

# Citizen Science: An Overview



Forest Research Advisory Council Meeting

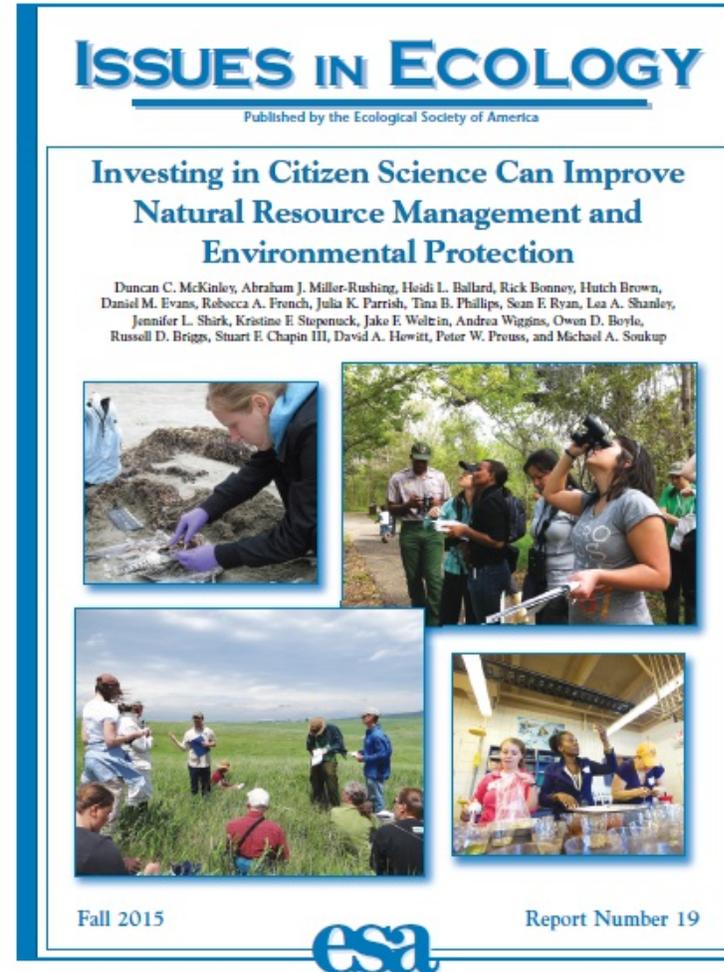
February 23, 2016

Lara Roman, Research Ecologist, NRS, Philadelphia Field Station

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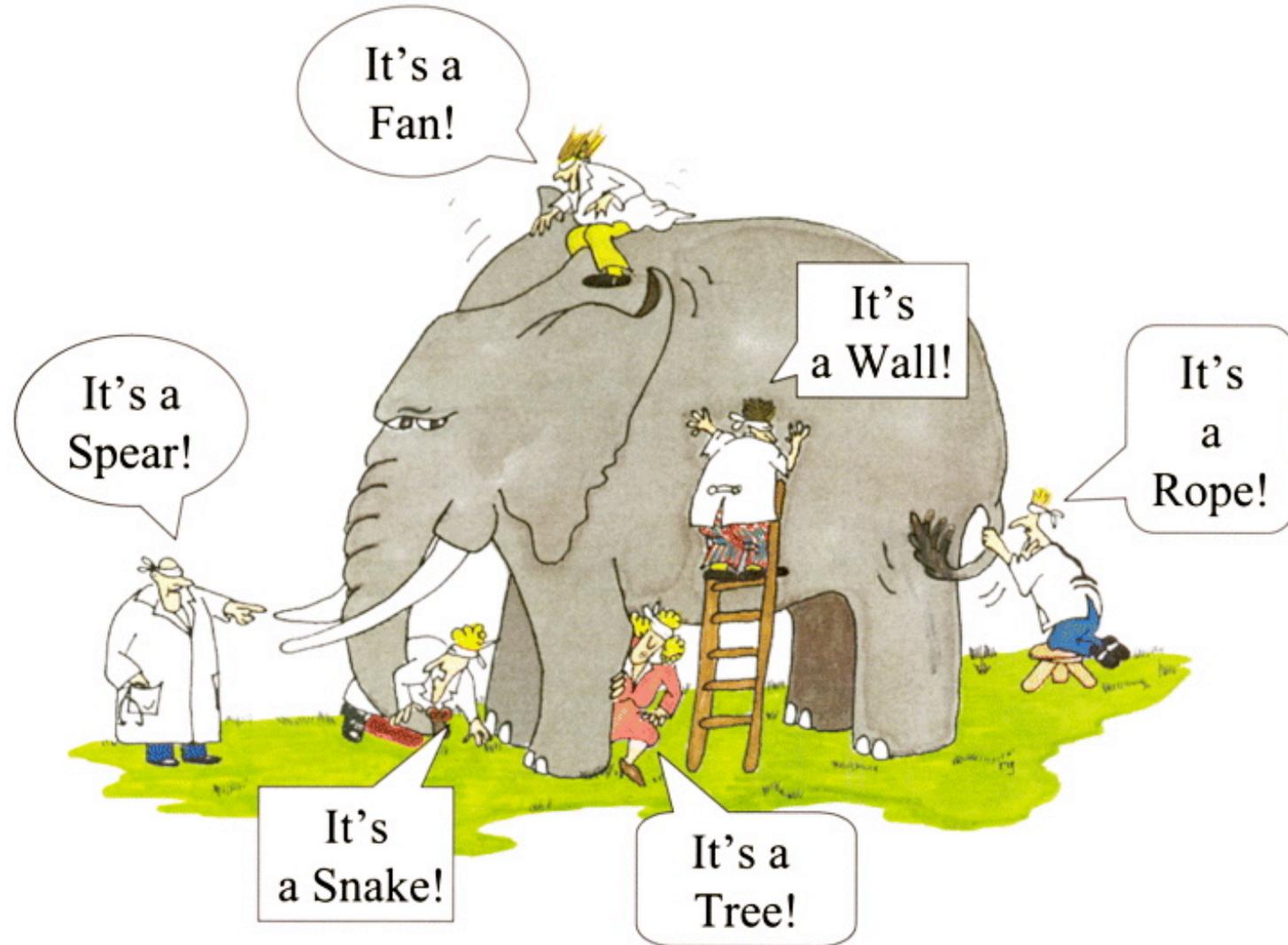


