Reducing Invasive Species Establishment in the U.S. Via the Pet and Horticulture Trades

Sonia Howlett

In a Tortoiseshell: *In this excerpted introduction from Sonia's research paper for a Conservation Biology course, she examines the threats posed by invasive species and past approaches taken to combat these threats. Working with an array of sources and studies, she proposes a prevention strategy of her own. This introduction is concise and effective, showcasing the necessary interplay of* ***motive****,* ***orienting****, and* ***argument****.*

Excerpt

With the rise of international trade and commerce, invasive species have become a major global economic and environmental threat. Invasive species are one of the most common causes of species extinctions, second only to habitat degradation, and are a recognized cause of endangerment to approximately 42% of the species listed as threatened or endangered under the Endangered Species Act (Wilcove et al. 1998; Clavero & García-Berthou 2005). An estimated 50,000 foreign species have been introduced to the United States and are estimated to cost over $120 billion annually in environmental damages and losses in the US alone (Pimental et al. 2005). Unfortunately, even as scientists and policymakers have begun to recognize the threat of invasive species, augmented globalization and free trade have increased the risk of their introduction (Bright 1999; Mack et al. 2000; Lehtonen 2005).

According to many scientific definitions, "invasive species" are non-native species that overcome the environmental and dispersal barriers to establishment and spread (Fig. 1; Blackburn et al. 2011). Many policy-makers additionally define invasive species as those that also pose an economic or environmental threat (Executive Order No. 13112 1999; Lodge et al. 2006). Therefore, some policy-makers estimate that although one-fifteenth to one-tenth of introduced species overcome establishment barriers, only one-tenth of those become invasive (US Congress OTA 1993). This paper will use the political interpretation of "invasive" and refer to "invasive species" as alien species that are both established and harmful.

Commerce in living organisms via the pet and horticulture trades is a major pathway for the introduction of invasive species (Fig. 2) and also the most ecologically damaging (Lodge et al. 2006). Although transport of pet and horticultural species accidentally introduces a wide variety of unintended "hitchhiker" species such as parasites, diseases, weed seeds, and soil micro-organisms, the majority of currently invasive plants and vertebrates in the US were introduced intentionally, often through trade in exotic plants, seeds, and animals (Mack et al.

2000; Pimental et al. 2005). Over 900 of the 25,000 exotic plants, mostly horticultural ornamentals, that were introduced to Florida have become established in the wild (Frank & McCoy 1995; Simberloff et al. 1997). Around one-third of the world's worst aquatic invasive species are aquarium or ornamental species (Padilla & Williams 2004). Eighty-four percent of the 149 introductions of non-indigenous amphibians and reptiles in Florida occurred via the pet trade and have resulted in the establishment of many highly destructive invasive species including several types of invasive snakes such as the infamous Burmese python (Krysko et al. 2011).

In looking for a way to reduce the rate of establishment of new invasive species in the US, the primary concern should be reducing the threat from the species transported intentionally, with a secondary emphasis on reducing the threat from potential hitchhiker species. Reducing the threat from such intentionally-traded living organisms is less costly and more efficient than addressing accidental introduction (Lodge et al. 2006). This is especially true since the traits that make an organism desirable as an imported planted or pet species, such as hardiness, adaptability, rapid growth, and easy reproduction, are the same traits that make it a particularly successful invader (Bright 1999). Prevention efforts should be particularly emphasized, rather than slow-the-spread or eradication efforts, since management cost increases and effectiveness decreases with increased time since introduction (Simberloff et al. 2013).

Author Commentary

Sonia Howlett

This paper was written as a final paper for my Conservation Biology class with Professor David Wilcove. I chose to write on the prompt of "What realistic but effective steps can be taken to reduce the rate at which new harmful, invasive species become established in the USA via the pet trade and the horticulture trade?" Starting out, I knew that I wanted to structure the paper similarly to the published policy recommendations that we read in class. From having read many such papers, I had observed that most started out with a background or overview of the issue before launching into recommendations. This also appealed to me logically because it makes sense to outline the problem before presenting solutions.

In order to make my argument as coherent as possible, I decided to split the content of my paper into five sections. In the "Introduction," excerpted here, I introduce the reader to what invasive species are, why they are a problem that needs to be addressed, and how they are coming into the US. I use this to set up the idea that we need recommendations to prevent the introduction of invasive species and to begin to narrow down what particular areas we should focus on in order to implement that. Later, in the "Current Efforts" section, I highlight what systems are currently in place, and then in the "Challenges" section I describe how and why the current efforts are insufficient. This leads me into my four "Recommendations," which I number and address one by one. Finally, the "Conclusion" briefly summarizes the paper and highlights its importance.

Once I outlined the structure, I wrote bullet points for what I wanted to cover in each section. For the introduction, I often included not only points I wanted to make, but also space for facts and information I didn't know yet but ultimately wanted to include, such as the role of invasive species in the US economy. Then I researched extensively, looking into all of the questions and relevant facts I had identified while outlining, as well as more that came up over the course of my research. I excerpted key quotes and facts which I copy-pasted into a separate document, organized by section. I then drew these facts and statements together into the bulk of my essay, and finally edited the paper extensively to create more of a cohesive narrative.

