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book review

A book for our time

Spatial Conservation Prioritization — Quantitative Methods and Computational Tools, by Atte Moilanen, Kerrie A. Wilson and Hugh Possingham

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http://www.oup.com/

"Spatial Conservation Prioritization" is a remarkable book about a remarkable field. In it, the editors have assembled a quiet manifesto for a new kind of conservation biology - or rather for the universal adoption of the last decade's mathematical developments in conservation planning. I say a quiet manifesto because in spite of an absolutely pressing need for conservation organizations worldwide to wake up and smell this particular methodological coffee, this is not an evangelistic book and the contents are left to stand on their obvious merits.

In a nutshell, Moilanen et al. present a series of chapters written by researchers at the forefront of the field, detailing the various ways in which precise spatial questions can be asked and answered with optimization techniques from the wider field of operations research. A reasonable amount of theory is introduced, and introduced well for the non-specialist: something to be commended as the specialist primary literature on the subject is sparse and difficult to approach. This is particularly true of the three excellent chapters dealing with the mathematical formulation of spatial choice problems, the linear programming techniques used to solve them, and the heuristics to those solutions which are used most frequently in current practice. As the concluding chapter says, this is most familiar to readers in the context of "which nature reserve to buy next?" given a goal and some available resources, but in reality can be extended to most stages of the conservation planning process.

These extensions are covered in detail in several chapters which look at recent advances in ways to increase the realism of the program to be solved: integrating population viability analysis, how to optimize for maintenance of metapopulation and landscape dynamics, how to deal with uncertainty, dynamism in habitat and in the future distributions of species. The book then proceeds with a series of chapters introducing (with examples) four of the most well-known software packages for heuristic spatial solutions: Marxan, Zonation, C-plan and ConsNet, before concluding with a best practice chapter on interacting with the other parts of the planning process and an intriguing future prospects wrap-up by the editors.

That's not to say the book is free from problems. Chapters with a heavy policy basis are in places pretty turgid going, and this might limit the utility of the book in undergraduate teaching. And to me one glaring omission is anything on the ability of spatial conservation planning to transcend the biological boundaries within and between spatial scales and levels of organization. There are good chapters on planning approaches at the level of the metapopulation, the community and the region, but nothing about how to cross-link such analyses into a holistic plan (see Cabeza et al. 2010 for an excellent example). These are, though, small gripes, in the face of the wider benefits of the approaches set out in the book. And these are, frankly, enormous.

Implicit in the use of actual or heuristic optimization is the use of a quantity to optimize – i.e. what it is *exactly* that we as conservation biologists are actually trying to do? If this process, the mathematical formulation of a goal in a programmatically tractable form, can become the *de facto* first step in any conservation process, then a number of things would begin to happen.

First, and most obviously, individual conservation decisions can take advantage of the techniques (as described in the book) to make the best use of resources whilst being assured that they are achieving their goals. If a particular outcome can be had with less land, less money, shorter borders or less antagonism, not only does that particular project work better, but more opportuni-

ties for action become viable. Furthermore, the case for public, governmental or private support is put on a better footing as the amount of guesswork and number of rules of thumb is reduced, and the business case improves.

Second, the arguments within the conservation community about alternative strategies, diversity metrics, prioritization schemes and all the other baggage in which action gets bogged down, become themselves more tractable. We can ask how different in practice the solutions are when a particular conservation decision if optimized for one group of organisms over another, or one measure of diversity over another. We can also determine how much it will actually cost to reconcile different priorities. I recently heard the head of science policy at a major NGO say that he saw the organization's business as being the preservation of species and not interspecific diversity. My concern is not with the decision itself, but that it is made without data: a choice amongst species necessarily produces some value of diversity. In fact, conservation action with one goal will achieve some performance against all goals, so why make a choice about how to conserve before knowing that you have to? And conversely, what is the cost of our preconceptions if different goals have very different solutions? Involving optimality gives us at the very least a more nuanced view of the decision process, and a quantitative basis for our opinions. In an increasingly data-rich world, if we're going to make decisions, they may as well be wise ones.

Perhaps most importantly, by doing conservation through optimality we would be doing it in the same language as (for want of a better term) our opponents. An open, transparent system with an explicit goal for conservation allows the integration of conservation goals into the same optimality frameworks businesses use to decide their activities and governments use to apportion resource use. The fear of compromise in many conservation strategies is paralytic: genuine conflict for habitat is clearly widespread and where it exists the conservation battles need to be fought as strongly as possible, but some conflict is clearly illusory. Each case where human activities and conservation success can coexist is vitally important for involving biodiversity preservation in wider society, where too often the conservation argument is seen as anti-business, anti-wealth and anti-development. But without integration under a systematic framework such situations cannot be seen beforehand, and every fight is entered into blind.

The problem, of course, with setting an explicit quantitative public criterion for conservation success is that conservation failure becomes public and easy to measure. Once committed to, conservation schemes quickly become inviolate, and do in proportion to their profile and worth. This is a wider issue for the conservation community to deal with, but incorporating spatial and wider systematic planning concepts into high profile schemes at the beginning, and using the scientific review process for its intended purpose would mitigate the problem.

For me, then, the single most important thing in this book isn't actually written down in it anywhere. It's an excellent summary of the state of the art and should make spatial prioritization a standard part of any conservationist's training. But by doing so, it might shift the baseline for all conservation decisions firmly into the quantitative, and into the rational. And that would be good for all of us.

References

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