

Demilitarizing invasion biology

Larson (*Front Ecol Environ* 2005; 3(9): 495–500) argues that scientists need to change their terminology when discussing alien species, so as to reduce military associations. He believes that militaristic terminology promotes misunderstanding by the public and encourages counterproductive militaristic policies against invasive species. While Larson's idea strikes a chord among many of us who disdain militarism, in particular when applied to environmental issues, a deeper examination suggests that his assertion is misdirected and actually promotes a non-scientific approach to the alien species problem.

First, it should be pointed out that militaristic terminology is common in the pest management lexicon and is by no means limited to discussions of invasive species. For example, brand names used by chemical companies (eg "Combat", "Warrior", "Ambush") reflect the violent and militaristic way that pest management is often marketed. Even in the scientific literature, the term "insect enemy" is used as a synonym for insect pest and "natural enemy" refers to a biological control agent. The concept of fighting insects through war is not unique to alien species and has existed for many years; Leland Howard, Chief of the USDA Bureau of Entomology (1894–1927), was perhaps the greatest proponent of war metaphors in pest management (Edmund 2001). In his autobiography, *Fighting the insects*, Howard (1930) argued that insects posed a threat to society and warranted a response by the government comparable to the Great War. I share Larson's dislike of military metaphors and regret such usage to "sell" pest management to the public, while obscuring ecological complexities.

Superficially, Larson's paper justly criticizes the war metaphor, but I was disturbed by his more subtle but pervasive critique of the use of eradication as a strategy for mitigating invasions. In most of the invasion biology

literature, eradication is considered a feasible strategy for eliminating species, as long as populations are detected in the early stages of establishment, but this is misrepresented in his paper. In one example, Larson objects to the use of helicopters by the National Park Service for eradicating exotic rat populations because it "can be interpreted as both a symbolic and a technological act of war", yet he fails to identify a practical alternative. Exotic rats are a common cause of extinction in island populations (Blackburn *et al.* 2004) and their successful eradication, in this example from Anacapa Island, breathes new life into efforts to preserve endangered shorebird populations.

While there is no shortage of examples of ill-fated eradication attempts, there have also been many success stories involving the removal of exotic species, thereby preventing severe impacts and/or environmental damage associated with their post-establishment management (see Krajick [2005] for a recent summary). In addition, there is scientific literature that can be used to predict when and where eradication is likely to be a viable option (eg Sharov and Liebhold 1998). I hope that government agencies make decisions about eradication programs based mainly on conservation science rather than solely on symbolic appearances.

There is little doubt among most ecologists that biological invasions represent one of the greatest threats to the stability of the world's ecosystems. However, Larson's paper points us in the wrong direction by advocating resignation rather than providing suggestions for feasible, proactive approaches. Surely it is possible to educate the public about the appropriate use of intervention, including eradication, when necessary. Instead of focusing exclusively on superficial appearances of management programs, we should be concentrating on how we can improve strategies to exclude and eliminate (when possible) invaders that threaten to permanently destroy the stability of the world's biota.



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- Blackburn TM, Cassey TM, Duncan RP, *et al.* 2004. Avian extinction and mammalian introductions on oceanic islands. *Science* 305: 1955–58
- Edmund R. 2001. War and nature: fighting humans and insects with chemicals from World War I to Silent Spring. Cambridge, UK: Cambridge University Press.
- Howard LO. 1933. Fighting the insects. New York, NY: The Macmillan Company.
- Krajick K. 2005. Winning the war against island invaders. *Science* 310: 1410–13.
- Sharov AA and Liebhold AM. 1998. Bioeconomics of managing the spread of exotic pest species with barrier zones. *Ecol Appl* 8: 833–45.

The author replies

I thank Dr Liebhold for his response to my article. I want to emphasize that I did not advocate resignation, but stated specifically that we don't need to give up. In fact, I believe that recent scientific critiques of invasion biology go too far (see Brown and Sax 2005), particularly in their limited conception of values within science (Larson, in prep). My paper was meant to encourage critical reflection rather than undermine passionate beliefs about invasive species.

Unfortunately, Liebhold's letter didn't address the main points in my paper, concerning our adherence to militarism despite its liabilities. As ecologists, we have valid concerns about biodiversity loss due to invasive species, but it is insincere to hide our values with misleading language. Gobster (2005) reviews social problems resulting from "fear-based" communication about invasion biology, and advocates reframing it as a restorative and "hope-filled enterprise". Such alternatives need to be discussed, since ecologists depend on taxpayers for their

funding. While I hope that government agencies make decisions in part based on sound science, I also hope that more ecologists will become aware of the pivotal role of “symbolic appearances” in this process. Though politicians use comparable “appearances” to gain support for their policies, ecologists should be more forthright.

