

## Exposure Science 21: Meeting the Needs of Citizen Scientists Ed Washburn<sup>1</sup> and Liam O'Fallon<sup>2</sup>

<sup>1</sup>U.S. Environmental Protection Agency, Washington, DC; <sup>2</sup> National Institute of Environmental Health Sciences, Research Triangle Park, NC

#### Introduction: Exposure Science, **Community Engagement, and Citizen** Science

*"The development of more user-friendly and less expensive"* monitoring equipment can allow trained people in communities to collect and upload their own data in partnership with researchers and thereby improve the value of the data collected and make more data available for purposes of priority-setting and to inform policy."





Figure 4. Selected scientific and technological advances for measuring and monitoring considered in rela tion to the conceptual framework presented in Figure 1. Reproduced from NRC (2012) with permission from the National Academy of Sciences, courtesy of the National Academies Press

#### **Example - Water Exposures: Excess** Nutrients (N, P) and Harmful Algal Blooms



#### Nutrient Pollution: One of the Nation's **Biggest Environmental Problems**



52.2 BILLIO FR YEAR

water violations for trates have nearly DOUBLED the last decade.





The Goal: affordable, accurate nutrient sensors to improve neasurement and monitoring

ATER NUTRIENT SENSO

We have limited data

- Current sampling capabilities are not sufficient
- Current commercial sensors costly and cumbersome

http://water.epa.gov/type/watersheds/monitoring/vol.cfm



#### **Passive Wristband** Sampler (Air & Water)



Contact: Ed Washburn, <u>washburn.edward@epa.gov</u> 202-564-1134

#### **National Academy of Sciences** Recommendations

National Academy of Sciences report (2012) inspired relevant federal agencies to form a working group Subgroup, focused on community engagement and citizen science, formed in 2014

- *"To maintain public confidence in the integrity of* exposure science, innovative forms of public engagement are required."
- *"People can then act as 'citizen-scientists', collecting"* their own exposure data to inform themselves about what they might be exposed to, ..."

## **Example - Air Exposures: Community-Supported** Monitoring, Passive Samplers, and Conscious Clothing



http://eprep.oregonstate.edu/

http://www.epa.gov/heasd/airsensortoolbox/





U.S. Environmental Protection Agency

Wearable Sensor, i.e., Clothing, Calculates **Amount of Particulate Matter (PM); Prototype is Part of EPA-NIEHS Challenge** 

http://www.niehs.nih.gov/funding/challenges/myair\_myhealth/

## How Can You Ride the "Citizen Science Wave?"



## **Example - Climate-Change Exposures: Local Knowledge, Tribes, and Alaska Native Communities**

#### Sharing Observations

Sharing observations about environmental change and connecting with technical resources are two objectives behind the Local Environmental Observe LEO) Network. Observations about unusual and extreme environmental events are posted to public Google maps. Many posts are related to climate change including erosion, ice conditions, landscape

| This<br>note<br>have | map includes unique, unusual, or<br>worthy environmental events that<br>occurred in the Bering Strat Region of | *   | *       | 17 | P |
|----------------------|--|-----|---------|----|---|
|                      | Add layer  |     |         |    |   |
| 9                    | Spruce beatles on the rise (photo)   | 1   |         |    |   |
| 9                    | This is the year for salmon berries  | 10  | ~       |    |   |
| P                    | Spruce bestles on the rise   | 1   |         | Y  | ( |
| P                    | Muddy river raises salmon concern  |     |         |    |   |
| P                    | Rare bird sighting in the Northwest  |     |         |    |   |
| 9                    | Norton Sound community observe   |     |         |    |   |
| P                    | Increased mussel roe observed in E   |     |         |    |   |
| Ŷ                    | Persistence rains cause food press   |     |         |    |   |
| 9                    | No ice fishing yst due to late freeze  |     |         |    |   |
| P                    | Hairless seal near Shishmaref  |     |         |    |   |
| P                    | Abundant mussel roe fouls fishing :  |     |         |    |   |
| P                    | Warm weather delays subsistence  | 5   | >       |    |   |
| P                    | Thin ice makes for hazardous ice fi  | 511 | assynce |    |   |
|                      | Presed Incorrect Corners at a source in Attacks  | 1 8 | -       | al |   |

Innovative Research for a Sustainable Future



# National Institute of **Environmental Health Sciences**

#### **Trends and Technologies that Enable YOUR Participation:**

- **Physical-Chemical-Biological Sensors**
- **Biomonitoring**
- **Geographic & Satellite Mapping**
- **Handheld Smart Devices**
- **Data Analytics Software & Algorithms**
- **Computing Power & Miniaturization**
- **Internet Access & Social Media**
- **Imaging Capability**
- **Innovative & Entrepreneurial Spirit**
- **Passion for Volunteering & Science**



shared with technical experts at agencies and academic institutions. There are LEO Network membe in fourteen communities in the Bering Strait Region.

change, unusual wildlife

and impacts from

extreme weathe

Observations are





e-lapse cameras are being used to recor easonal events such as freeze-up or breakip, episodic events such as winter storms, and adual change such as the thawing river banl



ome communities are using time-laps cameras to create photo records of year, short videos documenting the y in time lapse.

Cameras have been installed in Golovin, Shishmaref, St. Michael, Teller, Unalakleet and Nome as part of the LEO Network Community Camera Project

amera in St. Michael

Cheemuk show the time-lapse

"... advancing exposure science requires recognition of the interconnectedness of human health and ecologic health."

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