

Debate



Biological invasions – the widening debate: a response to Charles Warren

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Biological invasions are widely recognized as a major threat to biodiversity worldwide and are the focus of intense research by ecologists and substantial, multifaceted management initiatives. The human dimension of invasions is crucial, and we are pleased to see invasions receiving increasing attention from human geographers. In a recent paper in this journal, Warren (2007) acknowledges that invasions are hugely problematic and undesirable, but he questions key assumptions upon which interventions to deal with such problems are grounded. Notably, he argues that the conceptual foundations of the ‘native/alien polarity’ seem ‘irredeemably fractured’.

As an alternative to categorizing species as native or alien, he advocates, but does not elaborate on, an approach based on a ‘damage criterion’.

We agree with some of his arguments and concerns, but Warren (2007) dangerously oversimplifies the full range of complex issues that confront researchers and managers dealing with biological invasions, and misrepresents both their operational premises and current *modus operandi*.

First, we concur with Warren that ‘we should not hate introduced species solely on the grounds of their attributed alien status’; that ‘exotic introductions are often woven

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into people's sense of place'; and that 'attempts to control or exterminate them can create acute moral tensions'. As Warren observes, human societies in most parts of the world rely on alien species to supply most of their food and many other essential resources, and most of these alien species are not invasive. However, even a cursory examination of the mainstream literature on biological invasions shows that researchers and managers working in this field are acutely aware of conflicts of interest that sometimes arise when alien species that are valued in their new ranges become invasive. Innovative means are being developed to incorporate these issues in sustainable management strategies. Xenophobes obsessed with eradicating all organisms that evolved somewhere else on the planet operate on the fringe of the conservation movement, as do those who link informed efforts to manage introduced species with xenophobia (Simberloff, 2003).

Second, several comments are in order in response to Warren's view that the 'native/alien polarity' is 'irredeemably fractured'. This is not a 'polarity' issue to invasion ecologists; 'native' and 'alien' are regarded as points on a continuum, rather than absolute poles (Pyšek *et al.*, 2004). We agree that boundaries between provenance categories are fuzzy in some cases. However, we have argued at length elsewhere that objective criteria for distinguishing native organisms from other categories of organisms moved to new habitats through human agency are, in most cases, both achievable and essential for the development of a scientific understanding of invasions and for developing sensible, objective management strategies (Richardson *et al.*, 2000; Rejmánek *et al.*, 2002; Pyšek *et al.*, 2004). Much of the current understanding of the mechanisms and principles of biological invasions – knowledge upon which management is built – would have been impossible without distinguishing native and alien organisms (eg, Lonsdale, 1999; Simberloff and Von Holle, 1999; Sax, 2001; Pyšek and Richardson, 2006). Unfortunately,

Warren (2007) considers none of these arguments. All introduced species must be considered potential invaders, since many lie dormant for years or decades, starting to invade and cause damage only when certain conditions for reproduction or spread are realized (Kowarik, 1995; Crooks, 2005). This is not to say that we must 'hate' them all, only that we must know which species in a given area are alien. The 'native/alien polarity' is not as important an organizing principle of conservation as suggested by Warren (2007) – to suggest this is to parody modern conservation biology.

Finally, we must comment on the 'alternative' approach advocated by Warren (2007), one focusing on a 'damage criterion'. Damage caused by invasive species is often delayed and difficult to quantify. Sometimes, the impacts are immediate, dramatic and obvious. In many cases, however, they are subtle and cryptic, and they may be revealed only after protracted lags, as noted above. Impacts are also very difficult to predict before they have already played out, a point conceded by Warren (2007). This is an area of active research and some progress in invasion biology, but prediction will never be perfect (Richardson and Pyšek, 2006; Lockwood *et al.*, 2007). Consequently, to base management decisions on perceived damage *only*, without objective considerations of the alien status of a species, is to increase greatly the risk of subsequent harm. Warren (2007) essentially suggests refraining from using a valuable indicator to predict invasions. A species' status as alien is one of the very few warning signs that conservationists can rely on to determine the likelihood of invasion and hence potential damage. Ecologists have long known that native species can become weedy (we prefer not to call such species 'invasive'; see Richardson *et al.*, 2000). For instance, the native grass *Elymus athericus* has recently spread in salt marshes throughout Europe (Valéry *et al.*, 2004), and many conifers are weedy in their native ranges (Richardson, 2006). Such dynamics can almost always

be traced to human-mediated changes to environmental conditions (eg, increased atmospheric nitrogen deposition for *Elymus*; fire suppression or altered grazing pressure for conifers). However, on a global scale, problems caused by such weedy native species are minuscule in comparison with those caused by alien species. It would be foolhardy to ignore this fact in assessing policy and management options for dealing with invasions.

