

Invasion ecology fifty years after Elton's book

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Received: 13 January 2009 / Accepted: 2 October 2009 / Published online: 16 October 2009
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Charles Elton was a founder of ecology with fundamental contributions to diverse topics such as fluctuations of animal populations, food web theory, or what is now known as the Eltonian definition of the ecological niche (Macfadyen 1992; Simberloff 2000; Hardy 2002). His 1927 book *Animal Ecology* was reprinted many times and he was the first editor of the *Journal of Animal Ecology*. One of Elton's most influential contributions, however, was his book *The ecology of invasions by animals and plants*, first published in 1958. Although many earlier authors including Darwin had dealt with invasive species, this book has been considered the starting point for focused scientific attention on biological invasions and is the most cited reference in the field (Pyšek et al. 2006; Richardson and Pyšek 2007; Ricciardi and MacIsaac 2008; Richardson and Pyšek 2008).

Between 12 and 14 November 2008, the Centre for Invasion Biology at Stellenbosch University (South Africa) hosted an international symposium entitled '*Fifty Years of Invasion Ecology—The Legacy of Charles Elton*'. This is probably the most exciting scientific meeting I have ever attended. Why? Beyond the magnificent wildlife of South Africa and my interest in the meeting topic, the three main reasons were that many leading invasion biologists

were invited keynote speakers, that all the fourteen keynote addresses were superb, and that most other contributions to the meeting were presented as posters, thus giving ample time for discussion after the talks. Additionally, the organizing committee (chaired by David Richardson) had asked the attendees to structure their contributions around the theme of the symposium and this resulted in many diverse views of the last fifty years of invasion biology.

The meeting appropriately started with two historical overviews (by D. Richardson and Daniel Simberloff) that rendered tribute to Elton. David Richardson summarized the standard topics, history, and current challenges of invasion ecology. Daniel Simberloff suggested a number of important points, namely that Elton did *not* found modern invasion biology, which rather arose in the early 1980s from the realization that many invasive species were causing conservation problems worldwide, and that Elton has contributed more to conservation biology than is usually realized, through his direct influence on Aldo Leopold. The first point was also supported by a citation analysis by Hugh MacIsaac and Anthony Ricciardi, who demonstrated that the number of papers on invasive species and citations to Elton's book exploded only in the early 1990s, well after the publication of Elton's book (see also Simberloff (2004), García-Berthou (2007), Ricciardi and MacIsaac (2008)); an amusing anecdote was that the title of Ricciardi & MacIsaac (2008), which seems to contradict this point, was an editorial change after the

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galley proof stage of that paper. Several speakers provided insightful perspectives on biological invasions in a variety of ecosystems and taxa, such as the sea (James T. Carlton, who emphasized the overlooked strong underestimation of the antiquity and actual rates and scales of marine invasions), fresh waters (Anthony Ricciardi and Hugh MacIsaac), terrestrial plants (Petr Pyšek), birds (Tim M. Blackburn), and tree pathogens (Michael J. Wingfield). Other speakers addressed the implications of invasive species for ecosystem function (Peter Vitousek) and macroecology (Steven L. Chown) or the importance of an evolutionary approach (Andrew J. Lowe). Some polemic views were also presented (Matthew K. Chew, Mark A. Davis) and were vigorously challenged.

Management aspects were well represented by a session of short vignettes, convened by Philip Hulme, and by many poster contributions, which exemplified the enormous array of methods and techniques currently available to deal with this environmental issue, such as risk analyses, regulatory and socio-economic aspects, new genetic techniques to detect invasive propagules, analysis and treatment of ballast water and hull fouling, or monitoring programs and early detection. Many posters on more academic issues were also present, often with reflective insights on Elton's book. A symposium booklet with the abstracts of talks and posters is available at http://academic.sun.ac.za/cib/events/Elton_CIB_symposium.htm (last accessed in January 2009).

Elton should be proud of his enormous influence on ecological science and conservation biology. Even if he did not found or determine the immediate future of invasion biology, his book was subsequently lauded as the first comprehensive reference on biological invasions, blending an insightful and well articulated mixture of cases, conceptual ideas, and applied concerns. Had Elton attended the symposium, he would probably have been fascinated by our current ecological knowledge and tools. Ecological and evolutionary sciences have greatly benefited from the large temporal and spatial scales that invasions provide, as “experiments in nature” (Blackburn 2004; Sax et al. 2005). We seem, however, to be losing the conservation war (Hulme 2003). A famous quotation from Elton's book (p. 31) is “We must make no mistake:

we are seeing one of the great historical convulsions in the world's fauna and flora”. This was written before the zebra mussel invaded North America or the Nile perch eradicated dozens of endemic cichlids in Lake Victoria, illustrating Elton's ecological foresight. Given our current knowledge on the impact of invasive species and the formidable current opportunities for their prevention, control, and eradication—both points excellently illustrated in the symposium—the state of the planet in another fifty years depends entirely on our endeavor to address this environmental issue.

Acknowledgments I thank the Editor-in-Chief, D. Simberloff, for helpful comments and the Spanish Ministry of Education for financial support (CGL2006-11652-C02/BOS).

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