

Public Participation in Scientific Research: Converging on Effective Design Strategies

Jennifer Shirk¹, Heidi Ballard², Andrea Wiggins³, Tina Phillips¹, Rebecca Jordan⁴, Candie Wilderman⁵, Ellen McCallie⁶, Rick Bonney¹

¹Cornell Lab of Ornithology, ²University of California, Davis, ³Syracuse University School of Information Sciences, ⁴Rutgers University, ⁵Dickinson College, ⁶Carnegie Museum of Natural History

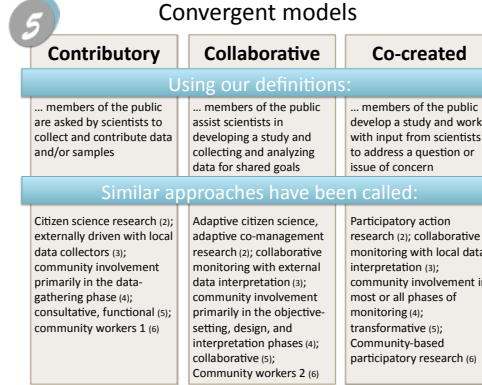
1 community science
participatory biodiversity
assessment Pro-Am partnerships
community based citizen
monitoring volunteer science
biological monitoring
... all public participation in scientific research?

2 Similarities? Meaningful differences?
Each of the above fields of practice may bring to mind a particular outcome (e.g., citizen science: large data sets). And yet most share an interest in three types of outcomes: for science, for individual participants, and for social-ecological systems. Our interest is in effective design: what programmatic elements influence outcomes?
We can explore a wide range of approaches and outcomes if we look across these fields of practice as if it were a single field: public participation in scientific research (PPSR). We define PPSR as intentional research collaborations between scientists and members of the public, where work aims to build on existing knowledge and contribute new understandings. Convergent meta-analyses across PPSR fields suggest that outcomes depend on the **degree** and **quality** of participation.

3 Participation
degree – who participates, and in what?
(in our context, depth of public involvement in the research process)
quality – whose interests are being served, and to what end?
(in our context, how interests are balanced in a project's design)

4 Models by degree of participation
per Bonney et al 2009 (1)

	Contributory	Collaborative	Co-Created
Choose or define questions for study			✓
Gather information and resources			✓
Develop explanations			✓
Design data collection methods		(✓)	✓
Collect samples and/or record data	✓	✓	✓
Analyze samples		✓	✓
Analyze data	(✓)	✓	✓
Interpret data and draw conclusions		(✓)	✓
Disseminate conclusions/translate results into action	(✓)	(✓)	✓
Discuss results and ask new questions			✓



6 Negotiating interests for outcomes
We propose that design choices enabling a certain degree of participation are related to the **quality** of participation: whose interests are considered, and how. Those choices can influence all phases of project development (inputs through impacts), as described below. The relationships between how these design considerations affect elements are visually represented in a framework for PPSR design (box 7).

Inputs

- The balance of interests (scientific/public) considered in project development or enhancement, that determines a research or monitoring agenda
- Can't make assumptions about interests, or about shared interests within a group
- The way interests are recognized, considered, and balanced can affect all stages of project development and implementation

Activities

- Include design and management of sampling strategies, trainings, data infrastructure, and means of communication
- Inputs will influence activity choices such as what/where/when to sample, who gets/needs/provides training, and who has access to data
- Activity choices can affect data quality, relevance, and usability

