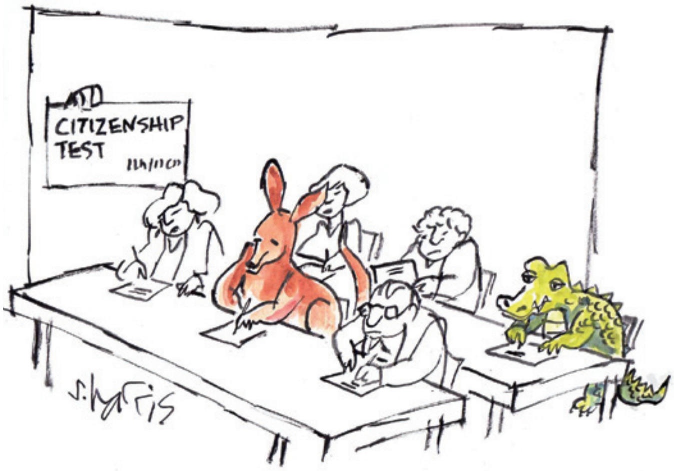
CORRESPONDENCE



Non-natives: 141 scientists object

We the undersigned feel that in advocating a change in the environmental management of introduced species (*Nature* **474,** 153–154; 2011), Mark Davis and colleagues assail two straw men.

First, most conservation biologists and ecologists do not oppose non-native species per se — only those targeted by the Convention on Biological Diversity as threatening "ecosystems, habitats or species". There is no campaign against all introductions: scarcity of resources forces managers to prioritize according to the impact of troublesome species, as in the Australian Weed Risk Assessment.

Second, invasion biologists and managers do not ignore the benefits of introduced species. They recognize that many non-native species curtail erosion and provide food, timber and other services. Nobody tries to eradicate wheat, for instance. Useful non-native species may sometimes still need to be managed because they have a negative impact, such as tree invasions that cause water loss in the South African fynbos.

Davis and colleagues downplay the severe impact of non-native species that may not manifest for decades after their introduction — as occurred with the Brazilian pepper shrub (*Schinus terebinthifolius*) in Florida (J. J. Ewel in *Ecology of Biological Invasions of North America and Hawaii* (eds H. A. Mooney and J. A. Drake) 214–230; Springer, 1986). Also, some species may have only a subtle immediate impact but affect entire ecosystems, for example through their effect on soils.

Pronouncing a newly introduced species as harmless can lead to bad decisions about its management. A species added to a plant community that has no evolutionary experience of that organism should be carefully watched.

For some introductions, eradication is possible. For example, 27 invasive species have been eradicated from the Galapagos Islands, mitigating severe adverse effects on endemic species. Harmful invasive species have been successfully kept in check by biological, chemical and mechanical means.

The public must be vigilant of introductions and continue to support the many successful management efforts.

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Non-natives: put biodiversity at risk

Bias against non-native species is not xenophobic (*Nature* **474,** 153–154; 2011) — it has a sound scientific foundation.

The non-native status of a species is highly relevant to assessing its potential environmental and economic impact. Unrestrained growth and environmental damage follow when there are no natural enemies in newly colonized areas. This is not necessarily a sign of an invader's superior evolutionary fitness: it may lead to a population collapse due to overexploitation of resources.

Non-native species can increase the variety of species in a community, but it is an oversimplification to equate this with increased biodiversity, of which species richness is only one component. Surviving populations of native species may shrink or become restricted to poor-quality marginal habitats. Such unevenness hardly contributes to a more diverse community.

The genetic diversity of invaded communities may decrease because of bottlenecks: native genotypes disappear as populations fall, whereas the invaders originate from very few initial colonizers.

Establishment of non-native species inevitably decreases global diversity. Australia, for example, was unique in having no placental mammals; their introduction by humans made the continent ecologically more similar to the rest of the world.

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Non-natives: plusses of invasion ecology

Contrary to the implications of Mark Davis and colleagues (*Nature* **474,** 153–154; 2011), invasion ecology has given us valuable insight into the effects of new species on ecological function and into some of the precipitous changes we may face in the coming decades.

Invasion ecologists generally assert that only a very small fraction of non-native species harm their new ecosystems. This position emerged as early as 1986 and was mainstream in the era that Davis and colleagues claim as the nadir of ecological nativism.

It is unfair to characterize any scientific discipline solely by past failures and to ignore its successes. Invasion ecology is making real progress with defining impact and characterizing risk. Let's not throw up our hands in despair just yet.

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Non-natives: four risk factors

Mark Davis *et al.* set an unrealistically high bar for those making management decisions about exotic species (*Nature* **474,** 153–154; 2011). Control is often easier, cheaper and more effective soon after detection (R. A. Haack *et al. Annu. Rev. Entomol.* **55,** 521–546; 2010). We agree that research on ecosystem impact is necessary, but such studies can take years.

Meanwhile, we suggest that

control priorities for potential invasive species could be based on easily available data about natural history and evolutionary ecology. We propose four guidelines for identifying such invasives.

An exotic organism may be more likely to invade and cause disruption the greater its rate of reproduction; the greater its dispersal ability; the closer (phylogenetically) its preferred food in its native range is to an abundant taxon in the new range; and the farther away (phylogenetically) its predators and pathogens are in its native range from those in its new range.

