Goal: To Close the Gap between Science and Society: Keywords and Concepts

- Public engagement
- Broader impacts
- Outreach
- Science engagement
- Citizen science
- Mainstreaming science
- Science literacy

These gaps between science and society – and between people and nature – have led to a call from high-level scientists for greater scientist-initiated public engagement (Bell *et al*. 2009; Foote *et al*. 2009).

Why all the fuss?

Broader Impacts (NSF)

"The Project Description must contain, as a separate section within the narrative, a discussion of the broader impacts of the proposed activities… NSF values the advancement of scientific knowledge and activities that contribute to the achievement of societally relevant outcomes. Such outcomes include, but are not limited to:

* full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM);
* improved STEM education and educator development at any level;
* increased public scientific literacy and public engagement with science and technology;
* improved well-being of individuals in society;
* development of a diverse, globally competitive STEM workforce;
* increased partnerships between academia, industry, and others;
* improved national security;
* increased economic competitiveness of the United States;
* and enhanced infrastructure for research and education."

See: http://www.nsf.gov/pubs/policydocs/pappguide/nsf13001/gpg_2.jsp#IIC2di

Broader Impacts Review Criterion

National Science Foundation Letter to Colleagues:
https://www.nsf.gov/pubs/2007/nsf07046/nsf07046.jsp

Questions you might want to ask yourself:

* How well does the activity advance discovery and understanding while promoting teaching, training, and learning?
* How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)?
* To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships?
* Will the results be disseminated broadly to enhance scientific and technological understanding?
* What may be the benefits of the proposed activity to society?

How broad are our broader impacts? An analysis of the National Science Foundation's Ecosystem Studies Program and the Broader Impacts requirement

Nalini M Nadkarni*† and Amy E Stasch

The National Science Foundation (NSF) has tried to narrow the gap between science and society with its Broader Impacts criterion. We analyzed the proposed Broader Impacts (ie the activities that benefit society through teaching, broadening participation, enhancing infrastructure, and disseminating research) of proposals funded by NSF's Ecosystem Studies Program. We obtained abstracts from 296 funded proposals from NSF's website and characterized the scope of the proposed Broader Impacts (2000–2009). Only 65% of abstracts included a Broader Impacts statement and, of those, 57 (19%) included just one of five NSF broader impacts activities (BIAs). The most frequent component was teaching and training (37%), followed by broad dissemination (22%), infrastructure enhancement (18%), benefits to society (13%), and underrepresented groups (11%). Most proposed audiences were small (61%) to medium-sized (32%) and were closely associated with academics. NSF as a whole, and Program Officers in the Ecosystem Studies Program in particular, are generally reinforcing the importance of BIAs, but improvements are required within the academic culture. NSF needs to create new mechanisms that make grantees accountable for BIAs and provide positive feedback for those efforts.

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Broader Impacts Review Criteria

National Science Foundation Letter to Colleagues:
https://www.nsf.gov/pubs/2007/nsf07046/nsf07046.jsp

Advance discovery and understanding while promoting teaching, training, and learning

Broaden participation of under-represented groups

Enhance infrastructure for research and education

Broaden dissemination to enhance scientific and technological understanding

Benefits to society

…not every proposal must demonstrate impact in each of these pre-defined areas. Rather, activities with significant broader impact will emerge from the nature of the proposal and the authentic interests of the proposer.