Outputs

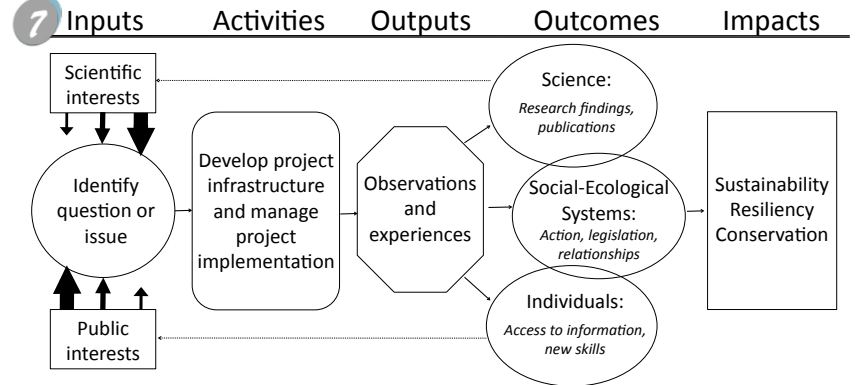
- Include observations, recorded as data, and the active experience of making, facilitating, recording, and/or analyzing those observations
- Will reflect activity choices regarding timeliness, actionability, and precision
- Choices regarding what data are collected, and what observations and experiences are relevant, can affect what outcomes are possible

Outcomes

- In this context, projects generally articulate/achieve outcomes in three categories:
 - for science: access to knowledge/observations; peer reviewed publications
 - for social-ecological systems: conservation actions; improved relationships between communities and agencies
 - for individuals: access to information; new skill sets; engaging an interest
- Outcomes in one category may influence outcomes in other categories
- Sustainable projects depend on outcomes for all constituents, and evolving projects respond to outcomes achieved

Impacts

- Are generally long term and difficult to measure, but often guide design
- Can include stewardship, a knowledgeable and empowered citizenry, and responsive science
- May only be achieved through combined successful outcomes for science, individuals, and social-ecological systems



8 Linking models to outcomes and design considerations
a survey of outcomes from PPSR meta analyses

Outcomes for:	Contributory	Collaborative	Co-Created
Science	Data precision and accuracy high, can inform large-scale monitoring (3); high potential for peer-reviewed publications to result (1)	Data precision and accuracy high, can inform large-scale monitoring (3, 6); presentations at scientific conferences (6)	Intermediate expectations of data precision and accuracy to inform large-scale monitoring (3)
Social-ecological systems	Decision-making slow to result (3); increased community awareness of environmental issues (1)	Decision-making slow to result (3); agency use of data to enhance management practices (6); citizen use of data to testify at hearings (6)	High potential for prompt decision-making (3); enhanced trust and relationship building between researchers and communities (4, 6); community, policy action outcomes high (6)
Individuals	Low potential for enhancing stakeholder capacities (3); increased content knowledge and science inquiry skills (1)	Some potential for enhancing stakeholder capacities (3); develop intimate knowledge of place and sense of stewardship (6)	High potential for enhancing stakeholder capacities (3); enhanced capacities to develop protocols, interpret data, present results (6)
Costs to:			
Science institutions	Intermediate (3);	Intermediate (3); resource intensive (5); limited technical training and support may be required (6)	High to establish, low to maintain (3); provide intensive technical training and support (6); requires commitment to support consensus-driven goal setting process (6)
Individuals/communities	Intermediate (3);	Intermediate (3); resource intensive (5);	High; requires commitment to intensive consensus-building process for goal setting (6); responsible for project planning, management, and action outcomes (6)
Compromises:			
	Data quality can decline if volunteers become complacent after repetitive tasks (5)	May need to choose between precision and reliability, between data collection for scientific validity and data collection for education and empowerment (5)	Outcomes more aligned with social change than with scientific precision (6)

9 Concluding thoughts
Data suggest that outcomes are influenced by the degree of participation. We suggest that the degree of participation is influenced by the quality of participation: how different input interests are negotiated.
More and better outcomes data are needed to help clarify cause and effect. For example, individuals may have unique experiences within a given project model (6); what other factors are at play?
Overall, articulating and reflecting on ways the degree and quality of participation relate to outcomes can help us be reflexive and intentional about design. These models and framework can suggest strategies to address unachieved outcomes.
Further conversations across fields of practice are encouraged, as they can provide avenues for integrated approaches and cross-tradition investigations, growing the field of PPSR in new and compelling directions.

10 Literature cited:
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