

# Assisted colonization: good intentions and dubious risk assessment

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Assisted colonization is an issue that merits greater scrutiny, and skepticism, than it has received thus far, and so we hope that this debate continues. The letters received in response to our recent article [1] reflect not only the fervor of the debate but also a tendency (for those who advocate the use of assisted colonization) to underestimate the risks of invasion and overestimate ecologists' ability to forecast those risks. Some proponents have begun to use the term 'managed relocation,' perhaps because it sounds less active and therefore more innocuous, but it is another synonym to describe the process of moving species into regions in which they have never previously occurred.

Schlaepfer *et al.* [2] suggest that we have overstated the probability that translocated organisms will harm native species. They claim that if our analysis of mammal data [1] had included translocations within a species' former range, it might have lowered the overall frequency of adverse impacts. Indeed, it might have done, because the recipient communities would have had evolutionary experience with the translocated species. As stated in our article [1], our concern is with the introduction of exotic species (i.e. species moved outside their natural range) rather than the reintroduction of species into ranges that they occupied in the recent past.

Schlaepfer *et al.*'s second criticism [2] is that our analysis inflates impacts because it includes reports based on anecdotal or correlative evidence. This problem is not, as they imply, uniquely characteristic of non-native species; it is also true for impacts attributed to other stressors, such as habitat alteration. Nevertheless, the best available evidence suggests that mammal and other species introductions have had a major role in animal extinctions worldwide (e.g. [3,4]).

Finally, Schlaepfer *et al.* criticize our analysis because we scored the most extreme impact (rather than the mean impact) observed among multiple introductions of a given species. However, the effects of most introductions are not even documented [5,6], and this absence of evidence does not imply absence of impact. The ecology of most invaded systems has been so little studied that it is impossible to assert with much assurance that most introductions have been harmless. The mean scores that would result from averaging over so many potential false negatives would underestimate impact potential. Schlaepfer *et al.* ignore this problem when they emphasize that 85% of intracontinental mammalian translocations in our data set had no reported impacts on native species populations, even though there

are good theoretical reasons to expect conservation problems to have arisen from such translocations [6].

Sax *et al.* [7] also downplay the negative consequences of invasions, observing that 'many exotic species provide important ecosystem services.' Unfortunately, many also disrupt important ecosystem services [8], and it is difficult to anticipate how most translocated species will act in this regard. Sax *et al.* emphasize that introduced plants, in particular, are rarely observed to cause extinctions. We agree, but the macroecological studies that they cite tell us nothing about how often, and to what extent, introduced plants reduce the populations of native species worldwide, because such data are not available. By contrast, there are ample data to demonstrate that introduced plants can extensively modify habitats (e.g. soil chemistry or hydrology), alter ecosystem processes (productivity, nutrient cycling, soil development and disturbance regimes) and hybridize with natives and other exotic species [5,8,9].

Vitt *et al.* [10] claim that assisted colonization 'should be undertaken only if a species is not capable of natural migration, plastic response or adaptation *in situ*.' We wonder how this would be determined. We do not question their desire for careful evaluation of the issues surrounding the use of this strategy or their deep commitment to the preservation of evolutionary lineages, but we suspect that many planned introductions that led to disasters in the past were carried out by similarly well-intentioned individuals.

We agree that fewer impacts would result from assisted colonizations involving short-distance intracontinental dispersal if the dispersal does not cross boundaries of evolutionary significance (*sensu* Ref. [6]). We also agree with Sax *et al.* [7] and Schwartz *et al.* [11] that the precautionary principle is, by itself, a weak reason to preclude conservation action. Furthermore, we concede that assisted colonization is not likely to be detrimental in all situations. However, it poses potentially great and largely incalculable risks, and we share Fazez and Fischer's view [12] that the widespread implementation of this strategy would interfere with, and divert resources from, habitat restoration and other conservation efforts.

In conclusion, we welcome these thoughtful comments, but they provide little evidence to refute our contention [1] that ecologists have not yet developed a sufficient predictive understanding of impact to engage safely in widespread species translocations. It is commonly assumed that a 'nuanced' analysis of the risks and benefits of assisted colonization is feasible. However, the burgeoning literature on invasions suggests that this view is misguided. Impacts

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of introduced species might be understood after they have happened, but forecasting their occurrence, scope and magnitude is fraught with difficulty. As such, we believe that the problem of uncertainty surrounding risk assessments of species translocations has been grossly underrated in this debate. At present, it is not possible to estimate accurately the likelihood of ecological harm with translocation or the likelihood of extinction without it. Risk scores can be obtained using a variety of algorithms and decision frameworks, but they are not necessarily trustworthy and could be misleading. Given the spatial and temporal context dependence of impacts [5,13] and the complexity of indirect and cumulative effects [14] of introduced species, it is naïve to assume that current risk assessment tools are adequate for anticipating undesirable consequences that might ensue from planned invasions.

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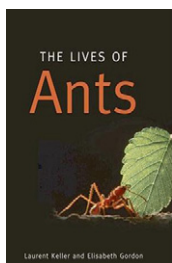
### Book Review

## Galaxies of the ants

**The Lives of Ants** by Laurent Keller and Elizabeth Gordon. Oxford University Press, 2009. £14.99 hbk (272 pages) ISBN: 978 0 19 954186 7

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*The Lives of Ants*, written for a popular audience, covers ant behavior, ecology and evolution in a lively way. Topics include ant diversity, the social organization of colonies, detailed accounts of species with interesting ecology, the evolution of eusociality through kin selection, some of Keller and colleagues' recent work on ant genetics, and the use of ant models in robotics. There is also a section of wonderful photographs, taken mostly by Alex Wild. The book emphasizes the work of Europeans, a refreshing change for the small field of myrmecology, which has been so dominated by American researchers.

*The Lives of Ants* is written from inside a universe where we already know everything we need to know – the universe yearned for, some believe, by the 'educated lay person' who buys books about science. The authors take the upbeat tone of tour guides, showing the uninitiated the delights of ants.

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However, reading the book as a scientist who inhabits a universe where we still have much to learn, I sometimes

found that the results of studies were reported incorrectly or a controversial interpretation was stated as although it were fact. Although the inaccuracies were small, more important are the broad claims that are so simplified that they end up being wrong; for example, that invasive species succeed because they are 'faster and better at finding food'. This might be why some invasive species do thrive in some places, but it is not clear how we could demonstrate this and it is certainly not the case that it is always true. Sometimes, the reader is asked to gloss over complicated ideas. For example, in the discussion of the genetics of behavior, a paragraph of caveats about the role of environment in determining behavior is followed by 'All that said, facts are facts', by which we are meant to understand that genes determine behavior. But what are the facts, exactly?

The translation from the French is awkward in places, and the attempt to be catchy sometimes leads to excesses of cuteness. For example, 'Nowt so rum as ants!' is the perky title of a section that begins 'Every society has its outstanding personalities, its stars, who swagger through life and are made much of. The galaxies of the ants are no exception, for they too have their stars, extraordinary luminaries with original ways of doing things and antics that prove very attractive to myrmecologists'. Perhaps in

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