

## The Research–Service Balance and Career Trajectories

The field of ecology encompasses activities that range from the highly competitive and in many cases solitary efforts of individual ecologists pursuing their curiosity about the workings of ecological systems to the highly cooperative and in many cases totally altruistic contributions that most ecologists make towards the good of the local, national and international community of ecologists. While in the long term, the two kinds of activities are essentially the same for ecology, their effects on individual careers are drastically different. Most ecologists are engaged in the full range of these activities, and in many cases there is a familiar struggle to achieve a balance between the pursuit of individual goals and ambitions and contributions to the community. The ubiquity of this struggle, and the great potential the balance between science and service has to influence career trajectories makes this an important topic for discussion. (By service, we mean the full range of activities that do not contribute directly to an individual's scientific advancement. This includes service to institutions, societies, journals, funding agencies, and local, national, and international programs.) Furthermore, the huge effect that senior ecologists can have on the professional development of their younger colleagues makes it crucial that, as a field, ecology and ecologists try to understand the trade-offs be-

tween research and service.

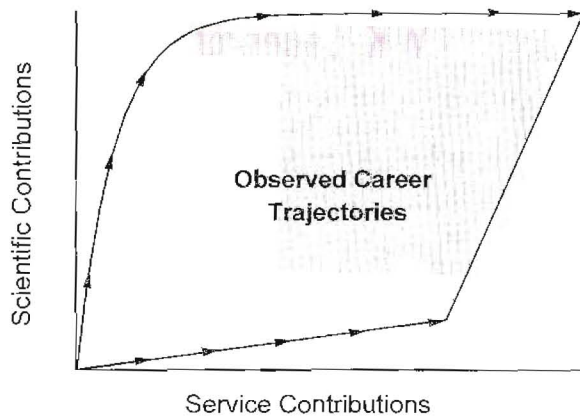
The impetus for our discussions and this paper has been the observation that we, and perhaps most of our colleagues, are driven by a strong desire to serve the public and the scientific community. Further, there are enormous numbers and types of opportunities for such service. Our service activities, because they consume a large proportion of energy and time, come at some cost to our scientific productivity. Although the trade-off may seem relatively simple, we sense that there are interactions that are neither simple nor clear, influencing career development and long-term contributions to science and society.

Because we have sensed a very strong relationship in our own careers between service and other areas of performance, we conducted a set of interviews to assess career strategies. This topic has been previously explored mostly with relation to the detrimental effects of service on scientific productivity for women and minorities, who because they are present in small numbers are often provided disproportionately numerous service opportunities. Our hypothesis about the relationship between service and research productivity is that the balance one strikes at an early career stage has a large influence on the balances that are possible later in one's career. Specifically, we hypothesize that individuals with the highest scientific contributions ultimately have the greatest impact on both policy and the direction of the scientific field, because they have achieved the highest credentials.

To evaluate our hypotheses, we

interviewed many ecologists, and had numerous informal interactions with others to develop a model of the career relationships between service and scientific contributions. Interviews included high-achieving, senior ecologists as well as up-and-coming scientists, and those of many different priorities. The questions asked were about the time commitment to service and research throughout careers, about how ecologists made decisions on how much and what kind of service to engage in, how these influenced tenure and promotion, and about how those decisions changed through the course of their careers. We did not conduct a quantitative analysis, mostly because commitments to service throughout careers are difficult to assess quantitatively. In addition, we focused on service outside of home institutions.

The results of the interviews and other observations led us to propose a two-dimensional phase-space model with two bounding career trajectories forming upper and lower bounds on the observed and perhaps possible strategies (Fig. 1). Each point in the plane represents a unique combination of commitment to service and scientific productivity at a particular point in a career. The trajectory that forms the upper bound represents the career path of many highly successful ecologists. Those that we interviewed showed a very clear pattern of an early, strong emphasis on research. During the first few decades of their careers, all of these scientists focused the bulk of their effort on scientific productivity; all stated that they had invested only a small amount of time



**Fig. 1.** Model of career trajectories comparing the impact of scientific and service contributions.

in service during their early career, and much less than they observe many young scientists investing now. Service opportunities were fewer then for these individuals, but in addition, several stated that they made explicit choices to control their service investments. Service activities that were offered as choices, such as opportunities to sit on panels, editorial boards, and national and international committees were minimized to some extent. Several of these individuals made very careful analyses of their fair share of service, relative to what they cost the community for peer-reviews. A strong initial focus on research allows one to rapidly increase scientific productivity, which can then feed back positively on funding success, which leads to greater productivity. Later in their careers, these scientists are then in a powerful position to contribute to the scientific and public policy communities and become true leaders in the direction of science and its influence on public policy. In some cases it is possible for them also to maintain their research programs because of the infrastructure they have built that maintains a high rate of productivity. This upper bounding trajectory represents the maximum amount of individual control on career development. These individuals make clear and conscious choices about the direction of their careers.