# This presentation is based on...



Duncan McKinley  
Research & Development, Policy Analysis

# What is citizen science?



G. Renee Guzlas, artist

# Definitions

The **collection and analysis of data** relating to the natural world by members of the general public, typically as part of a collaborative project with professional scientists. (Oxford Dictionary 2015)

Partnerships between the public and professional scientists to address questions and issues of common concern. Usually when people refer to citizen science they mean projects for which members of the public **collect, categorize, transcribe, or analyze scientific data**. (Cornell Lab of Ornithology)

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Participation by the public in a scientific project. Projects can involve public participation in **any or all stages of the scientific process**. Projects can involve professional scientists or be entirely designed and implemented by volunteers. (McKinley et al. 2015)

The public participates voluntarily in the **scientific process, addressing real-world problems** in ways that may include formulating research questions, conducting scientific experiments, collecting and analyzing data, interpreting results, making new discoveries, developing technologies and applications, and solving complex problems. (White House Office of Science and Technology Policy)

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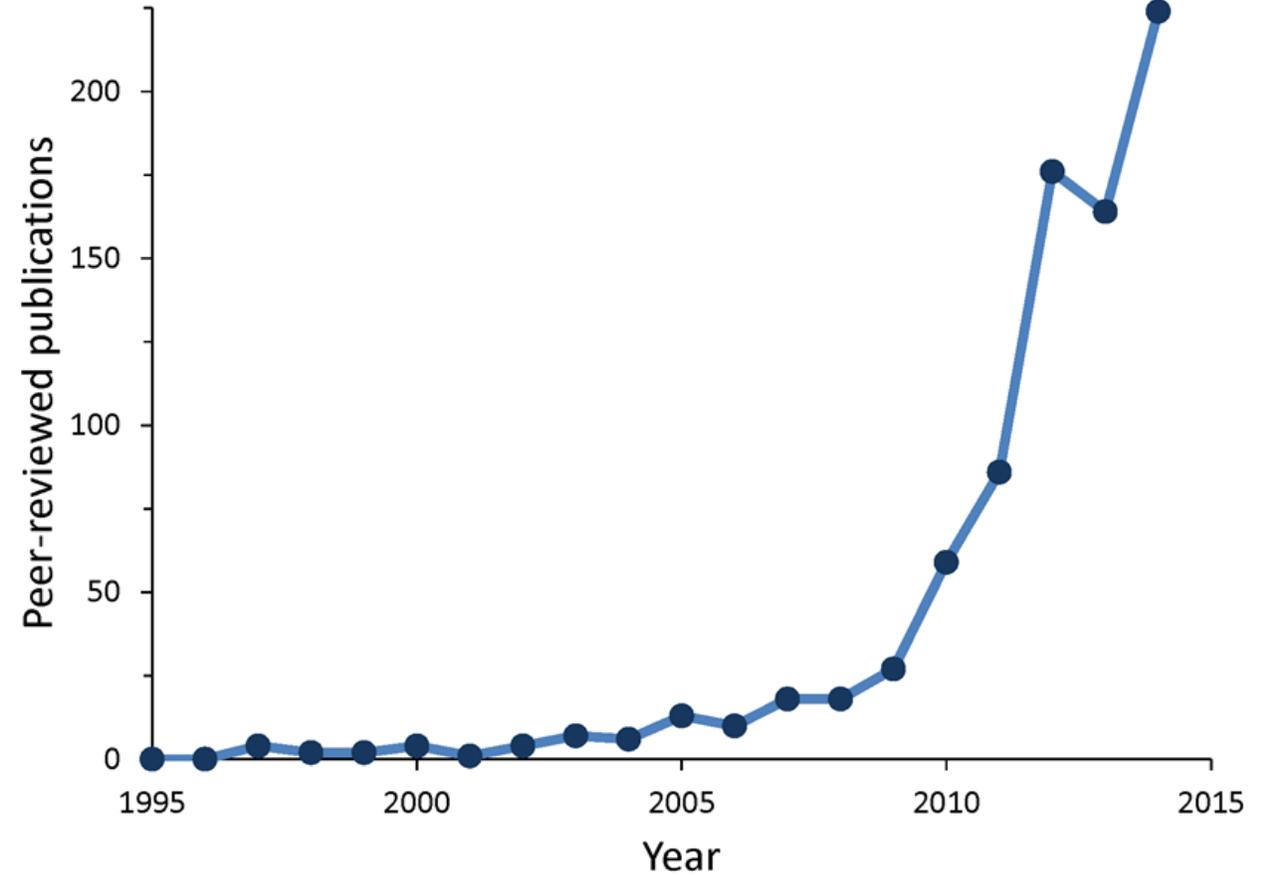
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Crowdsourcing: organizations submit an open call for voluntary assistance from a large group of individuals for **online, distributed problem solving**. (White House Office of Science and Technology Policy)

