

Book Reviews

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Descriptive taxonomy: a golden or gold-plated age?

Watson, Mark Francis, Christopher H. C. Lyal, and Colin Pendry, editors. 2015. **Descriptive Taxonomy: the foundation of biodiversity research. The Systematics Association Special Volume, 84.** Cambridge University Press, Cambridge, UK. 319 p. \$99.00 (cloth), ISBN: 978-0-52176-107-9.

Key words: barcoding; biodiversity; conservation; digitization; DNA; faunas floras; taxonomy.

Descriptive taxonomy, referred to here as “DT,” addresses how innovations in digital technology and molecular phylogenetics are changing not only how taxonomy is conducted but how taxonomic products (floras/faunas, global revisions) are disseminated and communicated to a widening group of users. The authors emphasize that efforts to transform the 250-year-old legacy of analog taxonomy have taken on new urgency in light of increasing rates of biodiversity loss and climate change impacts. If you want to know how descriptive taxonomists perceive their role in saving the world, read this book.

As a taxonomist myself (I research ants), I share many of the dreams expressed in the book. I want to live in a world where you could know the name of any plant or animal, and could learn not just its name, but what it looks like, its habits, its distribution, whether it is endangered, whether it is invasive. Ideally, I would be able to do this without visiting a museum or library, and harness this knowledge to help protect habitats, monitor or restore ecosystems, and demonstrate how the well-being of humans is inextricably connected to that of the natural world. *DT* outlines initiatives by individuals and research teams that have pioneered new strategies to realize this vision.

The 22 chapters are grouped into five parts: (1) current and potential users and relevance of descriptive biodiversity data; (2) outputs and impacts of descriptive taxonomic products in regional case studies; (3) field guides and application of floristic and faunistic works; (4) impact of new technologies on field collecting and management of collection data; and (5) impact of technologies in dissemination and integration, and DNA barcoding.

One strength of the book is that it puts the way taxonomists work, especially in the production of floras (Part 1, 2), into a historical context seldom appreciated by those in other fields. To summarize, (a) efforts to date are incomplete, because much of life has yet to be described, (b) coverage has been non-random as we have studied far more large than small organisms, but (c) little

effort has been devoted to considering the potential audience for taxonomic information. To put it another way, taxonomists have often worked alone, chosen taxa driven by their own interests, and been content with knowing that only a handful of taxonomists will ever use their work. Taxonomists have often failed to recognize that their discipline is an early step in a long chain of information that serves biologists, conservationists, and global change scientists, people who tend to have little contact with practicing taxonomists.

Within this historical context, it is easier to understand why *Flora Iranica* (Rechinger, K. H., editor. 1963–ongoing. *Flora Iranica*. Akademische Druck- u. Verlagsanstalt und Naturhistorisches Museum Wien, Graz/Wien), a monumental work of 72 fascicles on the plants of Persia, is a sadly inaccessible example of the entire genre. It’s written in Latin and German, languages not understood by most conservationists living and working in the region. *DT* calls for taxonomists to expand their audience beyond colleagues in the same field and to explore web-based tools.

Most of science has already accepted that content must be digital to be valued. Readers of *DT* may find it distracting that some of the points raised by the authors are outdated; examples include Chapter 4’s concern over embracing the electronic delivery of biodiversity data and the adoption of modern tools like digital cameras to document plants. These comments represent both the heterogeneity of the field of taxonomy and the period in which these chapters were written.

Unfortunately, the examples of progress outlined in *DT* demonstrate that we have far to travel on the path to achieving an online biodiversity knowledge infrastructure of all life. If past efforts in taxonomy were slow, non-random, and spread thinly across the diversity of life, the same can be said for the digital transformation of taxonomy. The wide variety of individual efforts and solutions happening spurs innovation, but the efforts involved are fragmented and prevent coalescence around reliable, long-term online solutions. Too many of the projects outlined in the book have links that are no longer viable. As in the world of software startups, the species informatics landscape is rich in acronym projects that turn over quickly, and it’s not clear which efforts will persist. But maybe Minter (Chapter 8) is correct in finding that an ecosystem of different sites offering similar but not identical services will be more robust and useful in the long run than a single site. For those who deal with sequence data, I still think you should count yourself lucky that

there is basically just one database, GenBank, and you can focus your efforts on using sequence data.

