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Framing Bioinvasion: Biodiversity, Climate Change, Security, Trade, and Global Governance

Peter Stoett

This article introduces the complexities of framing the policy debate over invasive alien species or, more generally, bioinvasion. It suggests that there are six principal framing conceptualizations that have emerged or are gaining steam and credence: biodiversity and conservation; climate change and globalization; human security; "natural national security"; market failure; and the commons and global governance. Although the biodiversity approach dominates the international discourse at present, it presents a partial and hence distorting picture. Over time, as the problem of bioinvasion compounds, the inadequacy of the biodiversity frame will become generally apparent and so the other framings will gain in currency. Ultimately, bioinvasion must be viewed as a policy challenge for global environmental governance and justice. The author concludes by raising the limited possibility of developing an International Convention on Invasive Alien Species. KEYWORDS: *global environmental governance, invasive species, framing, biodiversity.*

HOW AN ISSUE IS FRAMED BY VARIOUS PUBLIC STAKEHOLDER AND PROfessional communities is central to its conceptual evolution and policy responses; discourse-analytic approaches seek to capture emerging discourses that are actively framed by various interested constituencies.[1] With regard to the vexing question of invasive alien species (IAS), where global governance can be most easily identified by its absence, several dominant framing tendencies have emerged, including conservation/biodiversity, climate change/globalization, human security, what I term *national natural security*, market failure costs, and commons/global governance issues. In some cases it is very clear who is doing most of this framing, whereas in others the attribution of authorial responsibility is much more problematic because the frame has emerged from years of discourse. Today the conservation/biodiversity approach dominates international discourse. Because it presents a partial view of the problem—a view quite inadequate as a basis for an effective policy response—as the problem compounds, other frames will gain in currency.

Many IAS are the result of purposeful introductions of species in order to control the populations of other species; perhaps the most infamous case here is that of the venomous cane toad (*Bufo marinus*) in Australia, which continues its onslaught across the country despite highly expensive eradication ef-

forts. Native to the southern United States and Central and South America, a group of cane toads (originally from Hawaii) was released into the Australian wild in 1935 to control pest scarab beetles harming the production of sugar cane. Other high-profile cases, such as the zebra mussel invasion of the North American Great Lakes, or the infamous brown tree snake invasion of the island of Guam, have been unintentional; the former resulted from the release of ships' ballast water, and the latter was a stowaway in military aircraft.

Similar to other international environmental issues, the question of how to respond to the ecological threats posed by bioinvasion raises ancillary questions about national sovereignty, definitions of risk, the spread of fear and fears of securitization, parameters of acceptable actions, the politicization of science, and yet deeper ontological concerns about human-nature interaction. This article explores the thematic frames mentioned above and suggests that coping with bioinvasion demands a multifaceted global governance response. Though a new international convention or a long-promised IAS protocol to the Convention on Biodiversity could bring together many of the elements found in these perspectives, it does not seem likely to emerge from the present discourse. A more explicit understanding of the interlinked issues found within each framing of the problem is a sound first step toward a discourse sensitive to the problem's complex dimensions from which a coherent policy response could ultimately grow.

Biodiversity and Conservation

For the most part, invasive alien species have been the stuff of natural science. In fact, a subfield of ecology known primarily as invasive biology (also as invasive ecology) has grown over the preceding several decades, and a highly respected international peer-reviewed journal is entitled *Biological Invasions*. Especially in highly vulnerable contexts such as tropical islands, IAS must be eradicated or prevented altogether as part of the broader, nobler cause of protecting biodiversity. This is the dominant perspective shaped largely by an increasingly international community of scientists, but it presents two problems to the goal of preventing future bioinvasion: (1) there are cracks of dissent within this thematic frame; and (2) its dominance can obscure other thematic frames that may have more direct appeal to citizens.

Typically, the term *alien species* refers to one occurring outside its normal distribution range; an invasive species is not only alien (in itself a crime to certain puritan naturists) but also threatens the existence of indigenous species. This is not just about predation but of interbreeding and cross-pollination (or hybridization), habitat destruction, the introduction of parasites, and disruptions to the food chain. It took some time for the scientific community to devote considerable effort to related questions; the publication of Charles Elton's pathbreaking book in 1958 (*The Ecology of Invasions by Animals and Plants*)

began the process not only of serious scientific study but the stark scare tactic of using the term *invasion* during one of the heights of the Cold War.[2] Of course, parametric problems, such as the development of frameworks for the clear distinction between nonindigenous and indigenous species, were early (and remain ongoing) methodological obsessions.