# Growth of citizen science scholarship



# Why use citizen science?

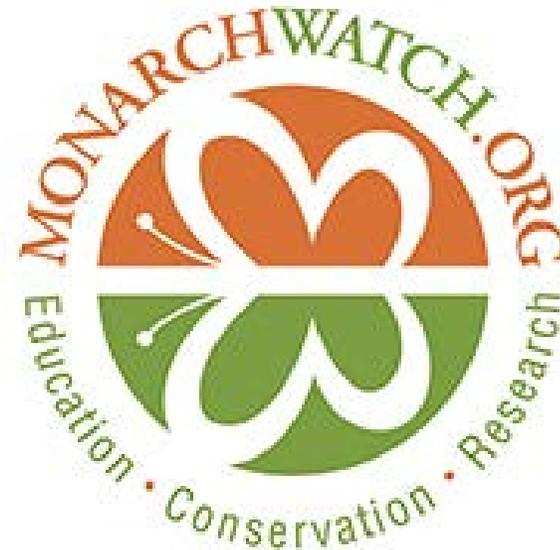
- Builds public trust
- Enhances scientific literacy
- Facilitates scientific research and resource management
- Fosters open and transparent government practices
- Catalyzes innovative use of technologies
- Creates and strengthens partnerships



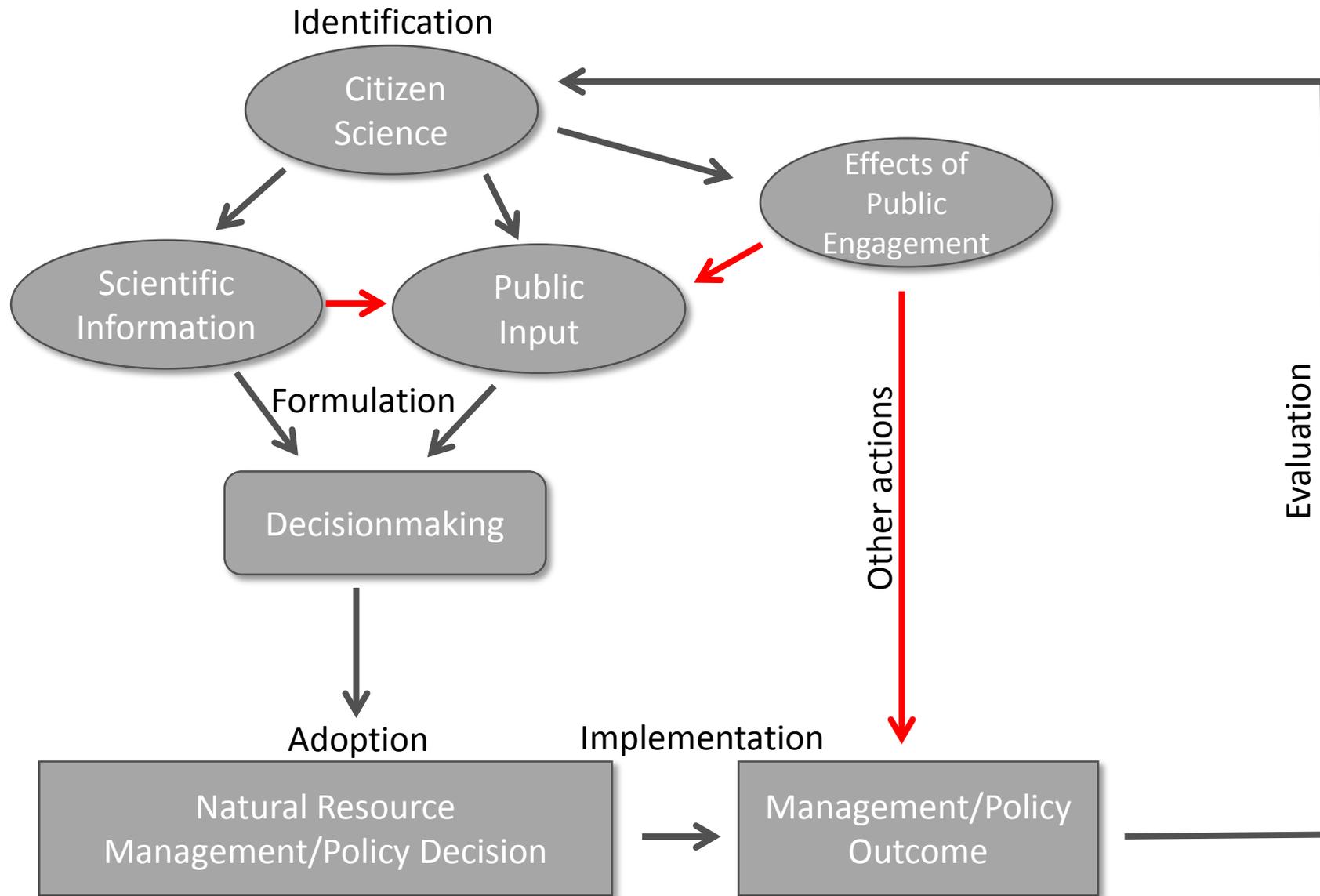
# Federal support for citizen science & crowdsourcing

- 1) Federal Citizen Science and Crowdsourcing Toolkit released
- 2) Office of Science and Technology Policy memo from Director John Holdren on crowdsourcing and citizen science
- 3) National Science Foundation announced core priority in citizen science and crowdsourcing
- 4) Citizen science & crowdsourcing legislation introduced by Senator Chris Coons (DE)

# Diversity of citizen science projects



# Citizen science in policy & decision-making



- Direct effects
- Indirect effects

# Example 1: eBird

- 272 million observations from over 200,000 individuals
- Extensive global coverage