I was intrigued by the notion of a “non-scientific approach” because of the problems in Liebhold’s claims. For example, I’m not convinced that eradication is necessarily “scientific”, and would query whether the illusion of militaristic victory that it provides accounts for the disproportionate attention it receives (Puth and Post 2005). The shorebirds of concern on Anacapa Island are not endangered (www.fws.gov/angered), though one could easily conclude so from the eradication literature (see also Russell *et al.* 2005). Finally, we would need some evidence for the implied poll of what ecologists think, but I suspect many would be skeptical of the apocalyptic claims about stability (see Brown and Sax 2005; Didham *et al.* 2005). My paper was simply meant to demonstrate these and other ways in which invasion biology is influenced by unwarranted assumptions, particularly militaristic ones. Ultimately, we require empirical evidence for the effectiveness of how we present invasive species and I hope to have stimulated such research.

We live in a militaristic culture, at a militaristic time, so it is difficult to perceive invasive species creatively. I find comfort in neither the continued reign of a mentality from the 1920s nor in the interweaving of military and pest management technologies. We could relate to these species in other ways. Heberlein (2005), for example, discovered that the Swedes do not even have a word for “management” of wildlife, instead adopting a less control-oriented attitude of caretaking. Unfortunately, there is no easy way to evaluate invasive species, for they are simultaneously natural entities and human creations. Of one thing I am certain – this too will pass, and we will become more accepting of most invasive species. As FH Bormann wrote in

the November 2005 issue of *Frontiers*, “There are mysteries at work [in nature], and we are a part of them”, so we need to “develop human enterprise designed to work with nature and not against it”.

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- Brown JH and Sax DF. 2005. Biological invasions and scientific objectivity: reply to Cassey *et al.* (2005). *Austral Ecol* 30: 481–83.
- Didham RK, Tylanakis JM, Hutchison MA, *et al.* 2005. Are invasive species the drivers of ecological change? *Trends Ecol Evol* 20: 470–74.
- Gobster PH. 2005. Invasive species as ecological threat: is restoration an alternative to fear-based resource management? *Ecol Rest* 23: 261–70.
- Heberlein TA. 2005. Wildlife caretaking vs wildlife management – a short lesson in Swedish. *Wildlife Soc Bull* 33: 1–3.
- Puth LM and Post DM. 2005. Studying invasion: have we missed the boat? *Ecol Lett* 8: 715–21.
- Russell JC, Towns DR, Anderson SH, and Clout MN. 2005. Intercepting the first rat ashore. *Nature* 437: 1107.



Time for international policies on biological invasions

One of the most important environmental threats our planet faces is intercontinental biological invasions. Invasions influence the health of our planet, altering soil properties, ecosystem function, agriculture, conservation, and human health. The approximate economic impact of the roughly 120 000 exotic species (fewer are truly invasive) in Australia, Brazil, India, South Africa, the UK and the US is US\$314 billion per year (Pimental *et al.* 2000). Perhaps of even greater concern is the threat invaders pose to conservation. We can protect ecosystems from development and destructive human activity with policies, but we cannot currently protect ecosystems from biological invasions – exotic species have reached the most remote

corners of Earth, including Antarctica and the Galapagos Islands (Rejmanek 2005). Like economy, disease, and terrorism, biological invasions have escaped regional control and become a global issue. The implementation of national policies, such as President Clinton’s executive order on invasive species (Order 13112, 3 February 1999), is important, but there are no existing *international* policies for biological invasions. Several Acts introduced in the US, such as the National Aquatic Invasive Species Act and the National Wildlife Refuge Assessment, address exotic species invasions and serve as potential models for international policy, but in most parts of the world even national and regional policies concerning biological invasion do not exist. In India, for example, which is rapidly becoming a driver of the global economy, awareness of biological invasions is lacking among the general public and politicians.

International policies can promote research on invasion by generating scientific exchange programs between countries that also exchange invasives, by streamlining the processes by which organisms from different areas of the world can be studied comparatively, and through exchange of technologies for ecological restoration. Invasion prevention will also benefit from globally organized and implemented joint scientific and political efforts. Besides focusing on the science of ecology, new policies must include societal decisions, economics, policy decisions, planning, and education (Davis and Slobodkin 2006). The battle against exotic invasions is a multi-step process that includes mapping of species distribution, understanding the basic ecology of species, estimating their economic impacts, implementing appropriate control methods, and restoring areas where invaders have been eliminated. Coordination of efforts between countries will help to avoid expensive duplication of effort and will reduce costs by focusing *local* scientific attention on data collection.

While there is already considerable international collaboration among scientists studying invasions, interna-