But there are broader strokes of disagreement. Whereas some ecologists are content to refer to IAS as a form of biological pollution, others are less sure. A small cottage industry has sprouted over the semantic debate concerning the choice of words used for invasive species. Brendon Larson, for example, has many suggestions, including "terrorists, piggy-backers, opportunists, spawn, mirrors, providers, hybrids, tricksters, matrices, transients, founts, and teachers."[3] Other titles include *exotics, introduced species, non-natives, non-indigenous, transients, pests, weeds, foreign, noxious, tramps,* and *waifs,* often depending on their specific context. There is consternation among some environmental ethicists and biologists that under a biodiversity framing, IAS will be seen merely as part of the broader crisis of extinction that dominates the public discussion today; indeed, they are subsumed as one of many contributory and interlinked threats (including habitat destruction and climate change) to biodiversity.

In fact, there is a lively debate among biologists and philosophers over whether invasive species (or, less emotively, non-native species) are an inherently bad thing. Mark Sagoff asks whether much of invasion biology is simply "an example of political advocacy parading as empirical science? Is there a scientific or empirical—as well as an aesthetic and spiritual—basis for the assumption that non-native species are, indeed, pernicious in their effects on natural areas and environments?"[4] He thinks not; similarly, Mark Davis concludes that "there is no evidence that even a single long-term resident species has been driven to extinction, or even extirpated within a single U.S. state, because of competition from an introduced plant species"; he believes this will be the case at "global, metacommunity, and even most community levels" as well.[5] Others rejoin, of course, claiming, for example, that the historical toll of invasive species such as rats and cats have been the "single greatest cause of recorded historical extinctions (since A.D. 1600)" on islands; or that of the currently threatened bird populations (over 1180 species threatened with extinction), almost half are threatened "wholly or in part by introduced species."[6]

Though there is no doubt that IAS is an important topic for biologists, there is concern also that framing the many issues related to the phenomenon strictly in terms of conservation and biodiversity has had the long-term effect of limiting the discourse. The Convention on Biological Diversity (CBD), for example, is viewed by some as the international agency best suited to organize a response to the international dimension of the problem, though it is clear that the threat IAS pose to biodiversity is but one aspect, and the CBD has rather limited political power. (Indeed, the parties to the 1992 CBD have yet

to agree on a set of prevention guidelines put forth in 2002.) There are other ways of looking at the problem that may be more relevant to the human species, more catchy to the public eye, and more indicative of the magnitude of the threat IAS present to environmental security.

Climate Change and Globalization

Another way of framing the issue, with an embryonic scientific orientation, is by emphasizing its link with climate change; this is becoming an increasingly popular approach, albeit one largely thrown in as an afterthought by advocates of serious action on climate change policy. Changing temperatures have profound effects on the survivability of species, and we have already begun to speak routinely of species' migrations as a consequence. There is little scientific evidence to suggest this is in fact occurring, but it is a rather logical deduction that warmer climates will render previously colder areas vulnerable to invasions from species that have been limited in range by climate. Thus, the pine beetle's destructive path in Alberta is often attributed to climate change, which has allowed longer life cycles and northern entrenchment. Likewise, it is common to refer to future generations of migrating plants and trees; finches and chickadees are already moving hundreds of kilometers into Canada, according to a recent Audubon Society study.[7]

The issue relates directly to the human health frame discussed immediately below because climate change is deemed a facilitative force behind emerging vectors for migrating diseases. Concerns include the higher risks of hookworm (*Anclyostoma* and *Necator*) infection and "an increase in distribution and number of species of chiggers, including some tropical ones such as *Trombicula batatus*, and the introduction of many tick- and mite-borne diseases."[8] Northern outbreaks of malaria, sandfly fever, bartonellosis, Lyme disease, and other pathogens are all considered possible consequences of a warmer global atmosphere. Climate change is also used to explain some of the unprecedented spread of giant jellyfish in recent decades, especially in the Sea of Japan: warmer waters speed growth and reproduction rates.

This area of research should accelerate if climate change brings new and dangerous microbes to the industrialized states (of course, many would argue this is already occurring).[9] At the very least it throws a very disruptive curve to the science of invasive biology because "interactions among the many factors mediating invasion dynamics, and the interactions between alien and native biota, are extremely difficult to predict under changed climatic conditions."[10] The temptation, of course, is to stress these great unknowns as further evidence that we need widespread adoption of the precautionary principle, and to thus publicize the issue as part of a broader global governance agenda that has received increasing attention. Thus IAS can be linked to energy production and industrialization, and they have been famously referred to

as "pathogens of globalization."[11] They are examples of the much broader environmental crises that affect the modern age, or even modernity itself as an intellectual epoch. This goes beyond the obvious link with globalized trade as the main pathway of invasion, suggesting in short that humanity has brought this scourge upon itself through its own incessant colonization of earth's "natural" areas.