For example, the red turpentine beetle (*Dendroctonus valens*) is not particularly disruptive in its native range in North America because it attacks only trees that are already weakened. In China it attacks and kills healthy trees (Z. Yan *et al. Biodivers. Conserv.* **14,** 1735–1760; 2005). The reasons for this beetle's success as an invasive include its high dispersal and reproductive rates, its affinity for Chinese pines closely related to those it feeds on 'at home', and the lack of predators or pathogens phylogenetically similar to ones found in North America.

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UK cancer genetics gets personal

There is a promising way in which personalized medicine can be incorporated into health-service infrastructure (*Nature* **473,** 253–254; 2011). In the United Kingdom, the charity Cancer Research UK is leading a partnership with AstraZeneca, Pfizer and the government's Technology Strategy Board to help the National Health Service to adopt a consistent approach to genetic testing for targeted cancer therapies, and to promote further research into personalized treatment.

The first phase will run from 2011 to 2013 and cost £5.5 million (US$8.8 million). The programme will model the processes required for routine testing of tumour molecular characteristics and for secure storage and retrieval of molecular and clinical data for research. It will involve seven Experimental Cancer Medicine Centres and 9,000 patients with one of six tumour types: breast, colorectal, lung, prostate, ovary and metastatic melanoma. Up to 22 mutations will be tested, with the aim of harmonizing practices across the centres and labs.

The second phase will establish a molecular diagnostics service to deliver high-quality, standardized tests for patients nationwide and to obtain routine consent for the collection, storage and research use of data on genetics, treatments and outcomes. The long-term strategy includes the flexibility to accommodate new technologies, other cancer types and other disease areas.

Cancer Research UK is in discussion with similar initiatives in the United States, France, Australia and elsewhere to exchange information on mistakes and successes.

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Nuclear winter was and is debatable

Alan Robock's contention that there has been no real scientific debate about the 'nuclear winter' concept is itself debatable (*Nature* **473,** 275–276; 2011).

This potential climate disaster, popularized in *Science* in 1983, rested on the output of a one-dimensional model that was later shown to overestimate the smoke a nuclear holocaust might engender. More refined estimates, combined with advanced three-dimensional models (see go.nature.com/kss8te), have dramatically reduced the extent and severity of the projected cooling.

Despite this, Carl Sagan, who co-authored the 1983 *Science* paper, went so far as to posit "the extinction of *Homo sapiens*" (C. Sagan *Foreign Affairs* **63,** 75–77; 1984). Some regarded this apocalyptic prediction as an exercise in mythology. George Rathjens of the Massachusetts Institute of Technology protested: "Nuclear winter is the worst example of the misrepresentation of science to the public in my memory," (see go.nature.com/yujz84) and climatologist Kerry Emanuel observed that the subject had "become notorious for its lack of scientific integrity" (*Nature* **319,** 259; 1986).

Robock's single-digit fall in temperature is at odds with the subzero (about −25 °C) continental cooling originally projected for a wide spectrum of nuclear wars. Whereas Sagan predicted darkness at noon from a US–Soviet nuclear conflict, Robock projects global sunlight that is several orders of magnitude brighter for a Pakistan–India conflict — literally the difference between night and day. Since 1983, the projected worst-case cooling has fallen from a Siberian deep freeze spanning 11,000 degree-days Celsius (a measure of the severity of winters) to numbers so unseasonably small as to call the very term 'nuclear winter' into question.

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All-male line-up yet again

Most prestigious prizes in science that are not set aside for women go primarily or only to men. The eight male 2010 Kavli prizewinners in astrophysics, nanoscience and neuroscience are the most recent examples (see go.nature.com/5xh17n).

The Kavli winners are accomplished and deserve their honours. But the frequency of all-male line-ups, and the number of meritorious women, indicates that women as a group are disproportionately overlooked. Why?

Gender schemas — cognitive structures that summarize our beliefs about the sexes — portray women primarily as nurturing and communal, and men as capable of independent action and work-oriented (V. Valian *Why So Slow? The Advancement of Women*; MIT Press, 1998). Such schemas mean that women's names are unlikely to come to nominators' minds; if women are considered, they are less likely than men to be perceived as prizeworthy (see also *Nature* **469,** 472; 2011).

Prizes matter in part because young women with scientific abilities and interests are more likely to aim high if they see examples of women receiving top awards. Why stay in a field where you have little chance of recognition? We are squandering the abilities of half the human race.

Prize committees need to learn where, how and why our perceptions give men an edge. Committees also need actively to solicit nominations of women and members of under-represented groups. Few guidelines, including those for the Kavli prize, include such encouragements. It is time to stop this cycle of neglect of outstanding women in science.

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CORRECTIONS

An editing change (T. Leitner *et al. Nature* **473,** 284; 2011) confused the point that phylogenetic experts should formulate an a priori hypothesis based on HIV epidemiological information.

B. Bosquet (*Nature* **474,** 36; 2011) notes that Cameroon's REDD Project Idea Note was prepared with the WWF's full support. *Nature*'s headline was not intended to undermine efforts by governmental and non-governmental organizations.

Supplementary information to: Non-natives: 141 scientists object

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