Editor Commentary

Myrial Holbrook

Introductions are a lot like dessert—tempting to dig into first, but often best saved for last in the writing process. Similarly, introductions should give us a taste that leaves us hungry for more. In her essay, Sonia has done precisely this: she began drafting her essay with a general outline, building in some flexibility to her argument, then researched and wrote the body of the essay, and, in the end, revisited her initial claims to ensure that they aligned with the evolution of her research. Moreover, Sonia's introduction, while it gives us a preview of her essay, leaves us expectant as to the more detailed analysis she will undertake in the body of her essay.

What Sonia's introduction does particularly well is lay out her methodology for her paper. As a Fellow at the Writing Center, I often see two extremes in undergraduate sourcework in papers: students deferring too readily to sources, letting their own voice get drowned out, or students trying to claim authority over sources, oversimplifying them in the process. Sonia, however, strikes a happy balance between these two extremes. In this excerpt, her introduction, for example, she successfully incorporates, via paraphrase, a wide range of sources, while maintaining her own position.

The structure of this introduction is streamlined and precise. The first paragraph motivates the paper, establishing the historical problem of invasive species. The second paragraph offers helpful orienting information by defining invasive species for this particular context. The third paragraph continues the motivating and orienting, this time with a more narrow focus that will culminate in the fourth paragraph as an evidence-based claim. With this structure, Sonia gives us the proper dosage of motive, orienting, and argument. Notably, these are not necessarily mutually exclusive. In fact, the best papers showcase a similar kind of fluid multi-tasking.

In short, Sonia's introduction shows her deft maneuvering of a complex issue into the context of a ten-page research paper. With an effective introduction, almost any topic can be made manageable, arguable, and tantalizing to a variety of tastes.

Professor Commentary

David S. Wilcove
Professor of Ecology and Evolutionary Biology and Public Affairs

For her final paper in EEB 308 (Conservation Biology), Sonia chose to write about an especially tricky problem: How do we reduce the rate at which harmful, invasive species become established in the USA due to importations of foreign plants and animals for the horticulture and pet trades, respectively? Our collective desire for strange and beautiful plants and animals leads us to import millions of non-native plants and animals every year. A significant number of these species subsequently escape from captivity and establish flourishing populations in the wild, often to the detriment of native plants and animals. Some even pose a threat to human health. The fact that this issue involves ecological questions (which species are likely to escape and become problematic?), economic questions (the pet and horticulture trade is big business), and social questions (people *want* to own strange, new species) makes it particularly vexing to solve. Sonia wrote a very thoughtful, well-written assessment of the issue. She provided a compelling overview of the problem, and she developed a set of well-reasoned, practical recommendations that would, indeed, make a difference. It was, in all respects, an excellent example of interdisciplinary scholarship.

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Figures

FIG. 1. The "Proposed Unified Framework for Biological Invasions" of Blackburn et al illustrates the various barriers organisms have to pass in order to become invasive, and the management options at each stage of biological invasion. (Blackburn et al. 2011)