The links to climate change may in themselves be fruitful conduits or pathways for increased awareness about IAS, but this raises the danger of an unintended effect of stimulating exasperation in the face of such a large global governance challenge, or the outright alienation of those policymakers reluctant to commit to the long-term collective sacrifices effective climate change policy often demands. Some would argue it is better to force our anthropocentrically inclined attention to more direct issues, such as the impact of IAS on human health itself.

IAS as a Human Security Issue

Perhaps the most vibrant growth area in the evolving framing of bioinvasion is its link, and more specifically the threat it poses, to human health. Some invading species pack terrible luggage, such as infectious diseases that can take human life, but they are at the very least lethal to the native plants, marine life, and mammals on which humans depend for physical, economic, and even cultural survival. Framing the issue this way are the medical profession, the pharmaceutical industry, development specialists, and advocates of a wide conception of security.

This may be the strongest appeal yet, and it may have the decidedly advantageous effect of not only involving the well-funded medical and epidemiological communities in the discussion, but of generating much more public discussion of the real risks associated with IAS—though it may also generate irrational panic in the process and excite the more militaristic response discussed below. One can, however, link the impact of IAS to the extant and emerging literature on human security, which seeks to place vulnerable individuals in place of the state as the main focus of efforts (and responsibilities) to protect. Doubtlessly, the changing dynamics of disease vectors are major cause for concern (and an issue for global governance efforts today); Adil Najam refers to General Assembly Resolution a/59/565 of 2 December 2004, which states that "poverty, infectious disease, and environmental degradation have been recently defined in a common cluster as threats to international security."[12] For some, however, *international security* is simply another way of saying *state security*; the human security position is that policies should reflect the provision of human welfare first.

History is full of nasty microbial examples, such as the infamous case of indigenous peoples harmed by foreign microbes brought over by the Euro-

peans during colonization.[13] More recently, the West Nile virus, spread by mosquitoes and birds, was first found in 1937 in Uganda and was located in 1999 in New York.[14] Species can be vectors for serious diseases as well as invasive species of their own right: for example, a virus that causes hemorrhagic fever is said to have found its way to Baltimore from Seoul by way of wharf rats that made the journey in cargo ships. IAS can have a devastating impact on food security: the maize grey leaf spot fungus threatens food security in East Africa; the water hyacinth invasion clogs waterways, making fishing impossible. In Africa invading hyacinth can also harbor the snails that carry bilharzia (*Schistosomiasis*) and provide hiding places for crocodiles and snakes, increasing the risk of serious injury or death to water users. Aquaculture operations involving introduced species can be especially hazardous to local fisheries, not only damaging occupational prospects but lowering protein consumption and increasing exposure to parasites and other health threats. In Ethiopia, the introduction of *Prosopis* in the late 1970s and early 1980s has resulted in "substantial species invasion. Up to a quarter of arable grazing land has been overtaken by the plant, soil nutrient dynamics have been adversely affected, and the thorns are a hazard to the local population."[15]

Invasive plants can increase the likelihood and economic impact of fires as well, and the environmental harm caused by military conflict raises the vulnerability to local invasion. More broadly, military conduct, which involves large shipments of materials and personnel, is in itself an IAS pathway.

There is another aspect to human health that should certainly not be overlooked, and this relates to the aesthetic value of nature (part of what ecological economists refer to as *intrinsic value*). The 1989 Presidential Address to the Society for Conservation Biology stressed the "sociological and public health implications of biological invasions,"[16] with several examples of the messy impact of invasive alien species on natural flora and fauna. Recreational activities, landscape architecture, and ornamental aquaculture have all contributed their share to the IAS problem, but the impact of IAS can ultimately in turn modify or lessen the experiential satisfaction provided by these activities. More profoundly, Paul Knights offers an array of examples in which local biota have become defining cultural features for numerous societies, including the establishment of activist groups opposed to the "increasing homogenization of agriculture and horticulture."[17] When the infamous brown tree snake (*Boiga irregularis*) invaded the Pacific island of Guam in the early 1950s, the ecological destruction was obvious; but as Mansel Blackford suggests, "Guam's residents viewed the snakes' extirpation of their native birdlife as an attack on their culture."[18]

We must also consider the idea that governance efforts further entrench the biopower of states and corporations and can create obstacles to the realization of environmental justice. This question is rarely raised when discussions of policy responses to IAS take place, yet it is vital as justice is coming to play a

much more central role in our evaluation of global environmental governance efforts, especially in the context of adaptations to climate change.[19] I return to this theme below, but it should be clear that a human security perspective will make certain demands, such as ample community participation and decision-making authority in eradication and restoration projects, that will often conflict with a more technocratic model. It will also raise issues related to civil liberties if quarantine efforts assume military proportion.

