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# Biological Conservation

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## Book review

**Green Equilibrium: The Vital Balance of Humans and Nature, Christopher Willis. Oxford University Press (2013). xxviii+280 pp., Hardback £20.00, \$34.95, ISBN: 978-0-19-964570-1**

**The Balance of Nature and Human Impact, Klaus Rohde (Ed.). Cambridge University Press (2013). xvi+413 pp., Hardback £61.36, \$89.10, ISBN: 781107019614**

These two books make good companions, and it is instructive to read them side by side. In doing so, the reader can reflect upon a central challenge to conservation science, and to the societies within which it carries out its business. Conservation biology, like some other fields of biology, not only aims to generate a coherent account of the phenomena under its purview, but does so for a practical purpose: conservation, however construed. In recent years, the construals center more or less on the protection of biological diversity. In order for this purpose to be achieved, science is not enough. Government action and social engagement are needed, and these must rest to a certain extent not upon data or “how things are,” nor even on theory or “how things work and why,” but on a vision of how things are supposed to be. This is at bottom an act of imagination, more or less informed by scientific understanding.

The language of the moral imagination is mythic, and thus Stuart Pimm correctly described “the balance of nature” as “ecology’s enduring myth” (Pimm, 1991). Enduring is right: while ecology generally has moved—slowly—away from this paradigm (Edgerton, 1973; Worster, 1994; Cuddington and Beisner, 2005), it still is a foundational concept as ecology is understood by society as a whole (Simberloff, 2014). For example, the expensive and sophisticated efforts at science education reform in the United States, guided by the National Research Council, have produced science standards that reasonably reflect the current status of understanding about ecosystem dynamics, and this view is increasingly found in textbooks (e.g. Miller, 2013). When one examines documents written at a local or state level, however, the balance of nature as an unquestioned constraint on the world’s behaviors is likely to be found, more or less as if the state or local standards had been written 50 or 75 years ago (see, for example, Hamden, 2014; Virginia Department of Education, 2010).

We cling to the notion of a balance of nature for deep reasons. The philosopher John Dewey (1929/1984) argued that much of Western philosophy, as well as social and cultural practice, was ruled by the “quest for certainty”: the basic need to reassure ourselves that the bad things in life can be kept at bay and the good things made more likely. We want the universe to make sense, and to enable us to flourish. The idea of a dynamic, hypercomplex, even chaotic world strikes at the heart of these desires. As Mayr (1988) argues, one root of the fear of evolutionary thinking is the realization that evolution, with its components of variation, stochasticity, and contingency, is incompatible with any view of the world founded on an optimistic teleology.

As Simberloff (2014) suggests, however, the cultural understanding of the balance of nature has begun to shift in first-world cultures, under various historical influences, to carry connotations of “a fragile aspect of nature and biodiversity that it is our duty to protect.” The possibility and the need for constructive action surely are entry points by which the science of conservation can have increasing influence, and the myth of balance gradually be modified to incorporate an understanding of dynamic systems under constant variation. But the myth still has such imaginative power that it will be part of our discourse, and a tool for advocacy and education, for a long time to come.

As a matter of historical development, it can be argued that the idea of the “balance of nature” was not overthrown by Kuhnian revolution, but rather eroded in a slow, widely distributed developmental process (Peters, 1991; Pickett et al., 2007). Edgerton’s (1973) magisterial review of the idea argued that we would not be able to salvage whatever empirical core might underlie the persistent image of balance until the term was replaced by more precise, and empirically testable, concepts. Much subsequent work in areas such as ecosystem stability, resilience, community assembly, ecosystem function and regulation, has ensued. And so to the books under review here.

Klaus Rohde’s fascinating edited volume *The Balance of Nature and Human Impact* offers a snapshot of current research, exploring evidence for or against equilibrium processes from an array of systems, interspersed with reviews of literature on selected topics. A brief gallop through the table of contents can only suggest its wealth of provocative entries.

Part I: “Nonequilibrium and equilibrium in populations and metapopulations” examines reef fishes (Forrester and Streeple), ectoparasites on terrestrial hosts (Krasnov and Rizzoli) and marine parasites (Pérez-del-Olmo et al.). Part II: “Nonequilibrium and equilibrium in communities” examines plankton communities (Rohde), community stability in relation to fire (Clarke and Lawes), marine and freshwater ectoparasite communities (Simkova and Rohde) and small mammal ectoparasites (Krasnov), and bird populations and communities. Part III addresses “Nonequilibrium and equilibrium on geographical scales” in the context of island flora and fauna (Morrison) and arctic vascular plant diversity and spatial variation (Brochman et al.). Part IV: “Latitudinal gradients” focuses on diversity gradients. Rohde reviews the literature providing evidence for and against equilibrium and nonequilibrium explanations, while Gilman and Wright discuss “effective evolutionary time.”

