

To Advocate or Not Is No Longer the Question: Paths to Enhance Scientific Engagement

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In an era defined by rapid communication, alternative facts, and the propagation of misinformation, the need for scientists to engage directly in public policy and education has never been greater (Pittinsky 2015). The ecological community has debated for decades whether scientists should publicly communicate their support for particular policy positions (Pielke 2007). However, fears that such involvement will undermine public perceptions of scientific objectivity appear to be overblown (Kotcher et al. 2017). Academic institutions have traditionally undervalued such engagement, and calls for redirecting science to serve society and the planet are increasing (Keeler et al. 2017).

Based on our belief that scientific understanding is fundamental to public discourse and policy debates, the question is how ecological scientists can engage most effectively while avoiding reputational costs regarding objectivity (perceived or otherwise). In the hope of broadening scientific participation in ecology and conservation, we highlight three general avenues by which ecologists can apply their training and skills to engage in the public and policy arena, namely by (1) broadening research impacts, (2) enhancing outreach to nontraditional audiences, and (3) participating directly in the policy process. By creating opportunities and incentives, universities and funding entities can facilitate greater public outreach and policy engagement by scientists. We provide suggestions on institutional changes that will help accelerate such activities.

A portfolio of approaches

With a history of addressing societal needs, the applied sciences provide a solid foundation for broadening scientific impacts. The co-production of scientific knowledge with practitioner groups, the interpretation of findings for nonspecialists, and collaboration to incorporate scientific insights into management plans and actions have long been staples of applied scientists. The recent explosion of new communication tools and rapidly expanding social networks provide opportunities to apply and magnify these approaches.

Broadening the impact of science requires that scientists focus on pressing societal issues and clearly present the utility of their findings beyond academia. Multidisciplinary teams enable the scientific community to tackle contemporary, complex socio-ecological problems and facilitate uptake in diverse arenas. In addition, diversifying the skills of individual scientists with relevant training in science-based policy initiatives, the links between regulatory laws and science, and cross-disciplinary communications and negotiations, while traditionally outside the scope of scientific training, are important for facilitating interdisciplinary approaches and the meaningful application of research results (Blickley et al. 2013). Scientists can apply their skills in information assimilation, consolidation, and analysis to support organizations engaged in policy formulation and decision-making. Active participation in such groups can serve to increase both the group's efficacy and the policy skills of the

scientist while catalyzing efforts to address emerging challenges.

Enhancing outreach to the broader public starts with leveraging the diverse avenues for popular communication (e.g., blogs, social media, and podcasts) to disseminate concise and accessible summaries of scientific knowledge (Kuehne and Olden 2015). Given the key role of the popular press in bringing science to the public's attention, scientific training for journalists and training scientists to communicate with journalists is critical for developing compelling stories that can elevate research outputs. Sharing the wonder of scientific discovery, as well as the vast diversity of life and the threats to its persistence, provides narratives that inspire and change perceptions through popular media outlets (e.g., movies, books, and plays). More fundamentally, involving and educating youth in the scientific process through captivating activities are fundamental to creating an educated and scientifically literate public (e.g. Project Learning Tree; www.plt.org). Given the educational mandate for academic faculty, contributing to primary-education curricula and teacher training provides an accessible and impactful approach to public engagement, but one with limited support by universities.

Being highly educated and capable citizens, scientists should not be reticent to engage directly with the political process. For example, sharing expertise with local interest groups (private sector and nongovernmental organization) and offering services to public representatives and decision-making bodies at all levels of

government can help ensure informed debate and policy actions. This can be initiated by building relationships with relevant organizations or politicians. Scientists can volunteer through professional organizations to review, develop, and release policy statements; organize members to raise and frame emergent issues; collate information for technical briefings; and track and respond to policy developments. Finally, the most direct engagement is to run for a political office, a path rarely taken by scientists, as is reflected by the dearth of scientifically trained politicians. However, involvement in policy creation and implementation through holding office, serving in administrations, or simply volunteering for local government agencies is among the most direct lines to influence science policy decisions.

Moving forward

Scientific institutions and funding agencies are in a unique position to accelerate scientific engagement. We encourage academic institutions to directly support public outreach and engagement (e.g., substantially increase investment in science-communication training and staff and expand cooperative extension programs to address contemporary policy challenges) and to develop the means to explicitly evaluate and reward such efforts by their faculty (Bazzaz et al. 1998). The definition of the service component stipulated in job descriptions of most academic scientists should be expanded to encompass direct public outreach and policy engagement (Arlettaz et al. 2010). This approach will catalyze formal consideration of these practices in the hiring, promotion, and tenure processes, encouraging academic scientists to engage.

The National Science Foundation and other funding sources can enhance public participation by developing programs specifically targeting emerging environmental challenges, including developing a scientifically literate and informed society. Advances have been made to encourage engagement through increasing the valuation of broader impacts of proposed research and through the creation of funding programs focused on K–12 and informal education, but explicit requirements for public engagement and dissemination—and the evaluation of those efforts—across all programs can enhance this focus. In contrast, many US federal agencies officially prohibit their scientists from offering explicit input on management or conservation recommendations, which limits public access to science and education opportunities. Enabling engagement can help amplify the impact of federally funded research.

It is time to move beyond debates regarding the role of scientists in the public-policy arena. While we debate, land conversion continues, action on climate change is delayed, and loss of biological diversity is accelerating. It is time for ecological scientists to mobilize and leverage the power of their training to protect and restore the planet's biological diversity. The metric of success in this endeavor is for native species to be sufficiently abundant and widely distributed to fulfill their functional role in ecological systems.

We emphasize the importance of ensuring the highest scientific standards (i.e., knowledge based on strong inference and resistant to falsification) and honest assessments of certainty when engaging in public and policy debates. Sound analysis and reasoned conclusions are the fundamental aspects of science engagement, and

the bar needs to be set very high. Analogous to the Hippocratic oath that formalizes the responsibility of medical doctors to administer to the health needs of the public, ecological scientists must recognize and embrace their moral obligation to apply their knowledge to the well-being of all life on our planet.

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doi:10.1093/biosci/bix134