

on freshwater and marine ecosystems, are similar and cover the major threats to biodiversity and ecosystem function and the current directions for overcoming these threats. These are important chapters for the book as most of the book focuses on and uses examples pertinent to terrestrial ecosystems. The island chapter is a very good review of the history of theory about island conservation and the key issues for conservation on islands. The final chapter, on tropical forests, takes a different approach and begins by reviewing the data on the effects of humans on ecosystem-level processes but then focuses on how we can build resilience into these systems using the tools ranging from satellite imagery aiding monitoring of deforestation to simple enforcement of current laws.

There are four chapters focused on taxonomic groups, covering butterflies and moths, tropical birds, large mammals, and plants. These chapters highlight the unique characteristics of each of these groups and then how those characteristics lead to differences in how each group is affected by different threats such as habitat fragmentation. Each chapter ends with conservation priorities for the group studied and, in some cases, recommendations for further research. These summaries are great starting points for graduate students looking for new directions for research in these specific areas. Reading these four chapters as a group also brings out how the differences in the biology of the organisms strongly influence the priority of different issues. For example, butterflies and moths are not strongly affected by invasive species. Large mammals do not have the taxonomic impediments of invertebrates or plants. Yet the devastating effects of landscape change and the increased human use of all areas lead to some common themes for conservation. All the chapters call for the usual solutions: more sustainable agricultural practices, maintenance of corridors or other ways for populations to remain connected, improvement of the ecological function of matrix lands, and strong recognition of the importance of large protected areas.

Finally, the book wraps up with chapters summarizing the current thinking on some of the typical solutions for conservation such as better monitoring, corridor establishment or restoration, and interestingly, rewilding, and modeling human behavior. There is a summary chapter that outlines explicitly the conflicts between conservation values and humans. The chapter on monitoring is an elegant summary of the key elements of a good monitoring plan and reiterates the

importance of optimizing monitoring so that it is most effective for answering the question asked. The chapters on conservation planning and corridors are also very clear. The figures and tables (which are available for download on a companion website) and boxes in many of these chapters help clarify the options and choices to be made by conservation practitioners. These chapters that summarize and evaluate the current tools available for conservation are interesting and well written. They give good but short overviews of the tools available to conservation practitioners in the broad sense—not just biologists.

*Key topics in conservation biology 2* covers a broad array of topics that provides a window into many of the issues pertinent to a conservation practitioner, more than to a typical researcher in conservation biology. This book is a useful starting place for entering the literature on the specific topics covered and, therefore, would be an appropriate text or accompanying text for a graduate seminar. Each chapter is strong, though the book does not provide comprehensive coverage of conservation biology as would a textbook. For example, there are several references within different chapters to ecosystem services, but the increasing importance of ecosystem services as a tool for conservation practitioners never stands out. Additionally, while there are chapters focused on marine and freshwater conservation, the more general chapters do not provide strong coverage of the issues for marine or freshwater systems and rarely use examples from that literature or practice. The strong focus on the broader world of conservation perhaps is the most interesting and weakest part of a book titled *Key topics in conservation biology 2*. While conservation takes place in a human context, this book is less about the biology of conservation and more about the reality and tools of conservation practitioners in the broadest sense of the term.

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## Where the wild beasts are

Sinclair, Anthony R. E. 2012. **Serengeti story: life and science in the world's greatest wildlife region**. Oxford University Press, Oxford, United Kingdom. xiv + 270 p. \$34.99, ISBN: 978-0-19-964552-7.

*Key words:* African buffalo; African savanna ecosystems; biodiversity conservation; national parks; wildebeest migration.

The Serengeti is an iconic ecosystem, and Tony Sinclair is one of its principal interpreters, admirers, and advocates. Sinclair's nearly 50 continuous years of research in East Africa have furnished answers to many fundamental questions of population and community ecology, provided important

insights for management and conservation, and helped establish the conditions for others to follow in his footsteps. His latest book is not a thorough synthesis of the Serengeti's ecology—for that, see the weighty compendia *Serengeti I, II*, and *III* co-edited by Sinclair and colleagues (University of Chicago Press, Chicago, Illinois). Rather, *Serengeti story* is equal parts memoir, popular history, and non-technical overview of key scientific findings by Sinclair, his students, and collaborators.

Over the course of 20 chapters, Sinclair builds a portrait of the ecosystem, in which he situates his stories of discovery, political turmoil, bandits, poachers, and the day-to-day challenges of conducting research in post-colonial Africa. We get a crash course in how modern Serengeti came to be, its trajectory in the 20th century molded by the Rinderpest pandemic, along with successive crashes and resurgences of

elephant populations associated with the ivory trade. Sinclair walks us through revelations about how ungulate populations are regulated, what determines the balance of trees and grasses in savanna, the impacts of humans on ecological dynamics, and above all, the central role of the wildebeest migration in structuring the Serengeti system. Along the way, we meet Oliver, the tame wildebeest, and the hand-reared buffalo calves Bogo and Rudolph, along with various park officials, presidents, princes, and keen young researchers. There are mishaps involving hot-air balloons, swamps, cantankerous yellow Land Rovers, punctured tires, armed robbers, surprise encounters with the big five, and East African border strife. Par for the course of doing research in that time and place, the harrowing episodes are recounted with quiet good humor. All's well that ends well.