The trajectory that forms the lower bound in our model represents scientists who contribute a great deal to service activities early in their ca-

reer, and who never achieve a high level of scientific productivity. While this career trajectory can be observed for many young ecologists, there are two forces that result in women and minorities being particularly susceptible to this trajectory. First, women and minorities are afforded many more opportunities for service, much earlier in their careers than are white males. Our personal experience and interviews suggest that young women are offered membership on national and international panels and committees at a rate that far exceeds any of their male colleagues, and in many cases the average academic age of the other members of such panels and committees exceeds those of the women by at least a decade. Notably, these opportunities result from the laudable goal of increasing the diversity of committee membership and leadership within our discipline.

Our observations suggest that the career trajectories of most ecologists fall somewhere in between these two extremes. This occurs because most ecologists balance science and service from an early career stage, rather than focusing a very high proportion of time on either. For many of the persons we spoke with who identify their own careers as lying between the extreme trajectories, a small amount of early career service had a very positive influence on their research programs, by exposing their work to peers and funding agencies, meeting and interacting with stimulating colleagues, and familiarizing them with the peer review process.

Implicit in our model is the suggestion that there are consequences of a early high level of service for potential cumulative scientific contributions. One of the key assumptions of the model is that after the first decade or so of a scientist's career, the trajectory has been essentially set. At this stage, a high-achieving scientist may begin to contribute more to service, but because of the cumulative effect of scientific productivity, they do not easily lose their place on the science contributions axis. Most scientists who initially devoted a large amount of time to service are likely to find that after a certain stage, it is difficult to move back into the rapid growth phase for scientific contributions. Particularly for those scientists near the lower bounding trajectory, the positive feedback between productivity and funding is extremely difficult to break into; a high level of scientific productivity is needed for continuous funding, and continuity of funding is needed for high productivity rates. It is not impossible, but rather unlikely, for trajectories to change.

An important prediction of the model is that the potential maximum service contribution possible for each of the strategies is different (Fig. 1). The most significant contributions to scientific and public policy cannot be made by persons other than those with extremely high scientific credentials. Although senior persons who follow a trajectory near the lower bound may have invested much more time over their careers in service, individuals who have followed trajectories close to the upper bound are predicted to be much more influential.

While no value judgment is intended about any particular trajectory in our model, understanding the trade-offs and their consequences for long-term career development is very important. Service as we have defined it is an important component of every ecologist's responsibilities. It is crucial to consider the load one places on the community in terms of reviewing; for every paper or proposal, numerous reviews are necessary, and we should each contribute at least that level of service, through-

out our careers. In addition to that normally expected level of service, our assessment is that there are many more service opportunities available to ecologists now than there were a decade or two ago, and a great deal of pressure from within the ecological community for ecologists to become involved. Consequently, current career trajectories for many young ecologists are quite different from those of the senior members of our discipline. The advent of the awareness of global change and other issues with a large ecological component within the scientific community as well as in the public policy arena have created numerous important outlets for ecology. For many ecologists, contributing to committees responsible for developing scientific consensus about environmental issues provides an important sense of fulfillment. However, the standards for tenure and promotion at most universities reflect a traditionally large emphasis on research relative to service; many of the young ecologists with whom we spoke were frustrated by a lack of appreciation by their university for national and international service, and the costs to their research productivity. While our objective is not to discourage such participation by young ecologists, we think it is crucial that everyone involved have as clear an idea as possible of the trade-offs involved.

Our interviews and analysis suggest that a large commitment of time to such services, particularly early in

a career, has a very high probability of decreasing one's potential career-long scientific contribution. Furthermore, it may limit the ultimate level at which one can contribute to service activities. For many women, minorities, scientists from developing countries, and those working in "fashionable" fields, the multitude of opportunities appear to be extremely flattering, but one needs to keep in mind that accepting a very large number of them has a high probability of constraining one's ability to achieve on the scientific axis. The key lesson is that every young scientist should decide where she or he would like to be at the end of her or his career, and continue to consider the fundamental rules about achieving that level of contribution on both axes. A large early commitment to service likely constrains career-long scientific contributions, but a large early commitment to science does not appear to constrain career-long service contributions. It is also important to evaluate ambitions relative to the reward structure, since at present, most university tenure and promotion systems place a much higher value on scientific than on service contributions.

Finally, administrators, mentors, program officers at funding agencies, and leaders of international and national programs need to pay special attention to these trade-offs as they advise young scientists or invite them to participate in national or international scientific service, even with the laudable goal of increasing diversity

for the community. Career-long contributions to science and service are not necessarily enhanced by a large amount of early career service.

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