Warren's proposed 'damage criterion' approach cannot be an 'alternative', but must be a 'complementary' tenet of sound approaches for dealing with biological invasions, along with the objective delimitation of native/alien status. Furthermore, there is nothing new about this approach. Such 'damage criteria' are already widely applied in prioritizing management of invasive *alien* species. Biological invasions are so pervasive that managers already pick their battles carefully – they focus efforts on those invaders deemed to have the most serious impacts and, increasingly, on those for which there is a good chance of reducing the impact. Objective techniques such as cost-benefit analysis (eg, Zavaleta, 2000) and formal decision analysis (eg, Maguire, 2004) are widely applied in formulating intervention strategies. These methods provide the means for integrating ecological, economic and social perspectives to arrive at sound management objectives.

In conclusion, the human dimensions of biological invasions, including many of the issues addressed by Warren (2007), are crucial (Le Maitre *et al.*, 2004). Humans cause invasions, humans perceive invasions, and humans must decide whether, when, where and how to manage invasions. But Warren's polemic is a red herring. In practical terms, it proposes nothing that is not already being done. He concedes that most conservation management already focuses on invaders that are damaging, including native 'invaders'. Worse, in the service of an apparent burning desire to reject invasion biology as passé and 'modernist' and to recast it on a 'postmodern'

philosophical footing, Warren (2007) depicts the entire field as dominated by an agenda that few of its practitioners would sanction.

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Alien concepts: a response to Richardson *et al.*

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I am grateful to Richardson *et al.* (this issue) for giving me the opportunity to re-emphasize what my paper does and does not say. When trespassing into interdisciplinary territory there is always a risk of ruffling feathers, but let me say at once that I have no ‘burning desire to reject invasion biology as passé’; that is a mistaken inference. In fact, the phrase ‘invasion biology’ appears nowhere in my paper. I am happy to defer to Richardson *et al.*’s expert knowledge of biological invasions, and appreciate their pointers to interesting literature which I had overlooked. The central question addressed in my discussion, however, is the validity of the concept of native and alien species. Whereas their focus is countering invasions, mine is a broader one of concepts and language. Clearly the two intersect but they are distinct. To some extent, therefore, our disagreements are more apparent than real.

Nevertheless, it is surprising that Richardson *et al.* mount such a vigorous defence of the alien/native framework when biologists themselves, among many others, have been pointing out its numerous flaws for so long. While they and I concur in viewing ‘native’ and ‘alien’ as points on a continuum, they argue that objective criteria

exist that enable native and alien species to be unambiguously and consistently differentiated (at least ‘in most cases’). For the reasons spelled out at length in my paper, I continue to maintain that any such line-drawing along a continuum involves unavoidably arbitrary spatio-temporal choices. This does not mean that the differentiation criteria are not useful in the practical and urgent fight against invasive species, simply that claims to scientific objectivity are unjustified. Indeed, it seems unnecessary to make such claims when there are such powerful socio-economic and conservation arguments for countering biological invasions. In particular, it is the label ‘alien’ that is so problematic. Is anything lost by using less loaded, more quantifiable terms such as ‘invasive’ and/or ‘damaging’? As Richardson *et al.* acknowledge, invasiveness is not uniquely the preserve of introduced species; natives can be invasive too, and it is surely invasions that are the issue, not slippery classifications of origins. Continuing to use the useful criterion of human introduction as a predictor of invasive potential does not depend on maintaining the flawed conceptual edifice of ‘native and alien’.

The passion with which Richardson *et al.* seek to defend these concepts undermines

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their assertion that the native/alien distinction is not a critical organizing principle of conservation, and it is a surprising claim given the extent to which conservation activity focuses energetically on native species. They seek to dismiss my discussion as a red herring, claiming that it proposes nothing new. On

the contrary, it proposes the abandonment of the prescriptive labelling of species as native and alien on the grounds that these terms are inescapably arbitrary, used inconsistently and are tainted with troubling associations. It implies, in fact, that if there is a red herring it is the native/alien framework itself.