The style is accessible and the genre is familiar: *Serengeti story* will be at home on the shelf next to the personal narratives of early hunter-naturalists, charismatic game wardens such as Bruce Kinloch and Myles Turner, and scientists such as Robert Sapolsky. Sinclair's prose is disciplined and workmanlike—enabling him to cover a tremendous amount of history, science, and anecdote in a mere 205 pages—while 314 endnotes provide extensive references and commentary for the benefit of professionals and anybody else seeking greater detail. Forty color plates and four maps enliven the text and help the reader keep track of where the action is happening. All of this makes for effortless reading—the stuff of two pleasant afternoons for me.

This is a trade book, but there is much here of value for practicing ecologists, even those already familiar with the workings of African savannas in general and Serengeti in particular. To take just one example, my reading of Dublin et al.'s 1990 paper (Dublin, H. T., A. R. E. Sinclair, and J. McGlade. 1990. Elephants and fire as causes of multiple stable states in the Serengeti-Mara woodlands. *Journal of Animal Ecology* 59:1147–1164) on the interaction of elephants and fire in determining savanna woody cover is greatly enriched by understanding the sequence of events leading up to and motivating that study. Sinclair's efforts to relate the stories behind the science will, I suspect, especially benefit young ecologists. Reading technical papers, one too often comes away with the impression that the only ingredients are a good idea and an elegant experiment; Sinclair is at pains to emphasize that his major discoveries were invariably the product of many years' work at the coal face. Slicing through hundreds of bloated carcasses to examine bone marrow is neither easy nor glamorous, but there in the marrow lies the answer to whether ungulates were starving—and, in turn, the role of food limitation in population regulation. Painstaking natural history, delayed gratification, and an organic connection to the study system were crucial to generating, over time, some of the most exciting and robust results this field has seen.

It is true that at some points in this telling, the alternative hypotheses guiding the research seem awfully clear-cut, the conclusions enviably unambiguous. If there were false starts, dead ends, contradictory data, anxieties, mistakes, and frustrations (other than logistical), Sinclair does not dwell on them. Indeed, the perspective throughout the story is outward looking and progressive. It is not introspective or confessional. The author and his editors may have judged such content overly indulgent and insufficiently interesting to the intended general audience, and they may have been right. Still, I'm curious.

Several themes recur throughout the book. One is flux. Sinclair sees the broad arc of Serengeti's evolution, and there is little room in this view for equilibrium theories: "Serengeti has been changing constantly both in environment and in species

over several million years, and we should expect it to continue to do so." Populations wax and wane; there is no "correct" number of elephants or trees. Let the system be big, connected, and protected, this view implies, and the details will sort themselves out—do not micromanage. Macromanagement, however, is essential, and this view is reflected in another of Sinclair's recurring themes: animal migration. The importance of migration is not restricted to wildebeest and other ungulates, whose annual movements determine so many aspects of the broader system; it extends to insects and birds, which constitute the bulk of Serengeti's biodiversity. This is where bigness and connectedness come in. These concerns were particularly salient while the book was being written, as the Tanzanian government contemplated running a highway through northern Serengeti. Sinclair forecasts the likely consequences of such a road: more traffic, higher speeds. Animals on the road cause accidents and human fatalities, and motorists agitate for a fence. Fences block the ungulate migration, and the wildebeest population shrivels. Serengeti's uniqueness evaporates; it becomes just another chunk of tropical savanna. (As of 2011, an alternative route south of the park is being considered, but as Sinclair pointedly notes, implementation of this plan hinges on the international community's willingness to foot the bill.)

A final theme of *Serengeti story* sings out clearly to me, although Sinclair only once mentions it directly. We see again and again throughout the book that a deep understanding of Serengeti's ecology has taken decades of uninterrupted study—long-term datasets collected by the same people using the same methods. Sinclair has been able to do that thanks to the grant-making policy of Canada's National Science and Engineering Research Council, whose five-year renewable awards "provided the security to develop the programmes that eventually told us what was happening in Serengeti." Sinclair's body of work is a testament to the importance of such security, which is increasingly hard to come by—certainly in the United States, but also worldwide, as the increasing pace of science tempts granting agencies to demand quick return on investment.

In many ways, we have only begun to understand the functioning of African ecosystems like Serengeti; as ever, the pioneering research of Sinclair and others illuminates as many new questions as it does answers. If anything, the pace of discovery is accelerating, as a critical mass of hard-won knowledge integrates with ever-expanding technological capacity. But technology and globalization also close some frontiers: GPSs prevent us from getting lost, cellular phones prevent us from having to sleep in our trucks when we get stuck in mud, and fancy coffee shops springing up throughout cities like Nairobi keep us from having to go too long without decent espresso. Much of my pleasure in this book flows from the glimpses it provides into an era of African field biology that was sufficiently accommodating for scientists to be highly productive, but not so sanitized as to make it entirely comfortable (or even safe). While there is no point lamenting the closing of that era, there is plenty of fun to be had reading about it. Sinclair's is not the only Serengeti story, but it is a very good one.

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