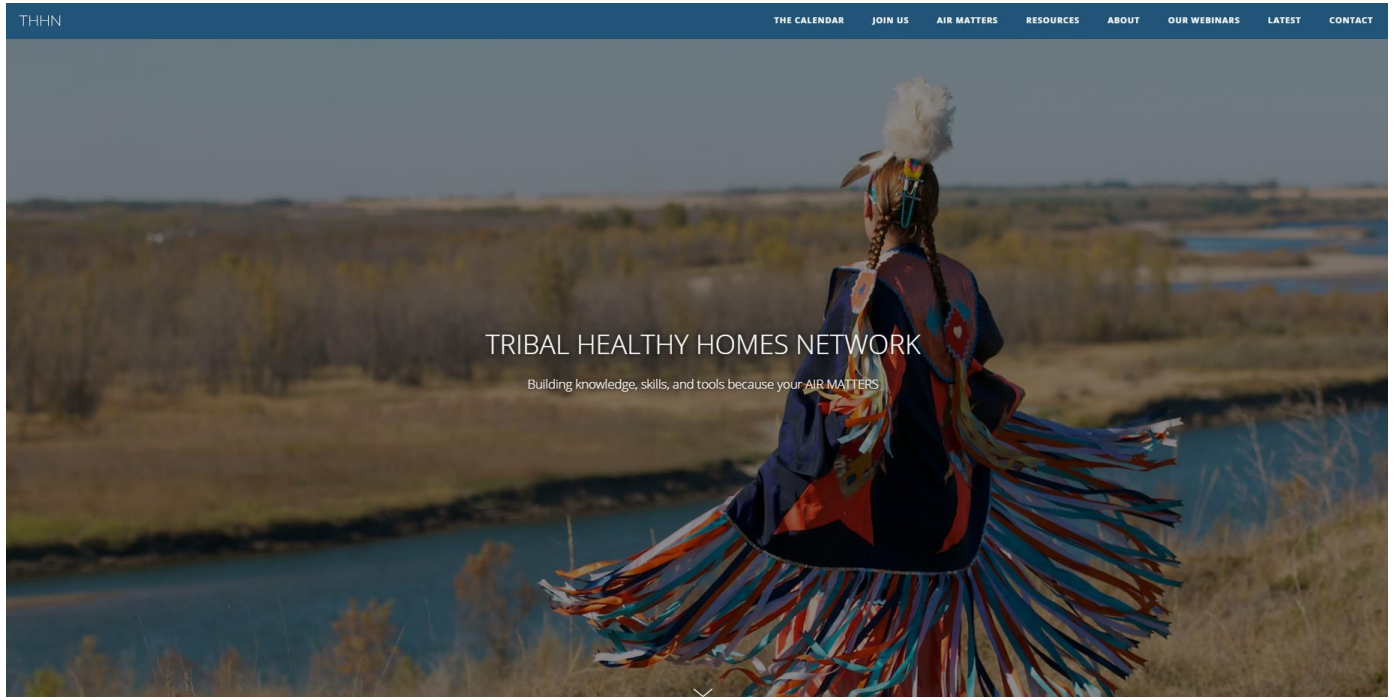

Example of filter/fan performance
Black carbon during wildfire smoke event, house #4, windows and doors closed
Inside
Outside
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Black Carbon
(micrograms per cubic meter)
Fan turned on
11 PM
12 AM
1 AM
2 AM
3 AM
4 AM
8/11/2017

***Increased time spent indoors*** due to smoke, high heat and extreme weather



# COLLABORATION

- ***Housing Authorities*** – ventilation and filtration improvements as part of energy efficiency or weatherization efforts
- ***Cooperative Extensions and Universities*** – education resources
- ***Research and Non-Profit Organizations*** – community-based projects to identify specific needs and approaches unique to your community




# WWW.THHNW.ORG

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