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Growing Pains for Ecology in the Twenty-First Century

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Ecology must modernize itself in order to remain relevant in a rapidly shifting landscape. This message was resoundingly clear at a session entitled "Growing Pains: Taking Ecology into the 21st Century," held at the annual meeting of the Ecological Society of America last year. A standing-room-only crowd of approximately 500 scientists filled the room; the conference Twitter feed was dominated by reports from the session and questions from the long line of interested attendees, which spilled out into the hallway. The message taken away by the attendees could have been dim and lamenting; instead, it was charged with optimism.

Four specific areas of tension emerged across the speakers' diverse topics: (1) the science ghetto—our working relationships must be expanded to include nontraditional partners, from corporations to citizen scientists; (2) sterile communications—a diversity of communication skills is critical; (3) a homogenous workforce—the workforce should reflect the diversity of society; and (4) orphan data—data must be treated as a first-class product of research.

Inspired by the session's thoughtful presentations, we propose a more general theme: These four issues all point to the need to dramatically reduce the insularity of our culture, which has historically been dominated by academia. Anachronistic incentive structures and practices that do not sufficiently engage other disciplines and sectors of society are hurting our capacity to maintain relevance in a fast-moving, multicultural, and highly connected society.

Expanding partnerships

Our relevance as a discipline outside of the ivory tower depends on our capacity as a professional scientific community to work well with ecology's full suite of stakeholders (Chapin et al. 2011), including citizen scientists, industry, government, and nongovernmental organizations. Compared with disciplines such as engineering, geology, or biomedical research, for example, ecology presently shows little inclination to integrate with its stakeholders. Ecologists often assert that their questions should be driven by their academic network's creative trajectory, and in this framework, specific conservation, resource management, or other societal needs often take a back seat. Meanwhile, many sectors of society are asking for more ecological knowledge that is both predictive and specific, and they are making decisions on the basis of models that require actionable ecological knowledge. Here lies a fundamental question for the ecological community: Who should provide that knowledge? Parameter estimates, confidence estimates, and potential trajectories of ecological systems are all increasingly used in models that drive a wide range of evidence-based decision processes; ecologists should take a leading role in constructing, assessing, and validating these models.

This is not an easy process for many academics. There are few obvious rewards for getting involved in on-the-ground management and policy issues, and many scientists are not at all comfortable weighing in on an issue early, before they feel that the evidence is conclusive. Unfortunately, that is exactly the time when expert advice is most crucial. Ecologists who are waiting for "conclusive" evidence before getting involved should recognize that there are always others willing to offer advice, and decisions will be made with or without the most knowledgeable people at the table. This is true for governments and for large for-profit corporations, which speaker Peter Kareiva provocatively called "keystone species" in the global ecosystem (Kareiva and Marvier 2012). Novel emerging partnerships that bring together academics and a spectrum of environmental stakeholders, such as the Natural Capital Project (*www.naturalcapitalproject.org*), will not only solve real-world problems but can also help provide guidance in the formulation of institutional structures that allow us to confront and transcend the cultural and epistemological differences presently confounding cross-sector partnerships.

A relatively new concept on the scientific landscape that ecologists (and many other professional scientists) are struggling to understand is *citizen science*, now often called *public participation in scientific research*. Public participation in scientific research has the potential to produce data that address scientific questions at scales much larger than can be achieved by individual investigators. However, an outdated attitude persists among many professional scientists that amateurs are incapable of producing high-quality data that can be used in scientific work. Robust data structures and technological data platforms can facilitate public contributions and streamline the quality control and verification process for data collected by amateurs. In addition, the proliferation of more flexible analyses and confidence assessments now allows scientists to efficiently use these data to address major questions. Society is increasingly seeing the benefits of crowdsourcing many tasks across sectors; science cannot afford to turn its back on this powerful opportunity to better understand our rapidly changing environment.

Improving communication

The impact of science beyond the ivory tower depends on communication skills, including the use of the widening array of media and communication tools. Collectively, we require a scientific workforce that is not only capable of doing good science but also willing to expend energy and creativity in skilled communication—communication that is jargon free, concise, compelling, and oriented toward dialogue rather than monologue (e.g., Olson 2009). However, many ecologists still avoid the press, and few have invested sufficiently in the new media that are increasingly setting the news cycle. Blogs such as *Dynamic Ecology* (*http://dynamicecology.wordpress.com*) are becoming increasingly popular go-to places for current opinion on ecological topics, but most ecologists appear to have little experience with blogging, Twitter, or other new media.

