 FRESH PERSPECTIVES

Striking a balance between the literature load and walks in the woods

Martin A Nuñez* and Gregory M Crutsinger
Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, TN 37996
**(mnunez@utk.edu)*

Graduate students in ecology are busy with teaching, lab meetings, coursework, research, and having a life (however minimal) outside of the lab. While we have no choice about the amount of time we devote to some tasks (ie lab meetings are from three to four o'clock on Thursdays), prioritizing time spent mastering one's study system versus keeping up with the current literature poses a dilemma. Should we be investing our time in observation of the study subjects, or should we be catching up on reading about cutting-edge topics in our discipline's top journals? Our advisors would probably say we should do both, but there are only so many hours in the day to read papers and watch beetles, and, after a certain point, coffee is no substitute for sleep. While we do not claim to have any magic solutions, there are some tricks that can help graduate students to both stay current in new research and know their own systems.

Keeping up with what's hot (and what's not) in ecological research is beneficial when it comes to grant funding, publishing in high-profile journals, and getting into spirited debates with other students at national meetings or the local pub. But a vast amount of new research comes out daily, either in print or online, and sifting through it can be a daunting task; Web of Science reports that more than 10 000 articles were published in ecological journals in 2005 alone! Then there are the classic papers that are just as important to know as the current ones. One way of staying current with new research is to have the table of contents from each new issue of your top 5–10 journals e-mailed to you. Be sure to dedicate time every week to reading through at least the titles and abstracts of relevant papers. This will help you to find the papers most pertinent to your research and will also fill you in on topics that other researchers are pursuing.

Another way to keep on top of new literature is to subscribe to online citation alerts through Web of Science. These alerts are e-mailed weekly and list recently published papers that have cited other articles you specify. Sign up to receive citation alerts for the key papers in your field, so you can see who else cites that paper, and in what theoretical context. Also, read the weekly updates by Faculty of 1000 Biology (www.f1000biology.com), a subscription-based online program that posts reviews and recommendations for the most interesting (in the opinion of reviewers) papers being published. Finally, form networks with fellow graduate students by sharing new research papers and reviews of interest, either through organized reading groups or casually over e-mail. Networking can help everyone to catch most of the new relevant literature.

What about developing the knowledge it takes to become a specialist in a particular system? After all, testing novel questions in ecology cannot be done in every system (eg it is hard to estimate life-time fitness in bristlecone pine forests), and learning the key attributes of a system takes time. To speed up the learning process, we recommend picking a relatively well-studied system for graduate research. We are not suggesting that everyone work on *Arabidopsis* or *Drosophila*, but it's also difficult to be dropped off in the remote Amazon with some plant presses and bug nets and walk out 5 years later with a PhD in ecology. (Impressively enough, people have done just that, but we suspect that it was challenging, and not for the faint of heart or accident-prone.) A system with lots of background research can be advantageous, because the literature may provide important details about your study site that you will not have to measure, thereby freeing up time for collecting other data. For example, one of us (MAN) studies plant invasions in pine tree systems. Because these species are highly invasive and have been planted all over the world, both within and outside their native ranges, MAN has access to many papers from both the forestry and ecological literature, making pine trees an ideal system for the study of biological invasion (Richardson 2006). Well-studied systems are advantageous because they necessarily involve many experts who may be consulted for advice. For example, one of us (GMC) studies insects on goldenrod (*Solidago* spp), the focus of entire academic careers for folks like Warren "Abe" Abrahamson (Bucknell University) and Richard Root (Cornell Uni-versity), not to mention their many post-docs and students over the past decades. GMC has learned a great deal in a short amount of time by emailing, calling, and chatting with these ecological legends.

Ultimately, if it comes down to knowing your system or knowing what is trendy, always go with the former and ask the questions that drive your curiosity. This is what will get you both the degree you want and a research career you enjoy. Get out of your cramped office, away from the computer, and into the field. After all, wasn't running around outside poking things with sticks and flipping over decaying (fill-in-your-favorite-decaying-thing) the point of becoming an ecologist in the first place? You certainly didn't do it for the stipend. So, no matter how many cool papers there are to read, try to get out in the field as much as possible, especially when first starting a graduate program. Even if you end up not using the data, you will be seeking out ecological patterns and planting the seeds for future questions. While this may not guarantee immediate, high-profile publications, spending time in the field can provide a fundamental understanding of how a small portion of the world works. Maybe what you learn from poking around in your system will lead you to the answer to a trendy question, helping you to obtain that great post-doc. Well...at least we hope so.