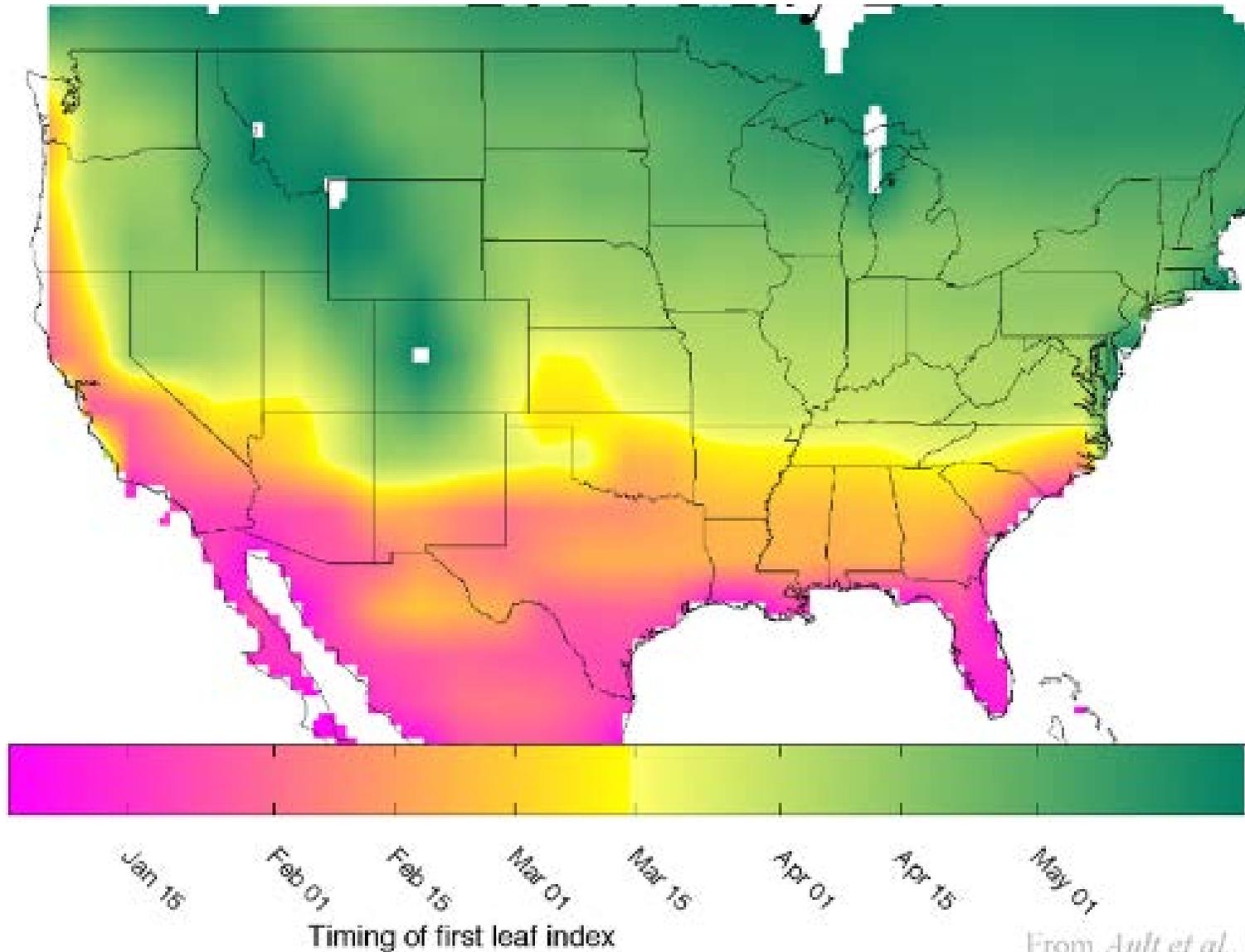
The **Cornell** Lab  
of Ornithology



Audubon



# Example 2: National Phenology Network

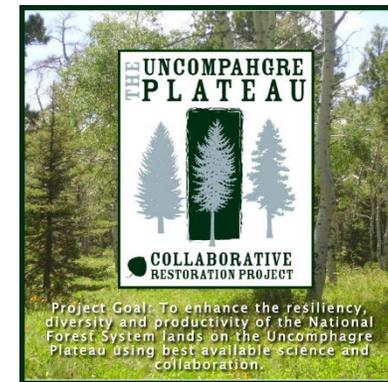


From Ault et al., (in prep.)

Courtesy of NPN

# Example 3: Collaborative Forest Landscape Restoration Program (CFLRP)

- Encourages collaborative, science-based ecosystem restoration of forest landscapes
- Promotes ecological, economic, and social sustainability (strong focus on reducing uncharacteristic wildfires)
- Monitors management outcomes for 15 yrs via multiparty monitoring / citizen science



# Example 4: Neighborhood Nestwatch

- Science
  - Monitor backyard bird populations
  - Identify management regimes
