

Preface

Widely regarded as second only to direct loss of natural habitats as a threat to native plants and animals throughout the world, the ecological roles and impacts of so-called alien species (often, ‘exotic species’) are a global concern in conservation. Their diversity and effects continue to increase and ramify throughout all major communities and ecosystems, and in a considerable variety of contexts. Many are related to human activities, and others are more natural or fortuitous as increasingly complex novel interactions occur between alien and native species with no history of previous co-occurrence. The outcome is a world that has been described as increasingly uniform with massive erosion of natural regional peculiarities to produce an environment that has been termed the ‘Homogenocene’ or ‘Anthropocene’, in which the extinction of evermore numerous localised and ecologically specialised life forms seems inevitable as biotic homogenisation progresses and adaptable ecological generalists spread and predominate as consequences of human activity and as environments change.

Amongst these, the roles of insects are very diverse – both as aggressors or putative aggressors when they reach new areas, and as the resident (native) victims or beneficiaries of a massive variety of alien insects, plants and other invaders. Both role categories occur in many parts of the world and in many different terrestrial and freshwater environments – essentially, wherever insects are found. Any species reaching a hitherto uninhabited area represents an addition to that area’s biota (some only temporary presences but many species establishing and spreading to become enduring, essentially permanent, additions) and may influence the receptor community strongly in positive or negative ways, or be entirely neutral with a little or no detectable impact.

The ecology and economic importance of alien invasive species has generated immense global and regional concerns, and their study and tailored countermeasures to redress undesirable impacts have led to a correspondingly vast and complex literature. The pioneering book by Elton (1958) was a major stimulus for interest – and some of the examples he discussed are still of major concern, and his influences displayed in the volume edited by Richardson (2011). Elton’s prescient comments on the Argentine ant, for example, were discussed there by Sanders and Suarez

(2011). Numerous other books since the appearance of Elton's volume have dealt with the theoretical, economic and ecological impacts of 'biological invasions' and 'alien species' (with other terms such as 'exotic', 'invasive', 'noxious' and others essentially synonyms unless otherwise specified, and many such species regarded broadly as 'pests') and are accompanied by burgeoning numbers of scientific papers examining both individual cases and wider fields from both practical and theoretical viewpoints. Some themes have come to the fore only well after Elton's book appeared – Richardson and Pysek (2008) noted propagule pressure, risk analysis, multi-scale studies and experimental approaches as examples flowing from more recent approaches to conservation biology and applied ecology in the intervening half century, together with progressive advances in technology and the availability of large data sets. Many more recent accounts display the legacy of the principles enunciated by Elton, and these are elaborated in more recent texts and essays such as those by Mooney and Drake (1986), Simberloff (1986) and Lockwood et al. (2007). Studies range from individual local situations involving single species to global scope for wide 'biodiversity', but each contributes progressively to sound understanding. Some appear in specialist journals (such as 'Biological Invasions'); others in a wide spectrum of broader conservation, ecology, entomology and plant and animal biology journals, symposium proceedings and government agency reports. Collectively, they span considerations of fundamental ecological changes from planned and less purposeful introductions, as well as numerous practical and economically vital aspects of crop and other commodity protection. They thus encompass aspects of pest management, suppression of threats to native biota and ecosystems, quarantine and 'biosecurity' (with accompanying regulation and legislation) to prevent arrivals and establishment, the subsequent spread and ecological impacts and prediction of those impacts in the future, in relation to changes such as climate modifications and changing availability of key resources such as susceptible crops. In short, alien species affect many aspects of human well-being, as well as the integrity of the receiving environments, and the survival of many of the species they contain. Not all those influences are harmful – many alien species confer massive benefits on humanity, and many others scarcely intrude on normal societal consciousness. However, in comparison to the massive concerns over impacts of alien vertebrates and plants, many alien insects gain only a relatively low profile unless they are direct pests or control agents of concern for human welfare – this trend is clear in two recent compendia on invasive species in Australia (Prins and Gordon 2014, with no chapter on insects) and eradication of alien species from islands (Veitch and Clout 2002, with only two insect-focused essays amongst more than 50 case studies outlined). Whilst such biases reflect the predominant major concerns arising from mammals and weeds, in particular, the ecological insights from parallel studies on insects and other invertebrates add enormously to understanding.