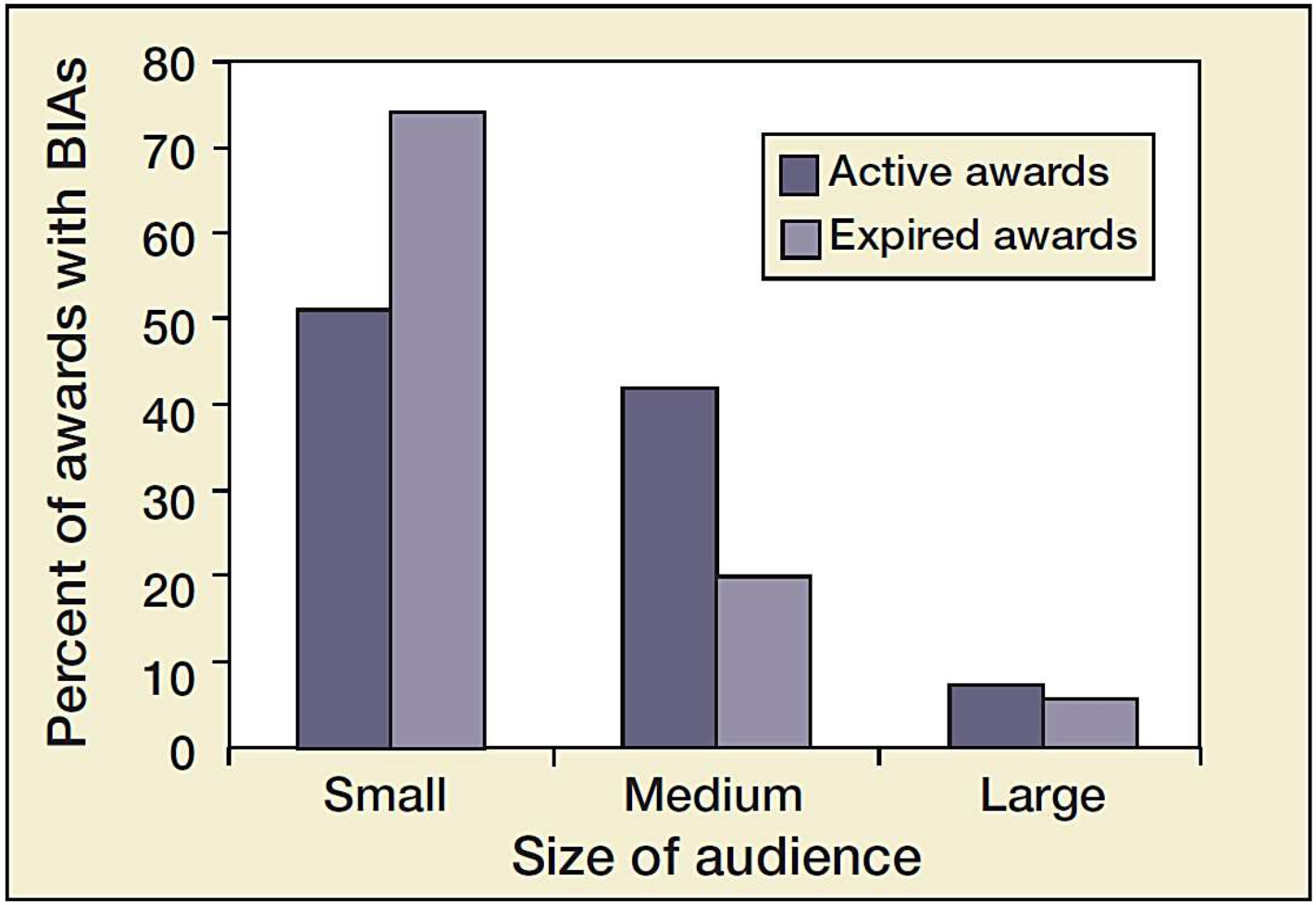

Figure 3. *Distribution of the percentage of active and expired awards that proposed Broader Impacts that were categorized as having small, medium, or large audiences.*