  - Improve wildlife habitat
- Engagement
  - Partner with households
  - Increase environmental literacy
  - Reconnect people with nature



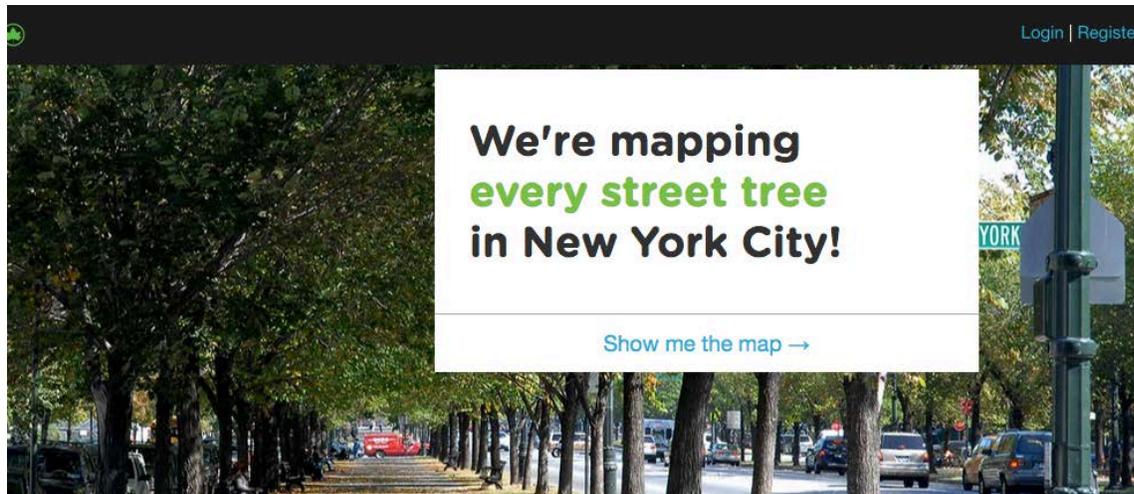
PI: Peter Marra, Smithsonian Migratory Bird Center  
coPI: Susannah Lerman, US Forest Service

# Example 5: TreesCount! 2015

- Decadal street tree census in NYC
- FS and USDA contributions:
  - Grants for OpenTreeMap
  - Assessing volunteer errors
  - Research on citizen science for civic engagement



**NYC Parks**



# Who participates?

- Does citizen science really...
  - Engage diverse constituencies?
  - Promote scientific literacy?
  - Promote environmental stewardship & civic engagement?