While the taxonomic community struggles to provide a vetted list of names linked to literature and specimens, end users need information yesterday about the ecological context of species. Efforts to digitize specimen records do unleash museum and literature records, but end users should view this unvetted data with caution (Hjarding, A., K. A. Tolley, and N. D. Burgess. 2014. Red List assessments of East African chameleons: a case study of why we need experts. *Oryx*: 1-7 doi:10.1017/s0030605313001427; Goodwin, Z. A., et al. 2015. Widespread mistaken identity in tropical plant collections. *Current Biology* 25: R1066–R1067. doi: 10.1016/j.cub.2015.10.002). Given the slow and uneven progress to describe what's out there, how can taxonomists collaborate in meaningful ways with ecologists and ecosystem service scientists, and provide solutions to the biodiversity crisis, especially when the data isn't accurate? *DT* does not address this point directly, but suffice it to say that funding and organizational structures have prevented taxonomy from scaling up to meet the current challenge of sustainability. This remains just as true in the past as it is now.

This uncomfortable reality undercuts the book's core premise: that descriptive taxonomy is the foundation of biodiversity research; that taxonomic products must be made available for conservation strategies. *DT*'s main message now sounds more like wishful thinking than a principal driver of change.

A GOLDEN OR GOLD-PLATED AGE?

A few years ago, I too would have agreed that we were in the golden age of taxonomy. New tools including digital images, micro CT scans, next-generation sequencing, and integrated publication platforms such as *Zookeys*, combined with a new awareness of urgent global issues, had provided what I thought was fertile ground for the taxonomic effort to expand. I imagined a world responding to the biodiversity crisis by clamoring for trained taxonomists, and providing an accompanying surge in funding to explore the world's biodiversity before the chance to use this knowledge to conserve and sustain was lost. Such a time would transform museums from places viewed as warehouses of dead creatures into hubs seeking to understand the natural world and apply this knowledge to protect habitats, monitor ecosystems, and help people recognize that the welfare of humans relies on the fate of the natural world. I hoped I would be called to participate in a world inventory of all ants, an effort to put ants on equal footing with birds in conservation and climate change studies.

But just when taxonomists have the tools to make the maximum impact, they've been relegated to sitting on the sidelines while others are called on to save the world. Efforts that skirt the conservation of species in favor of preserving ecosystem services and natural capital (Guerry, A. D., et al. 2015. Natural capital and ecosystem services informing decisions: from promise to practice. *Proc. Natl. Acad. Sci.* 112:7348–7355) are moving forward instead. Maybe conservationists didn't have a choice. Given taxonomists' slowness at delivering a holistic view of biodiversity, our infrastructure may have left few options for participating in conservation. Conservationists had to move forward, focusing on the systems and services they knew more about.

So how can the description of another new species help save the rainforest? I contend that's not the right question to ask. When Landsat was launched, we didn't ask how the next photo of Earth could help monitor natural landscapes; we understood that repeated photos of our changing globe would be indispensable for a long list of uses. In the same way, we need high quality, accurate biodiversity data—not just a single pixel of a sample, a single new ant, but a grasp of all life across the globe.

DT explains why this scaling will not happen quickly. If the current funding and organization of the practice of taxonomy can't grapple with global issues quickly, maybe taxonomists should take a different approach. Could taxonomists work together to focus global efforts on a strategic set of taxa across the phylogeny of life? What if our efforts were not distributed thinly across the globe but instead focused on conservation outcomes in a particular region? For example, what could we accomplish if we focused all our efforts on rainforests? What would it take to understand the role of biodiversity, how it relates to a functioning rainforest, and how much biodiversity is needed to keep these services intact?

Above all, if taxonomists want to impact global issues, we need to find a way to develop a shared vision that builds on our individual narratives. Our legacy of floras demonstrate that taxonomists can collaborate. But now we need more groups to work together. Taxonomists will not be able tackle this ugly battle alone, but must join hands with ecologists and systems biologists to save the life we are so passionate about studying.

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