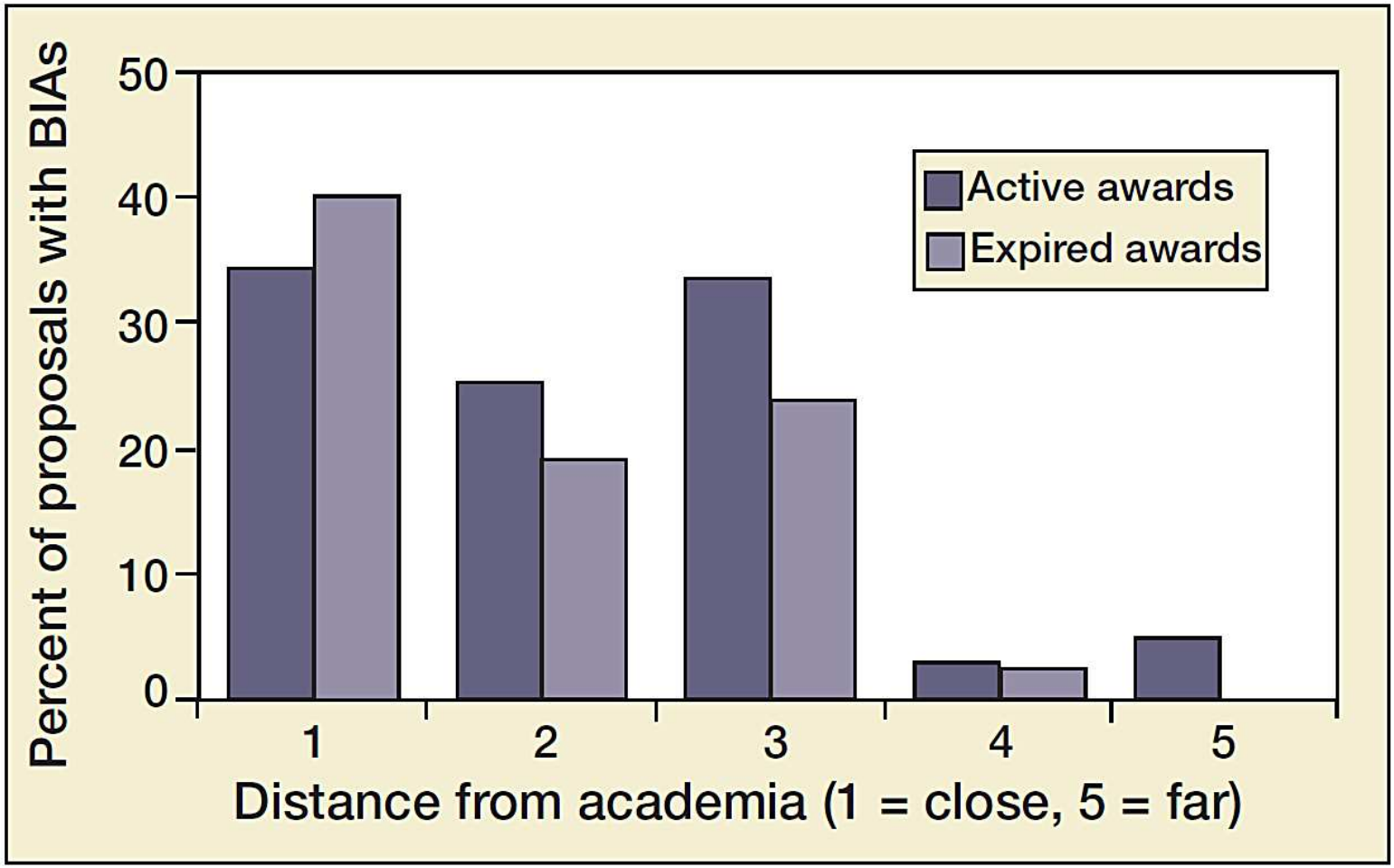

Figure 5. *Distribution of the percent of active and expired awards that proposed Broader Impacts that were categorized as being very close (1) to very distant (5) from academia (see Methods, category 4).*

