

**Section:** Science and Society

**Title:** The Rise of Invasive Species Denialism

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**Trends**

- Perceived impacts of invasive species depend on both evidence and values
- Evidence for invasive species impacts is increasingly being challenged
- The motivation for challenging impacts can depend on underlying values
- Invasion biologists should report evidence while acknowledging values

**Abstract**

Scientific consensus on the negative impacts of invasive alien species is increasingly being challenged. Whereas informed scepticism of impacts is important, science denialism is counter-productive. Such denialism arises when uncertainty on impacts is confounded by differences in values. Debates on impacts must take in to account both the evidence presented and motivations.

**Text**

Invasive alien species (IAS) are defined by their negative impact for which there is such an overwhelming body of global evidence [1] that IAS now rank as one of the major challenges to biodiversity conservation of our time. Reporting on invasive species and their threats is increasingly found in the mainstream media and literature. At first, this coverage reflected the scientific orthodoxy that IAS have negative biodiversity, social and economic impacts. More recently, however, many of these stories, sometimes in high profile media

outlets (e.g. The Economist<sup>1</sup>, New Scientist<sup>2</sup> and the New York Times<sup>3</sup>) or books<sup>4,5</sup>, have challenged the existing scientific consensus on IAS. In some cases the scientific evidence and consensus on the impact of IAS has been mis-interpreted and mis-represented. Although many of these challenges have come from lay-people, scientific journal opinion pieces [2] and books [3] written by ecologists have also attempted to re-frame, downplay, or even deny, the role of IAS in global change [Box 1]. Here, we outline how disagreement over the impacts of IAS can arise from both the interpretation of evidence and underlying motivating values. Where evidence is disregarded, or motivations are disingenuous, arguments against IAS take a form of science denialism. We hope to inform ecologists how better to identify invasive species denialism and to engage in progressive arguments to further invasion biology.

### **Box 1: Arguments against IAS**

Opposition to policy and action on invasive species has recently emerged, often attempting to re-frame the debate [4]. Impact is narrowly defined only as extinction, when that is actually an acute extreme end-point of a wide range of more subtle and chronic impacts attributable to IAS [5]. Although IAS might increase local and regional species richness, the extinctions for which they are responsible cause global species richness to be reduced much faster than it is recovered.

Some opponents argue that the debate should be about species effects exceeding a damage threshold, rather than species origin. However, the definition of an IAS itself depends on exceeding a damage threshold, while recognising that impacts [6], and the ethical duties of humans [7], differ between native and alien species. Some authors have suggested that the future of environmental management should involve acceptance of alien species in ‘novel ecosystems’, rationalising defeat or conciliation as the morally acceptable course of action [8]. Nevertheless, although in many cases it might not be possible to reverse the effects of IAS, this still does not ethically legitimise capitulation as a course of action [7], any more than it would for climate change or deforestation.

### ***Defining Impacts***

The IUCN defines IAS as “*introduced by man [sic] into places out of their natural range of distribution, where they become established and disperse, **generating a negative impact***” (our emphasis). Determining the negative impact of IAS depends on both objective scientific evidence alongside subjective value definitions of impact. Disagreement over impacts, and hence classification of an alien species as an IAS, can thus arise from either differing interpretations of the evidence, or underlying values. However, it might not always be clear which of these is the primary motivator for dissent. Further disagreement can arise from other

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<sup>1</sup> <http://www.economist.com/news/international/21679447-nobody-likes-interloper-invasive-species-are-more-benign-generally> and <http://www.economist.com/news/leaders/21679471-most-campaigns-against-foreign-plants-and-animals-are-pointless-and-some-are-worse>

<sup>2</sup> <https://www.newscientist.com/article/mg22730372-000-invasive-species-caused-nearly-half-of-extinctions-its-hearsay/>

<sup>3</sup> <http://nytimes.com/2016/03/01/science/invasive-species.html>

<sup>4</sup> Orion, T. (2015) *Beyond the war on invasive species: a permaculture approach to ecosystem restoration*. Chelsea Green Publishing.

<sup>5</sup> Pearce, F. (2015) *The new wild: why invasive species will be nature's salvation*. Icon Books.

definitions of IAS which do not always include an explicit statement about impact; determining that species might be invasive because of a wide distribution without observed negative impacts, or not yet widely spread enough to generate impacts. In these cases doubt can exist over the current evidence for perceived negative impacts, and it necessarily exists over negative impacts yet to eventuate. This can further cloud the legitimacy of distinguishing invasive from other alien species.

Scientific evidence always contains an element of uncertainty, which will continuously play a role in valid research and debate over the impacts of IAS. Even if IAS are in the minority of alien species, these uncertainties precisely necessitate that a precautionary approach to all alien species is still warranted [9]. However, the additional component of a value definition of negative impacts in IAS can create disagreement outside the scope of science of what does and does not constitute an IAS. Such differences in values can be capitalised on by those who might want to challenge the case for the impact of IAS for a variety of motivations. In some cases, the rejection of scientific evidence of the negative impacts of IAS takes the form of a type of science denialism.