In this overview, I bring together some of the massive amount of information available (up to late 2015) on the roles of alien species in insect conservation and drawing on the themes noted above, to illustrate both the concerns that arise from their presence and interactions with native species, and the balances between the benefits and threats they confer. The substantial economic and sociological

implications of alien species sometimes result in intense debate – as in some classical biological control programmes against arthropod or weed pests. Collectively, they affect almost all terrestrial and freshwater communities and ecological processes. Members of many plant and animal groups participate and, very broadly, an ‘alien species’ is simply one living beyond its natural range – often with the connotation of being ‘invasive’ in continuing to spread and thrive in this expanded distribution. These, and related terms, are often used loosely and are discussed further later in relation to ambiguity of definitions, categorisation and the numerous ecological processes through which such range expansions occur (Chaps. 1, 2, and 3). The major concerns for conservationists relate to impacts of these arrivals on native biota (Chap. 4), with my emphasis here on the fates of native insects. A wide array of direct impacts and intricate cascade effects are involved and are exemplified especially well amongst (1) the interactions between insects and plants; (2) interactions between predators or parasitoids and prey or hosts; and (3) mutualistic associations, in all of which either one or other participating taxon is alien, or both are alien in a new, expanded range beyond their historical arenas. They are exemplified for a variety of taxa and contexts in Chaps. 5, 6, 7, and 8, and the need for each chapter to be self-contained necessitates some minor overlaps of themes. The principles displayed have much wider applications in understanding changes in natural communities and advancing appreciation of the complex roles of alien species in novel environments as a key, and increasing, concern for insect conservation for which increasingly novel management will be needed (Chaps. 9 and 10). This book complements parallel treatments of two other major aspects of ‘threat’ in insect conservation, with similar ambiguities and varied opinions of balances between harm and conservation opportunity. Those others dealt with the roles of ‘fire’ (New 2014) and ‘urbanisation’ (New 2015) to summarise some of the recent increases in knowledge and understanding that contribute to effective environmental management for the maturing science of insect conservation, and appreciation of need for the discipline to continue to develop and contribute to safeguarding this most diverse animal component of non-marine biodiversity. I hope that the roles of invasive species and their effects on native insects, many of them locally endemic and highly vulnerable – so of fundamental conservation interest in addition to their ecological intricacies, may thus become understood increasingly by biologists and others on whom their fates depend.

Melbourne, Australia

Tim R. New

References

- Elton CS (1958) *The ecology of invasions by animals and plants*. Methuen, London
Lockwood JL, Hoopes MF, Marchetti MP (2007) *Invasion ecology*. Blackwell, Oxford
Mooney HA, Drake JA (eds) (1986) *Ecology of biological invasions of North America and Hawaii*. Springer, New York

- New TR (2014) *Insects, fire and conservation*. Springer, Dordrecht
- New TR (2015) *Insect conservation and urban environments*. Springer, Switzerland
- Prins HHT, Gordon IJ (eds) (2014) *Invasion biology and ecological theory. Insights from a continent in transition*. Cambridge University Press, Cambridge
- Richardson DM (ed) (2011) *Fifty years of invasion ecology: the legacy of Charles Elton*. Blackwell, Oxford
- Richardson DM, Pysek P (2008) Fifty years of invasion ecology – the legacy of Charles Elton. *Divers Distrib* 14:161–168
- Sanders NJ, Suarez AV (2011) Elton's insights into the ecology of ant invasions: lessons learned and lessons still to be learned. In: Richardson DM (ed) *Fifty years of invasion ecology: the legacy of Charles Elton*. Blackwell, Oxford, pp 239–251
- Simberloff D (1986) Introduced insects: a biogeographic and systematic perspective. In: Mooney HA, Drake JA (eds) *Ecology of biological invasions of North America and Hawaii*. Springer, New York, pp 3–26
- Veitch CR, Clout MN (eds) (2002) Turning the tide: the eradication of invasive species. In: *Proceedings of the international conference on Eradication of Island Invasives*, Occasional Paper no 27. IUCN Species Survival Commission. IUCN, Gland



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