On Identifying Rising Stars in Ecology

Laurance and colleagues (2013) argue that the primary predictor of scientists' productivity in the decade following the completion of their doctorate is the number of papers they published prior to completing their degree. Unfortunately, shortcomings in Laurance and colleagues' (2013) data collection and analyses call into question the generality of this relationship. First, it appears that they failed to control—statistically or in their sampling—for the type of institution where their focal researchers were based. Given differences in obligations and resources, scientists are likely to have very different relationships between pre- and postdoctoral productivity if they are based at large research universities, smaller colleges focused on undergraduates, or government research institutes. Second, they neglected to correct for the fact that not all researchers, even those at the same institution, devote the same proportion of their time to research. For example, at the University of Florida (which is categorized as a research university with very high levels of research actvity by the Carnegie Foundation 2013), the proportion of one's full-time equivalent (FTE) devoted to research can vary from 10% to 100%, with the remainder dedicated to teaching, extension, service, or administration. Laurance and colleagues (2013) should have used productivity per research FTE, rather than absolute productivity, as the response variable in their analyses. Finally, Laurance and colleagues (2013) appear to have pooled researchers from different countries in their analyses without including national identity as a factor in their model. The countries alluded to in their methods have vastly different academic cultures, training philosophies, resources, expectations, and incentives for publication. Without explicitly considering the influence of national identity—or, at the very least, reporting the number of researchers sampled from each country—it is difficult to determine whether their results are widely applicable or driven by countries overrepresented in their data set.

The generality of Laurance and colleagues' (2013) results ultimately depends on two factors: the composition of the study population and their analyses of its productivity. Without knowing details about the former, including in what countries the scientists were based, the types of institutions employing them, and the structure of their positions, it is challenging to assess the appropriateness of the latter. This is lamentable, especially given the implications of their suggestion to use early productivity as a means of identifying "rising stars" in biology.

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Identifying Rising Stars in Biology: A Response to Bruna

We assessed Bruna's (doi:10.1093/biosci/biu003) assertions and found no evidence that the approaches he advocates would have appreciably improved our analysis or altered our conclusions.

Bruna asserts that we should have incorporated the extent to which an academic biologist's employing institution was research intensive and the proportion of his or her time available for research. However, this suggestion is problematic. Both aspects are probably at least as much *consequences* as they are *causes* of high productivity (a *circulus in probando* logical fallacy). This is because productive scientists will clearly be better than unproductive ones at securing positions at research-intensive institutions and at devoting more time to research. Furthermore, quantifying these two variables would be difficult, because many academics change institutions or work patterns during their careers. Sourcing such information for a large sample of researchers would have been highly time consuming and antithetical to the goal of our study: to assess the relative importance of simply derived variables for explaining variation in researcher productivity.

In terms of incorporating the country of each researcher in our models as a random effect, we initially considered this tactic but discarded it, for two reasons. First, we had inadequate within-factor replication, with many countries in our sample represented by just one or a few researchers. Second, researchers as a group are remarkably mobile. If one wanted to include *country* as a random effect, would one use the country (or countries) where a researcher was born and raised, the country where he or she received his or her PhD, or the country (or countries) where he or she was subsequently employed?

We did, nonetheless, repeat our analyses with each researcher's native-born continent as a random variable, because, at this coarse level, we did have adequate replication. This increased the amount of variance explained by our models (see *http://is.gd/PEc76Q*) but did not alter our main conclusions—that the number of papers researchers had published at the time of PhD conferral was the most important predictor of their long-term productivity and that the ranking of the university from which they received their PhD was the least important predictor.

Empirical analyses such as ours can always be expanded or made more exhaustive by including more potential predictors. We favored simplicity over complexity. Many seem to like our approach: Our article has been

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recommended on *Faculty of 1000* (*http://f1000.com/prime/718146531*), and a popular synopsis that we penned (*http://is.gd/Hoz6nt*) has had over 15,000 views so far.

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What Are We Trying to Conserve?

In addressing "What is Conservation Science?" Kareiva and Marvier (2012) advocated increasingly pragmatic and socially acceptable tactics, incorporating human well-being as necessary to ensure conservation success. In response, Noss and colleagues (2013) argued that unlimited population growth and unregulated human development are incompatible with the preservation of natural ecosystems and indicated that economic gain in the pursuit of human well-being lies at the heart of biodiversity loss. The resulting debate is focused on two opposing philosophies: collaboration with corporations and work toward minimizing their detrimental activities (Kareiva and Marier 2013) and opposition of corporate development and acceptance of limits to growth (Noss et al. 2013). In our view, a debate about mechanisms of conservation should be preceded by addressing the more fundamental question, "What are we trying to conserve?"

Because the goals of conservation are often to reduce biodiversity loss, to improve biodiversity status, or to increase the abundance of a particular species, success tends to be measured quantitatively, regardless of the strategy used to achieve the goal. Conservation strategies range from wilderness preservation to targeted, highly interventionist species management. Strategies such as wilderness protection and securing connectivity between populations inherently protect the natural behavioral, ecological, and evolutionary processes that drive the selection of biodiversity and the abiotic processes that shape the landscape, but quantifying these may be difficult. Conversely, strategies such as translocation, culling, supplementary feeding, and habitat modification are employed to achieve and maintain a predefined optimum that can be quantified without necessarily maintaining natural processes.

In human-modified landscapes, the future of many endangered species will probably depend on intervention: Conservationists control plants and herbivores to protect habitats, cull generalists to protect specialists, and cull predators to protect prey. Where translocation is used to regulate demographics and genetics, populations do not have to be ecologically viable or naturally connected and may be fenced in to minimize conflict with humans. Selection pressures in such intensively managed landscapes are increasingly imposed by humans, limiting the potential of some species to adapt naturally to a changing environment. In other cases, species inhabiting human-modified landscapes have adapted to coexist with people. Further development now threatens these landscapes, which may lead, ironically, to conservation initiatives designed to simulate historic human activities to maintain anthropogenic landscapes and the human-adapted species inhabiting them.

Where conservation requires continuous intervention, we have already lost nature in its wildest form. However, where there is a choice, we should give more value to conservation strategies that maintain natural processes rather than intensively managing human-modified or semiwild systems. We agree with Kareiva and Marvier (2012) that conservationists need to collaborate with corporations, but we have to be smart in how we manage the last pockets of nature. A pragmatic approach to conservation that incorporates human needs, as was advocated by Kareiva and Marvier (2012), may compromise on the conservation of natural processes. Because "pristine nature no longer exists," Kareiva and Marvier (2012) argued that conservation initiatives cannot ignore human activities. Surely, this should only serve to remind us that wherever the conservation of natural processes is possible, it should be valued more highly than other conservation efforts.

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