Faculty response

Daniel Simberloff * and Nathan J Sanders
Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, TN 37996
*(tebo@utk.edu)

Nuñez and Crutsinger's admonition to keep up with the literature and tips for doing so are spot on, but we are less enthusiastic about their suggested criteria for selecting a graduate research topic.

True, literature on a well-studied species or community can obviate some data collection and preempt pursuit of unfruitful lines of research. And yet, perhaps 10 000 000 species populate the earth, existing in millions of ecosystems and communities. At most, a few thousand species and a few hundred ecosystems and communities have been studied intensively and are well understood. These constitute the empirical basis for the entire science of ecology, and a pervasive theme is their variety and idiosyncrasies, suggesting that the best (perhaps the only) way to progress is to amass an ever-expanding catalog of well-studied cases (Shrader-Frechette and McCoy 1993). Their suggestion might be the safe route, but not the one with the greatest impact. In Nuñez and Crutsinger's view, students should not work on the under-explored communities in forest canopies or the overwhelming diversity of life found in the soil, simply because we don't know enough about them yet. Taken to its extreme, this would have all ecology grad students working on *Drosophila*, *Arabidopsis*, or *Caenorhabditis elegans*.

That is not to say that dissertations that test current ecological theory can't be done on these species. Yet, of many exciting dissertations we have read, two exemplify the kinds of pay-offs one might gain by following the road less traveled. AP Moczek studied the horns of the beetle *Onthophagus taurus* (Moczek 2002). Noticing that male horn allometry in introduced populations of the US and Australia differed from that in the native Mediterranean range, he set out to learn both the proximal (developmental) and ultimate (ecological) reasons and ended up with insights on mechanisms producing innovation and diversification (often surprisingly rapidly). He built on a background of some previous work, especially the endocrine basis of horn development, but there was no extensive literature on this beetle and no guarantee that studying it would lead in so many exciting directions (cf Moczek 2005).

S Caut's research was conducted on Île Surprise, an uninhabited, barely studied 20-ha islet about 230 km from Grande-Terre of New Caledonia (Caut 2006). He sought to find out what would happen to the food web (seabirds, plants, lizards, insects, marine invertebrates) if introduced rats were eradicated. Surmounting astounding logistic challenges, he assessed rat diets and various indirect interactions with other species and found that introduced mice were also present. Modeling the food web to generate predictions, he eradicated both rats and mice and is currently observing the results. He incidentally made substantial contributions to our understanding of stable isotope analysis, plus a plethora of natural history observations that could easily support a lifetime of interesting research.

Either of these students could have chosen a safe project, but we doubt if, in each case, the work would have been as exciting or as important to ecological understanding. Both learned an enormous amount about a system that, previously, had been only marginally studied, while producing findings that enlighten many other systems.

Of course, a student can ask interesting and novel questions about well-studied systems, but, in the end, one should be driven by questions, not marketability, and by a love of organisms or processes, not hot topics.

Now, off to talk to Nuñez and Crutsinger about their dissertations…

References

Caut S. 2006. Invasions biologiques, réactions en chaîne et relations trophiques (PhD dissertation). Orsay, France: Université de Paris Sud XI.

Moczek AP. 2005. The evolution and development of novel traits, or how beetles got their horns. *BioScience* **55**: 937–51.

Moczek AP. 2002. Evolution of polyphenic development in the beetle *Onthophagus taurus* (Coleoptera, Scarabeidae) (PhD dissertation). Durham, NC: Duke University.

Richardson DM. 2006. Pinus: a model group for unlocking the secrets of alien plant invasions? *Preslia* **78**: 375–88.

Shrader-Frechette K, and McCoy ED. 1993. Method in ecology. Cambridge: Cambridge University Press.