Part V: “Effects due to invasive species, habitat loss and climate change” is by far the largest section. This is not surprising, given the grab-bag section title, but the section marks a transition, as all the rest of the book looks at “biocomplex” (coupled human–nonhuman) systems—where the nonhuman component may include insects (Andrew), coral reefs (Sale), emerging infectious diseases (Brooks and Hoberg), human impacts on biodiversity

(Mora and Zapata), amphibians (Heatwold), and reptiles (Lilywhite). Part VI: “Autecological studies” comprises two articles: “Autecology and the balance of nature—ecological laws and human-induced invasions” (Walter) and “The intricacy of structural and ecological adaptations: micromorphology and ecology of some Aspidogastrea” (Rohde).

Part VII: “An overall view” sets much of the foregoing into a larger theoretical and practical context, coming back to the challenges faced by conservation biology in a world in at least one kind of chronic disequilibrium: anthropogenic climate change. Rohde discusses interspecific competition as a regulator of communities, and the status of evolutionarily stable strategies. Finally, Rohde and co-authors discuss “How to conserve biodiversity in a nonequilibrium world.”

Here we come to the crux of the matter. As Wallington et al. (2005) argue, much conservation strategy betrays an underlying “balance” orientation, which often takes the form of creating reserves and assuming that they will “do the job” (not a safe assumption, see e.g. Drayton and Primack, 1996); or of reintroducing species or otherwise restoring a system, and then assuming that short-term success will last (also not a safe assumption, see e.g. Godefroid et al., 2011). Rohde et al. argue cogently that in the world we now inhabit, equilibrium assumptions will result in deep design weaknesses in many conservation strategies, and the kind of reflective research represented by this volume as a whole must result in substantial innovation.

In *Green Equilibrium*, Christopher Wills accepts a different challenge: the challenge of interpretation and advocacy described earlier. His book is an engaging mixture of ecologist’s travelogue and science exposition, which manages to convey a wide range of important ideas in evolution and ecology in the context of ecosystems around the world, including California, Sri Lanka, Thailand, Africa, New Guinea, and more. Each chapter is full of such stories, and indeed in more than one place I found it hard to connect the vignette with the themes Wills was supposedly expounding. His approach is courageous, however, as it becomes clear that his understanding of a “green equilibrium” closely reflects that of the current understanding of ecosystems and communities. (By contrast, Kricher (2009) makes different choices in his own cogent and popular account, focusing on regulation, resilience, and stability, rather than on “balance.”)

While he brings into play mimicry, natural selection, parasitism, predator–prey dynamics, and other mechanisms, Wills reasonably makes the choice to simplify the reader’s task of making sense of all the details by returning over and over to frequency-dependence as a central factor in just about every setting he describes. In many cases, this is effective; for example, in recounting theories about tree species distribution and diversity in neotropical forests. In other cases, however, it seems a stretch; for example, in an account of tribal competition in highland New Guinea. Yet his effort does represent a clear commitment to providing some empirically based explanatory mechanisms to undergird the message he is conveying. Wills introduces a popular audience to current environmental changes around the world in the language of contemporary conservation science, and manages therefore to contribute to the shift in nuance about “nature’s balance” which Simberloff describes.

‘Balance’ or ‘equilibrium’ in Wills’s account includes both the dynamic equilibria of relatively stable, bio-diverse systems, and the power balance (or imbalance) between humans and such systems. Wills argues that because the power balance is so often in humans’ favor, we are faced with the moral challenge of choice. We can continue to act without according any respect to other species and their needs. We can choose instead a second path,

by which we can value biodiversity to the extent that we try to protect some areas from our influence (as in great nature reserves), but otherwise act in relative ignorance of the bio-systemic consequences. These two alternatives are likely to be variants with similar outcomes of ecological impoverishment, though in different time frames. A third path, which Wills argues for, is to accept the implications of the imbalance of power in our species’ favor, and to consciously change social and economic practices to redress the power balance, and to support robust biodiversity and dynamic ecosystem processes everywhere. He notes that human population control leading to a reduction of human ecological impact will be a necessary part of this path of responsibility.

Both books under review make the case—not hard to make to *Biological Conservation* readers, perhaps, but not so easy to convey to policymakers or the general public—that the unexamined assumption of “balance” has contributed to many of our current ecological crises, and inhibits proper responses to them. In some cases, a naive reading of “balance” contributes to the assumption that in time, any disturbance caused by human activities will be remedied by Nature as it comes back into balance. In other cases, the “balance of nature” is reified without sufficient understanding of ecological systems and their dynamics, so that intended remedies result in further, different disturbance or even system transformation. Our challenge as scientist-communicators is to convey a much richer, but perhaps just as satisfying, understanding of the way things work, and the implications of that understanding for what conservation must become. As Donald Worster (1994) wrote in his seminal treatment: “It is a pattern of behavior based on the idea that preserving a diversity of change ought to stand high in our system of values, that promoting the coexistence of many beings and many kinds of change is a rational thing to do. . . . Such a strategy of trying to conserve a diversity of changes may seem paradoxical, but it is founded on a crucial and reasonable insight. We may have to live with change, may even be the products of change, but we do not always know—indeed, we *cannot* always know—which changes are vital and which are deadly.” (433).

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