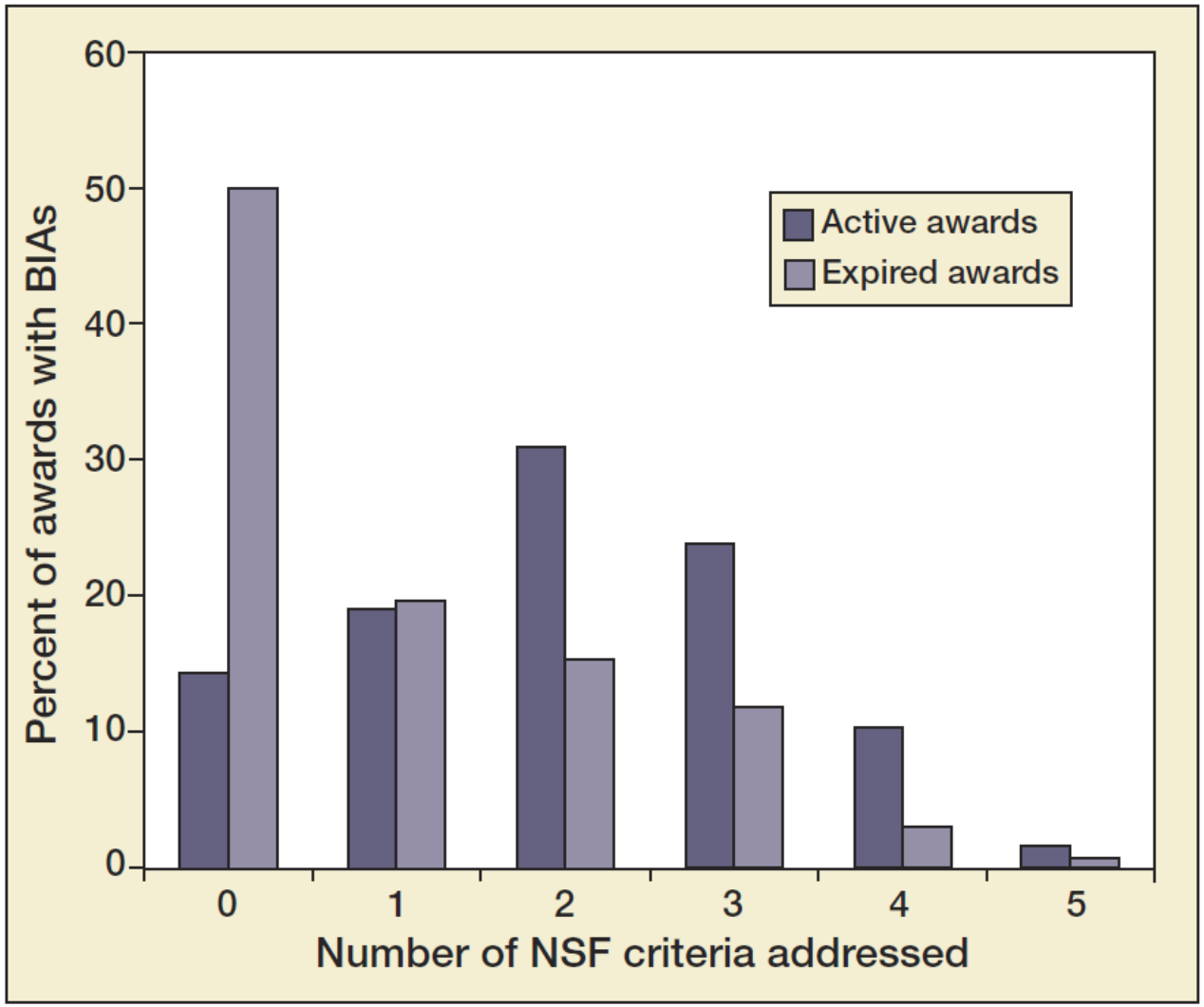

Figure 2. *Distribution of the percentage of total active and expired awards that were categorized as meeting 0 to 5 of the NSF criteria.*

Nadkarni and Stasch's (2013) Recommendations

On the basis of this study, we suggest that the "best" BIA [Broader Impacts Activities] might include one or more of the following aims:

(1) reach much broader audiences than students alone;

(2) be very specific with respect to target audience;

(3) be genuinely collaborative with social scientists, outreach specialists, and users of content;

(4) involve the public in "real" science; and

(5) explicitly engage underrepresented groups.

