Where will all the PhDs go?

In a recent event entitled '50 years of ocean discovery', National Science Foundation- (NSF) funded researchers, graduate students and administrators commemorated the history of NSF funding for US oceanographic research and heralded past achievements by NSF-funded programs. This event celebrated 50 years of oceanographic breakthroughs, from the discovery of mid-ocean spreading centers and hydrothermal vent communities to recent experimental testing of the Iron Hypothesis. But as well as the history lessons, there were lively discussions of how NSF should fund future oceanographic research. The scope of the debates was not limited to the subjects of oceanography or federal sources of research funding. Instead, I often found myself engaged in discussions that challenged the current rationale and guidelines for educating and funding scientists in general.

All recognize that current resources will not meet the employment needs of the ever-increasing population of ecology and evolutionary biology (E&E) PhDs. As throughout the past 50 years, a large number of PhDs are vying for a limited supply of jobs in academia and research. The problem is well described by the dynamics of natural populations. Universities produce new PhDs at prodigious rates, resulting in high population recruitment. For example, US universities awarded 245 new ecology doctorates in 1996, up from 158 in 1987 (Ref. 1). However, resources available to the multitude of new PhDs are very limited. Most faculty do not retire at 55. Faculty residence times are long and the age of faculty at retirement steadily increases[2]. The subsequent decrease in faculty appointment rates[2] is compounded by the fact that many E&E departments are just able to replace outgoing faculty at a one to one ratio. Furthermore, most funding agencies are barely keeping up with inflation[3] and, because many prominent researchers enjoy long histories of continued funding success, the low turnover leaves little funding opportunity for the growing population of young E&E PhDs. Thus, with increasing growth, decreasing mortality and limited resources, the population of E&E PhDs is well past the carrying capacity.

So, how do we expect to meet the employment needs of new E&E PhDs? Two obvious solutions come to mind: (1) decrease the number of new doctorates to be awarded each year; and (2) free up existing resources. Certainly, such adjustments might already be under way. Given increased competition for limited E&E funding, departments that rely on external sources for student support will probably see decreased opportunities available for graduate admissions. In addition, despite the recent abandonment of mandatory faculty retirement, many universities are currently re-evaluating the use of the tenure system and are proposing alternatives[4]. Both of these adjustments, however, have long lags before their benefits will be felt by the surplus of PhDs.

Instead, our best hope for enhancing employment opportunities may be to look for jobs outside academia and research. Such an initiative, however, must overcome two major obstacles. First, we must change our perception of what constitutes an appropriate career for an E&E PhD. Unfortunately, advisors generally encourage their students to seek faculty positions or initiate strong federally funded research programs in their own image. In some cases, they even disparage alternative career options and, as a result, few jobs outside academia and research are deemed 'acceptable' for E&E PhDs. As an extreme example, Safina[5] recently quoted one of his dissertation committee members as stating, 'conservation is for people who aren't smart enough to get PhDs.' Subsequently, as we attempt to channel new PhDs into academia and research, many are forced into an endless routine of bouncing among postdoctoral appointments without any real hope of reaching the promised land[6,7].

Second, and much more troubling, job opportunities are virtually nonexistent for E&E PhDs outside academia and research. In 1996, industry hired 27.8% of physics and 30.1% of chemistry doctorates compared with only 5.5% for biology (predominantly molecular biologists employed in biotechnology)[6]. The low percentage of E&E PhDs that chose industrial employment is undoubtedly because the disciplines of ecology and evolutionary biology produce few resources of direct economic value and marketability.

Ultimately, we must address this problem at two levels. First, we should dispense with the elitist attitude that nontraditional jobs are not worthy of our degrees and, second, we should try to cultivate a greater demand for E&E PhDs in nontraditional job markets. The latter is a much more difficult task. An important first step would be the formation of NSF panels and initiatives that specifically discuss innovative ways to market ecologists and evolutionary biologists for nonacademic and research jobs. Such discussions would require creative input from ecologists, evolutionary biologists and various representatives of societal interests (e.g. local politicians, entrepreneurs, resource managers and land developers). We need to convince society of the potential economic benefits of incorporating sound E&E principles into public policy and management decisions, not just habitat and species conservation. Given impending global environmental crises and increased financial penalties against environmentally hazardous human activities, contributions from experienced, well educated and impartial E&E PhDs will probably become very valuable to the daily operations of manufacturing, urban planning and resource-use efforts.

Thus, the benefits of developing 'quality' nontraditional jobs for E&E PhDs will be twofold. First, additional career choices will be provided for a generation of ecologists and evolutionary biologists whose academic and research opportunities are being severely impacted by the current employment crunch. And, second, much-needed knowledge and philosophies for sustainable interactions among humans and nature, provided by E&E PhDs, will be integrated into future societal policies and decision making.

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