In many ways, those scientists who have embraced new media are volunteering to become the treatment group in a societywide experiment exploring emerging ways of doing and communicating science (e.g., Wheat et al. 2013), and they often use the tools in different ways. Some use new media to provide a public face for their scientific research; others emphasize the importance of new media for building strong networks that facilitate rapid, long-distance communication among like-minded scientists. These new-media pioneers in ecology tend to be strong proponents of many aspects of open science, where ideas, code, data, and papers in all stages of preparation are more accessible and more transparent, and the process of science has a more explicit focus on the collaborative pursuit of knowledge.

Demographics

A large part of effective communication is authenticity. Building an authentic voice for ecology as a whole requires us to take a hard look at who we are and whom we want to represent. Although the gender balance and ethnic diversity of ecology has improved in recent decades, the changes have been radically outpaced by demographic changes in the United States (ESA 2006). At the ESA session, presenter Nyeema Harris captivated the audience with her nearly slide-free presentation on the challenge and necessity of improving diversity in ecology. She invited the audience to look around the packed room and to take in the almost homogenous sea of white faces. At the close of her presentation, she displayed a single slide with the projected demographics of the United States in 2050: Caucasians are predicted to be a minority. This reality provided powerful punctuation for her message. Our relevance is dependent on our capacity to represent the views of our increasingly multicultural society. The process of diversifying our field requires concerted effort mentoring the next generation, and although many ecologists understand the need to broaden participation, we again lack the incentive structures necessary to create rapid change in our field. Like other disciplines dominated by academia, we measure success using a very narrow set of metrics, which limits our capacity for change.

Emphasizing data

Finally, it is time for ecologists to step firmly into the information age and to treat data as real products of research by sharing and managing data for the long term. In a recent survey, only 8% of ecological projects produced non-genetic data that could be found online (Hampton et al. 2013). This finding shocked but did not necessarily surprise the ESA audience; in our guts, we know that ecologists are still using data only as a precursor to publication, and it is often left on our computers to grow obsolete once we have published. This behavior is not compatible with the increasing focus of society on the rising power of big data and data-intensive science.

Many ecologists think that big data has nothing to do with them; they do not consider that in the aggregate, ecology, itself, has big data—a massive number of relatively small, extremely heterogeneous, and high-quality data sets. These scattered data capture many of the details of natural history and ecological processes that are not represented in the higher-volume data streams that are more commonly included in big data discussions. The "three Vs" of big data are volume, velocity, and variety; together, there is no question that ecology is a poster child for the variety that presents both challenge and opportunity in data-intensive science. However, if we continue to behave as if we are not on this data landscape, we can be certain that we will be ignored and will continue to fall behind.

We have a lot of work ahead of us to build a predictive ecology. We must provide evidence-based solutions that are both granular enough to work within specific, place-based problems and robust enough to hold up in a future full of contingencies and deep uncertainty; it will not come easy. The task is expensive and expansive, and it is as important to society as is medicine or engineering. It is crucial that we articulate the importance of this predictive, tool-oriented, big-data brand of ecology. Change is beginning within academic institutions but is also likely to proceed more rapidly through the increasingly prominent and comparatively nimble cross-sector institutions that nurture novel partnerships.

The speakers in the session were JJT, SEH, Randy Olson, Peter Kareiva, Mary Ruckelshaus, F. Stuart Chapin III, Jarrett Byrnes, Nyeema Harris, Faith Kearns, and Alexandra Swanson. CAS moderated the session.

References cited

Chapin FS III, et al. 2011. Earth stewardship: Science for action to sustain the human–Earth system. Ecosphere 2 (art. 89). doi:10.1890/ES11-00166.1

[ESA] Ecological Society of America. 2006. Profile of Ecologists: Results of a Survey of the Membership of the Ecological Society of America. ESA, Education and Human Resources Committee. (13 November 2012; *www.esa.org/education_diversity/pdfDocs/profilesReport2006.pdf*)

Hampton SE, Strasser CA, Tewksbury JJ, Gram WK, Budden AE, Batcheller AL, Duke CS, Porter JH. 2013. Big data and the future for ecology. Frontiers in Ecology and the Environment. Forthcoming.

Kareiva P, Marvier M. 2012. What is conservation science? BioScience 62: 962–969.

Olson R. 2009. Don't Be Such a Scientist: Talking Substance in an Age of Style. Island Press.

Wheat RE, Wang Y, Byrnes JE, Ranganathan J. 2013. Raising money for scientific research through crowdfunding. Trends in Ecology and Evolution. Forthcoming.

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