**How to Read These Maps**

Each of these two maps describes the participants of the Trees Count! 2015 Street Tree Census.

When a user creates their account, they are asked to enter in their zip code. In the map on the left, the zip code of the volunteer who collected each block was generalized and colored to the borough it's in, producing a map that shows where the volunteer who collected each block comes from.

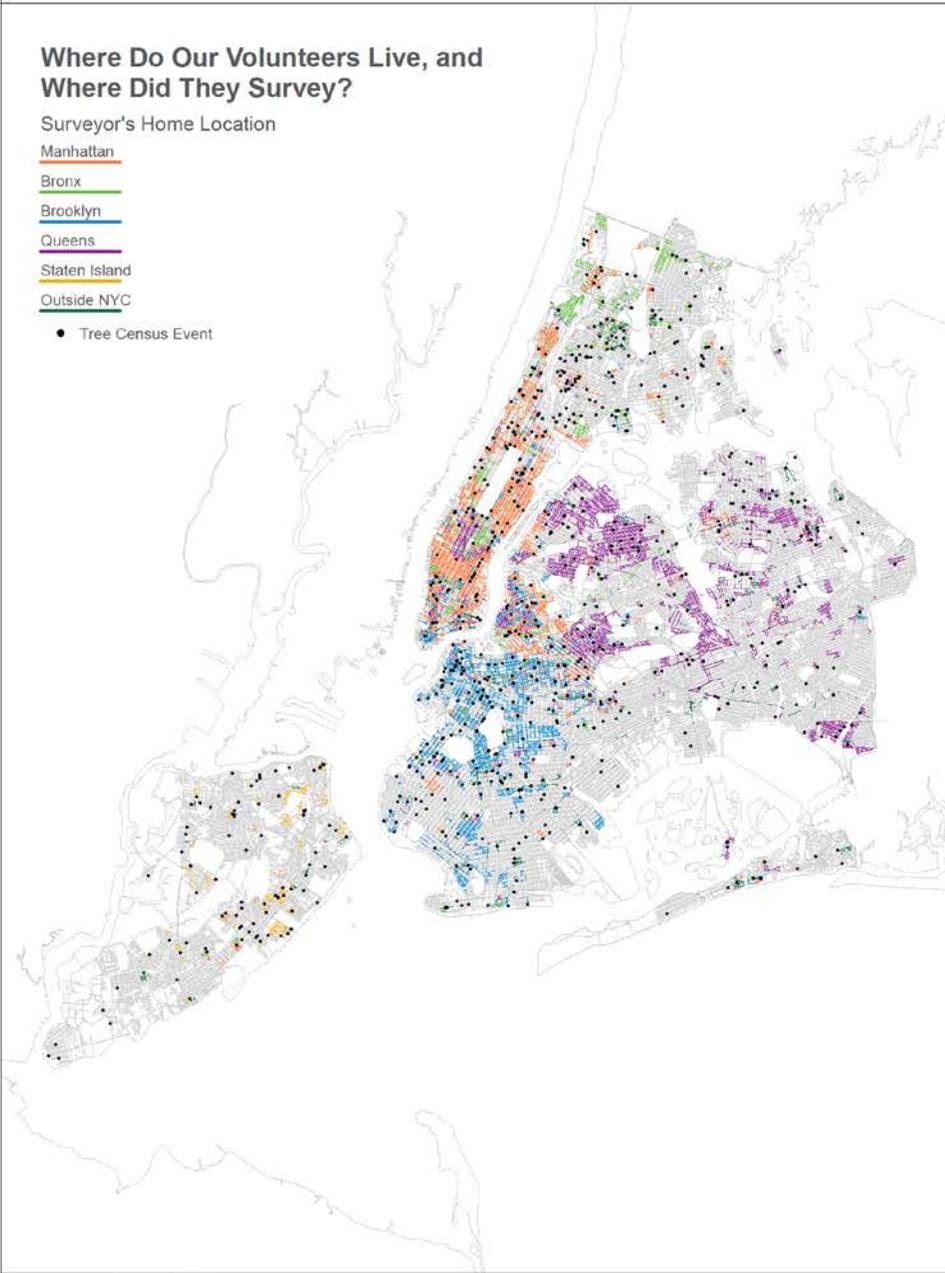
The map on the right shows census tracts, a geographic unit of consistent population used by the US Census. Each tract has been colored based on the number of unique volunteers who collected data in that area.