### ***Debate and Denialism***

Science denialism is the rejection of undisputed scientific facts. Denialism differs from scientific debate, which arises from uncertainty implicit in the scientific method. Ideas that survive and become accepted parts of the body of scientific knowledge do so because they are yet to be falsified, or at least provide the most likely explanation that is consistent with the existing body of scientific knowledge. The scientific process relies upon informed scepticism and challenges by bold scientists to the prevailing consensus (e.g. the heliocentric model, Darwinian evolution, plate tectonics), but these challenges succeed because the new ideas provide a better or more parsimonious explanation of observations. In contrast, denialism attempts to manufacture uncertainty in the scientific consensus on an otherwise undisputed topic (e.g. the risks of tobacco smoking or immunisation, the causes of AIDS or climate change, evidence for evolution), exploiting the fact that all scientific knowledge contains an element of uncertainty. This can lead to journalists presenting consensus and contrarian alternatives as ‘balanced’, ignoring the fact that the weight of evidence is heavily in favour of the former, and conflating debates about policy responses with debates about the supporting science [10].

Science denialism typically originates from groups with a vested interest in opposition to the scientific consensus, and is often characterised by downplaying the scope of a threat. It often arises when science enters the policy arena, and policy outcomes threaten to impact upon the freedoms or behaviours of others. It is therefore probably no coincidence that the original challenges to the orthodoxy of invasion biology came from outside science [11]. Although no formal studies of invasive species denialism exist, research into other domains of denialism finds that deniers typically consistently reject scientific evidence on a range of different topics, and that there is a strong correlation with support of free-market ideologies, such as laissez faire regulation [12]. Invasion biologists regularly call for increased regulation and restrictions on species transportation, translocation or trade, in response to the current and future threat of invasive species [9]. It is therefore not surprising that the tenets of invasion biology and policy are also rejected in a framework of science denialism. Such invasive species denialism is likely to become even more prominent with the growing efforts to address the threats posed by IAS, and is likely to come from the same types of sectors that oppose climate change in a denial framework.

## *Moving Forward*

The emergence of the discipline of invasion biology has been productive scientifically [13], but for many reasons has struggled to translate into meaningful action towards IAS remediation or prevention, particularly for nation-states on continents where the challenges can be overwhelming [1]. The role of IAS as global change drivers can be uncertain and subjective, critically relying on the definition of impact, but denying evidence of impacts is not helpful to developing meaningful policy.

Addressing the challenges of IAS and resolving conflict in their management will require adopting frameworks from other areas of conservation conflict which invoke appropriate social science and stakeholder processes alongside the natural sciences [14]. Meanwhile, the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) now provides an analogue to the Intergovernmental Panel on Climate Change (IPCC) to address the major challenges facing biodiversity. International meetings such as the Convention on Biological Diversity (CBD) now explicitly include IAS, such as in the 2020 Aichi targets. The EU has recently adopted legislation to deal with the threat from a small number of IAS. Individual governments recognise the need to deal with some IAS, and eradication of IAS is increasingly gaining currency as a conservation action [15].

The recent rise in IAS scepticism and denialism is alarming, especially when coming from both popular and scientific quarters, but reflects both scientific uncertainty and underlying motivations and values. Ultimately, this characterises a broader discourse emerging on the role of IAS in global change. Invasion biologists should be prepared to respond to challenges to their evidence and discipline [Box 2]. A comparable rise in dissenting voices was also observed in emerging climate change dialogue a decade earlier [12], and in general such vocal, public debates on perceived threats characterise an acknowledgment and mainstreaming of the scope of the problem. There should be a vibrant and robust dialogue on the negative and potentially also any positive impacts of IAS and on the allocation of resources to remediate their diverse threats. However, such a discussion should be evidence-based, and not disrupted by appeals to values or denial of the magnitude of the threat. We believe it is imperative that invasion biologists engage constructively and lead on such discussions, reporting the most current scientific evidence available while acknowledging that values also contribute to the definition and management of IAS.

### **Box 2: Responding to IAS denialism**

For those faced with science denialism, general guidelines on engaging in a public discourse are available [8]. Three broad types of response are recommended: (i) engage the criticisms but shift debate from questions of scientific fact to questions of policy response, (ii) do not deny scientific uncertainty where it exists as a natural part of scientific advancement, but do not overstate it, and (iii) emphasise evidence where scientific controversy is being manufactured to manipulate policy outcomes e.g. [16]. Specific responses to some of the commonly levelled criticisms of invasion biology are also available [4].

Scientists should be encouraged to publish opinion pieces on important topics, where their extensive knowledge in an area of expertise best places them to communicate complex scientific ideas and evidence to the public or policy-makers and where appropriate raise scepticism. At times it may even be valuable for scientists to be contrarian where it offers the opportunity validly to challenge scientific paradigms. However, in doing so scientists must be

mindful of their own underlying motivations and values which all people hold, and distinguish scientific evidence from values in their arguments.

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