Exposure Science 21: Meeting the Needs of Citizen Scientists

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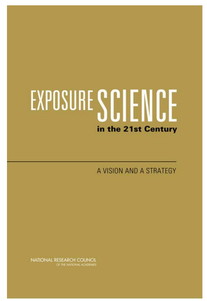
Introduction: Exposure Science, Community Engagement, and Citizen Science

"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."



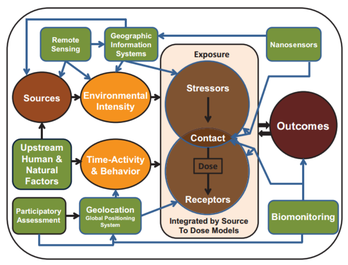


Figure 4. Selected scientific and technological advances for measuring and monitoring considered in relation to the conceptual framework presented in Figure 1. Reproduced from NRC (2012) with permission from the National Academy of Sciences, courtesy of the National Academies Press.

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, …"***

How Can You Ride the "Citizen Science Wave?"

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**

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

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

Passive Wristband Sampler (Air & Water)

http://eprep.oregonstate.edu/

My Air My Health

U.S. Department of Health and Human Services
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/

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

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

65% of assessed estuaries and coastal areas have moderate to high **WATER QUALITY IMPACTS** from nutrient pollution.

Freshwater nutrient pollution costs the nation **$2.2 BILLION PER YEAR.**

Reported drinking water violations for nitrates have nearly **DOUBLED** in the last decade.

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

WATER NUTRIENT SENSORS

Why?

- **We have limited data**
- **Current sampling capabilities are not sufficient**
- **Current commercial sensors costly and cumbersome**

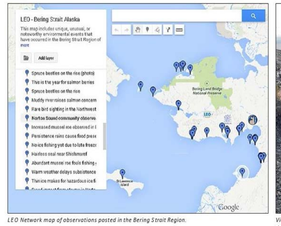
http://water.epa.gov/type/watersheds/monitoring/vol.cfm

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 Observer (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 change, unusual wildlife and impacts from extreme weather.

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



LEO Network map of observations posted in the Bering Strait Region.

Victoria Katongan points out storm damage in Unalakleet.

Recording Change

Time-lapse cameras are being used to record seasonal events such as freeze-up or break-up, episodic events such as winter storms, and gradual change such as the thawing river banks.

Image from the time-lapse camera shows low snow levels in 2013.

Some communities are using time-lapse cameras to create photo records of environmental conditions throughout the year, short videos documenting the year 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.

Michelle Snowball and Aida Cheemuk show the time-lapse camera in St. Michael.

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