Other advice (from me)

- Actively harness existing infrastructure (e.g., community website/projects: iNaturalist,, GenBank, BOLD)
- Look to add components that are active (versus passive) learning or engagement
- Consider new or *innovative* broader impacts and tap into novel interest groups, etc.
- Demonstrated or *pre-existing commitment* of activity is more credible than promises
- *Find partners* whose primary mission is education, engagement, and outreach
- Fold in assessment measures
- Don’t go overboard…good outreach is time intensive and expensive
- Fund it

The Evolving Culture of Science Engagement is an initiative to explore how the public connects to science, how science connects to the public, and how it's all changing in the 21st century. What are the new strategies, sensibilities, and settings of science communication and education?
http://www.cultureofscienceengagement.net/

Science Engagement

Download the report: http://www.cultureofscienceengagement.net/2013convening/report

Eight Dimensions of Change

Among other topics, the workshop explored eight dimensions of change—six chosen in advance by the organizers and two nominated by the participants:

1. **Story(telling):** A resurgence of personal storytelling in contemporary culture has helped science communicators humanize what might otherwise be bloodless scientific ideas; telling stories also shifts some of the focus from the *objects* of science (phenomena, facts, etc.) to the *subjects*, the people doing science and their personalities, drives, doubts, etc.

2. **Humor**: Although it carries risks (e.g., of trivialization or exclusion), humor can help make science welcome and relevant in other contexts; it can link relatively obscure material to familiar ideas, help put scientists and non-scientists on a level playing field, and foster a sense of community and connection.

3. **Mystery and the unknown:** Focusing on what we can't yet grasp taps into a basic human attraction to the unknown, makes certain subjects "grabby" to non-experts, and conveys the idea that science isn't finished yet—that it's a living enterprise with room for others to participate.

4. **Informality/science as part of everyday life:** A sense of casualness, playfulness, and spontaneity are evident in many of today's science engagement programs, helping audiences feel more comfortable when encountering science and lowering the barriers between science and other areas of contemporary life.

5. **Artistic expression:** The interest of visual and performing artists in exploring science as both subject-matter and method seems to be increasing, as does the range of collaborations between artists and scientists in diverse settings; both can help foster perceptions that science is a creative, human way of exploring the world.

6. **Participatory engagement:** The rising popularity of dialogue events, citizen science projects, and other forms of public participation in scientific research and policy-making is one of the most noteworthy shifts in the culture of science engagement; it alters the definition of authority and lets non-experts identify with science.

7. **Emotion:** An emotional connection can be a powerful "way in" to a science experience for non-experts, capturing initial attention and increasing feelings of bonding with the communicator or educator as well as the subject; but it can include negative emotions as well as positive ones, and requires a vulnerability that may be difficult for some practitioners.

8. **Power, barriers, and belonging:** Participants pointed out that the community of science engagement practitioners is not sufficiently diverse, nor are its audiences; to move past this longstanding problem, the field may need to focus less on science literacy and learning goals and more on engaging communities on their own terms, for their own purposes.

Participants also discussed several themes that emerged from those initial discussions, including learning; civic engagement; affiliation and community; the difference between a desire to inspire or otherwise affect audiences and a desire to express or create something on the part of the science communicator; and how the shared goal of mainstreaming science can be accomplished without losing the "edge" of creativity and cultural innovation that marks so much of today's practice.

Great examples

- Radio lab
- Filmmaking/Screen Casts and YouTube shorts and channels (e.g., Emily Graslie's Brain Scoop) ("Best of" link)
- Ted Radio Hour
- Blogs
- Social media
- Contact Margaret Rubega