**Where Do Our Volunteers Live, and Where Did They Survey?**

Surveyor's Home Location

- Manhattan
- Bronx
- Brooklyn
- Queens
- Staten Island
- Outside NYC

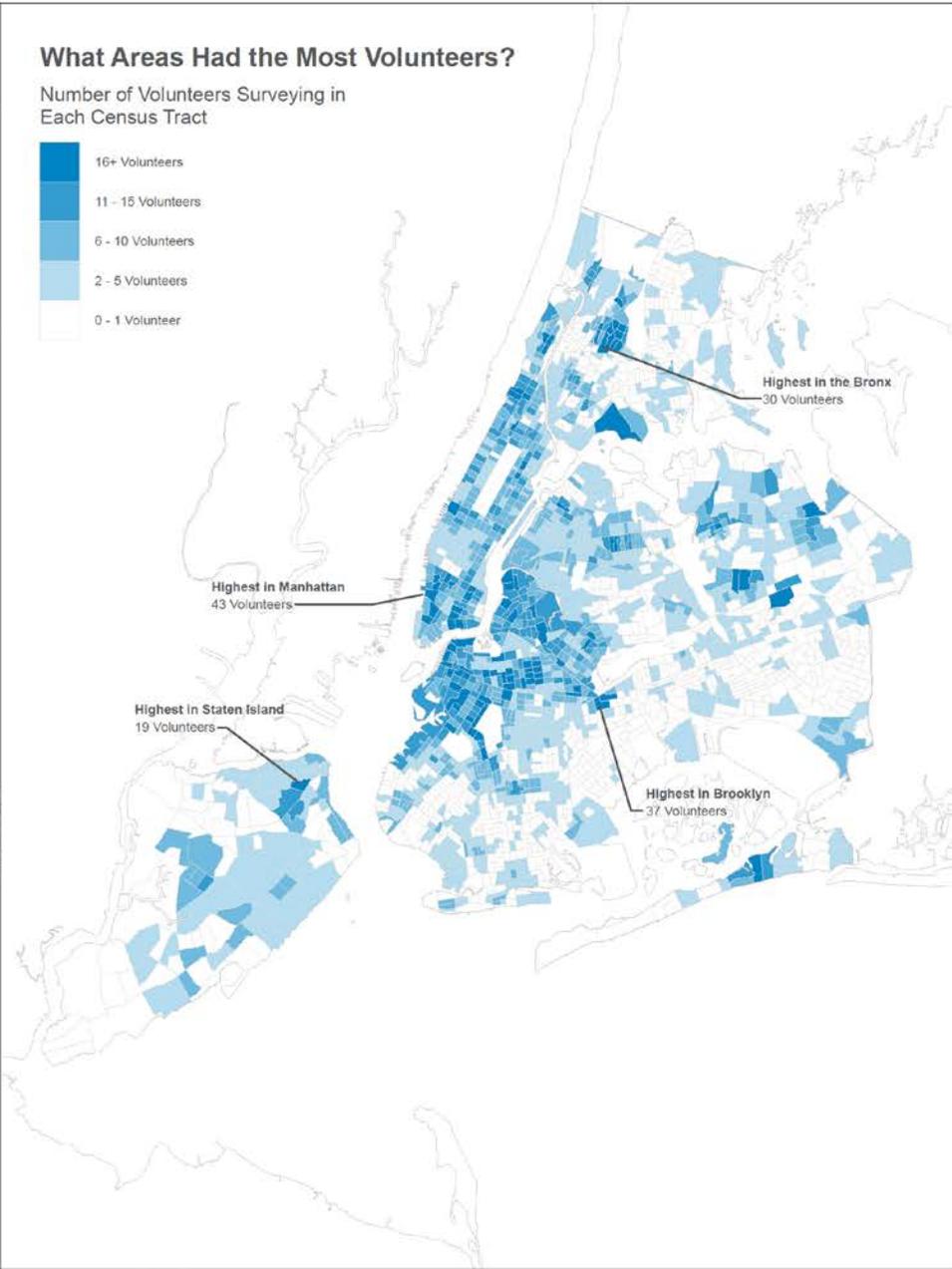
• Tree Census Event



**What Areas Had the Most Volunteers?**

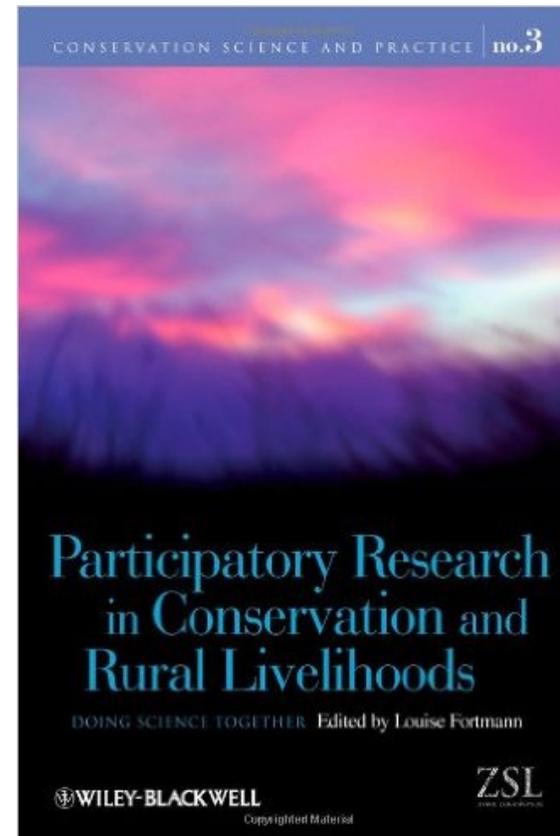
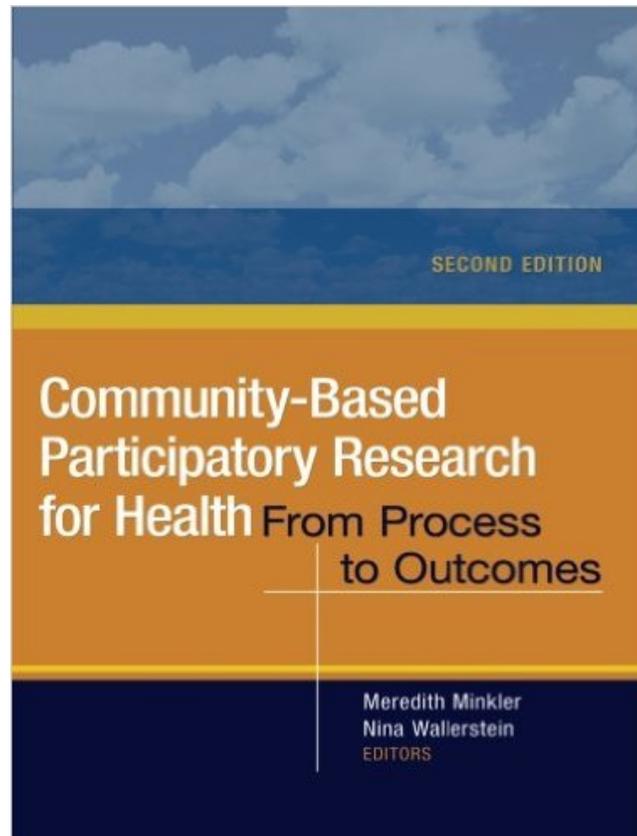
Number of Volunteers Surveying in Each Census Tract

- 16+ Volunteers
- 11 - 15 Volunteers
- 6 - 10 Volunteers
- 2 - 5 Volunteers
- 0 - 1 Volunteer



# Participatory action research

A **participatory, democratic process** ... in the pursuit of **practical solutions** to issues of pressing concern to people, and more generally the flourishing of individual persons and communities (Reason & Bradbury 2001, Green et al. 2003)



# Data quality?

- Sampling bias in crowdsourcing
  - Uneven spatial & temporal distribution
- Observation error
  - Species misclassification
    - Urban trees: 92% correct genus (Roman et al. in preparation)
    - Bees: volunteers missed half the species (Kremen et al. 2011)
    - Birds: common species more accurate (Farmer et al. 2012)
  - Measurement error
    - Urban trees: DBH issues for multi-stem trees (Roman et al. in preparation)
    - Woody biomass: similar estimates from community members & professionals (Danielsen et al. 2011)

# Mechanisms for ensuring data quality

- Repeated samples
- Uniform or calibrated equipment
- Understanding volunteer skills
- Training & testing volunteers
- Filter unusual reports
- Expert review / validation
- Data triangulation
- Data quality documentation

# Conclusions

- *Benefits* to research, policy and communities
- Opportunities to strengthen *partnerships*
- *Support* from across federal government
- Citizen science is *science*
- Mechanisms to address *data quality*
- Citizen science *does not devalue* “conventional” research
- Part of a broader array of *public participation in scientific research*

# Thank you!

Federal Crowdsourcing and Citizen Science Toolkit:

<https://crowdsourcing-toolkit.sites.usa.gov/>

Internal Citizen Science and Crowdsourcing Sharepoint Site:

<https://ems-team.usda.gov/sites/fs-nrm-illac/SitePages/Citizen%20Science!.aspx>

Forest Service Citizen Science and Crowdsourcing external site:

<http://www.fs.fed.us/naturewatch/citizen-science.php>