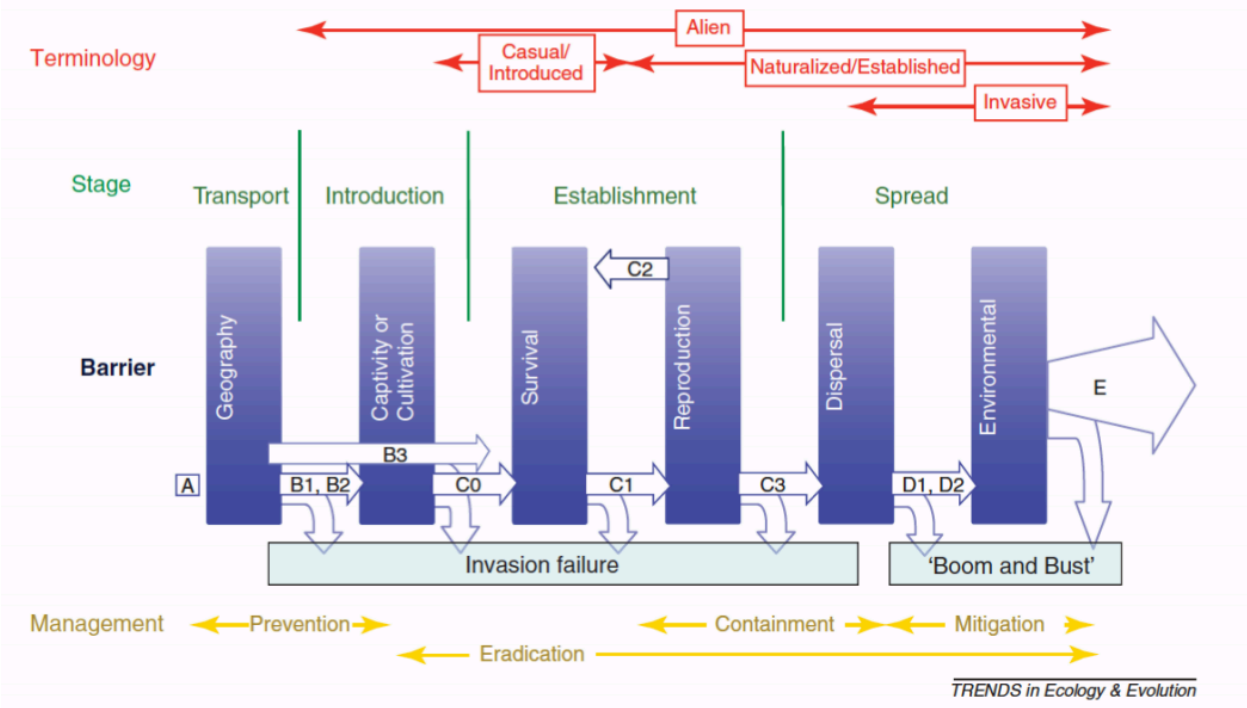
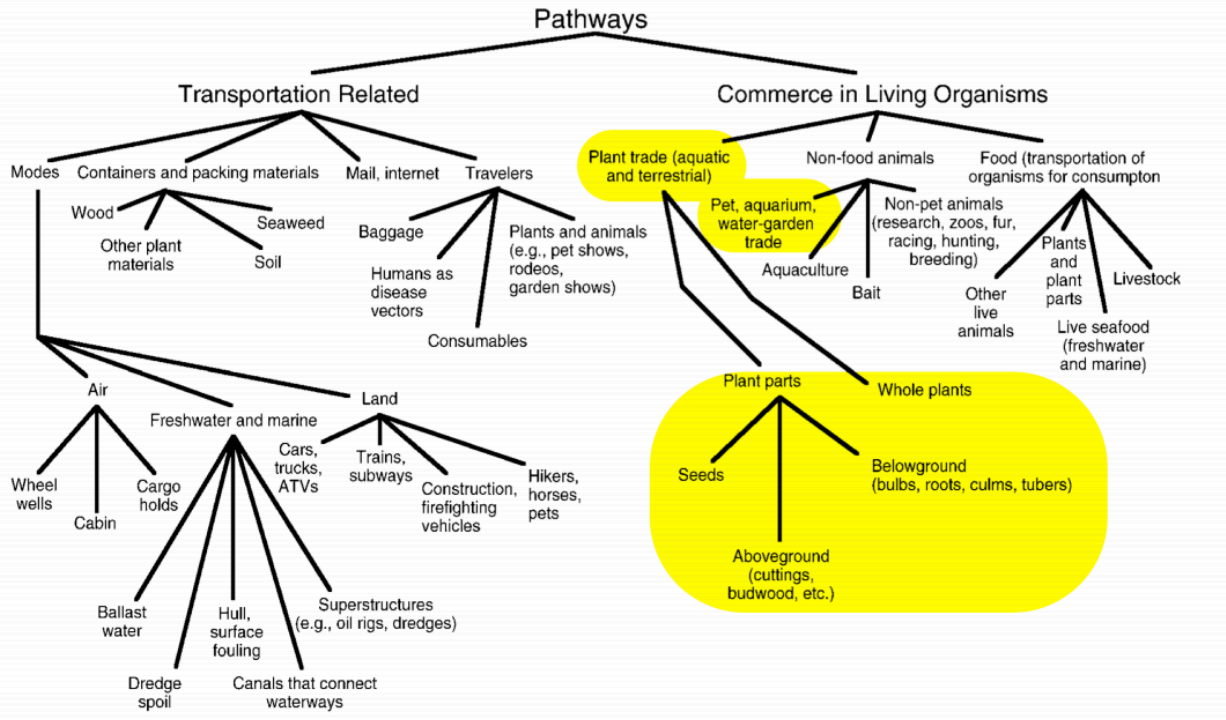


FIG . 2. Major pathways by which nonindigenous species enter and are transported within the United States. For the right-hand branch of pathways (Commerce in Living Organisms), each

pathway also entails the possibility of other species hitchhiking on or in the species that is the focus of trade, or in the medium (e.g., water, soil, nesting material) or food of the focal species. Figure and caption courtesy of Lodge et al. (2006). Highlighting added to mark the pathways for the pet and horticulture trades.



Bios

Sonia Howlett '18 is studying Ecology and Evolutionary Biology, with a certificate in Environmental Studies, and loves nothing more than exploring the natural world. She comes from Cornwall, Vermont, but lived for 3 years in New Zealand, an island country that suffers from the effects of introduced species. As a result, she finds the topic of invasive species very interesting and relevant and while at Princeton has written several papers on it. She was a senior when she wrote this.

Myrial Holbrook '19 is a Comparative Literature major pursuing certificates in European Cultural Studies and Cognitive Science. When she isn't mixing up English, Chinese, and Spanish, she can be found in the kitchen whipping up vegetarian delights, reading the non-fiction of Dickens and Twain, or watching obscure classic films. In addition to *Tortoise*, she also contributes to the campus publications *Innovation* and *The Nassau Literary Review* and serves as an Executive Board Member of the Community House Big Sibs program. She was a junior when she wrote this.