There is room, then, to further explore the linkage of invasive alien species with an international human security agenda, though doing so raises all the prickly questions about the universality and relativity of human rights, the ambiguity of the very term *human security*,[20] and the need to unearth causes of the deeper structural inequalities that predetermine the relative vulnerability of certain populations to both natural and economic disaster. One can argue, more specifically, that IAS are clearly threats to economic livelihoods and to public health, and these threats are as likely to be viewed through a securitization prism as they are through a conservationist one. Of course, the introduction of some species—such as drought-resistant crops—may promise to improve the human condition as climate change proceeds, further complicating the human security perspective.

Thus, the IAS issue is already part and parcel of the larger securitization of public health that has seen a marked escalation since September 11, 2001; biological weapons are an element of this, but natural invasions certainly fit the profile (this leads also, however, to the global governance discussion raised later in this article).[21] As Brendon Larson writes, "part of our concerns about [invasive species] may derive from related fears about the invasion of our body by disease and of our nation by invading peoples."[22] I turn briefly to the latter concern, which hinges on one of the more pervasive human mental constructions, that of the nation-state, next.

"National Natural Security"

The fire ant "invaded" the United States via lumber or coffee shiploads from South America in the 1930s, and it continues its long march across the country, spreading by land and water (yes, water) from Texas to Florida to Tennessee and North Carolina, Puerto Rico, New Mexico, and California. As a popular biology textbook notes,

> Wherever fire ants have gone, they have sharply reduced or wiped out up to 90% of native ant populations. Their extremely painful stings have killed deer fawns, birds, livestock, pets, and at least 80 people allergic to their venom. [They] have invaded cars and caused accidents by attacking drivers, made crop fields unplowable, disrupted phone services and electrical power, caused some fires by chewing through underground cables, and cost the United States an estimated $600 million per year.[23]

Of course, anyone who has been attacked by a squadron of fire ants is likely to appreciate the militaristic concept that they are at war with us, though this is an absurd notion. What is more striking perhaps is how easily the discourse of warfare is adapted by the scientific community when dealing with invasive species, and how this links to our perception of an inside/outside international politics.[24] Prior to the 1960s there were few references in scientific journals to *invasive* species; they were as often referred to as "colonizers," "founding populations," "non-native," or the relatively cheery, even welcoming, designation of "new arrivals." The militaristic tone was well established by the 1970s, however, propelled by books such as George Laycock's *The Alien Animals* in 1966. Peretti even discusses the "disturbing historical legacy of purist biological nativism,"[25] with links to Nazi ideology. The implication that a responsible concern with invasive species can be seen as a form of xenophobia has been dismissed as political correctness run amok by many others.[26] Even Daniel Simberloff concedes, however, that "the attacks of 9/11 have surely increased public concern about foreign immigrants and visitors [and] the potential link of introduced species to ecoterrorism and bioterrorism."[27]

Two potentially prevalent streams of thought regarding national security and IAS (both tied closely to the economic and trade issues discussed below) might emerge in the contemporary discourse, especially if it borrows from the realist tradition of international relations (IR) thought. Both of these streams flow within the valley of militaristic thinking about community inclusion and outside threats but are also reflective of contemporary policy dilemmas faced by political elites. The first is that invasive alien species pose a genuine threat to national strength, as measured in terms of hard power. By attacking the economic infrastructure of states, as well as the health of human populations, IAS weaken the ability to convert wealth to military power. This may sound phantasmal, until we consider the impact of IAS on power stations, shipping lanes, train corridors, and other measurable sinews of the state organ; and it is obvious that the pathogenic spread of debilitating and deadly diseases reduces the human capital of the state.[28] Of course, we also have to consider the possibility that bioinvasions will be deliberately introduced in order to inflict harm on ecosystems (ecocide) or used as weapons against human populations (bioterrorism). This has happened in the past and could easily be considered a form of ecocide or biological imperialism, and it probably will happen in the future despite various multilateral efforts to curb such behavior. Although the generally slow speed of spread for deliberately introduced organisms probably renders this approach to sabotage undesirable, the threat of microbial and virus introductions is, of course, a permanent concern. Interestingly, many indigenous groups would view the introduction of non-native crops as a form of bioterrorism practiced over several centuries, and current concerns with genetically modified organisms (GMOs) echo this sentiment.

The second stream relates to the broadening of the security agenda itself

to include biosecurity issues. The confluence of environmental security, climate change, and national security agencies and projections make this less an intellectual adventure and more of a reality, especially for states with serious histories of bioinvasion, such as New Zealand or Australia, which have basically adopted the equation that national security and biosecurity are synonymous terms (a book published in 1984 entitled *Immigrant Killers* described the impact of introduced predators on birds in New Zealand).[29]

State agencies based in countries that will experience serious ecosystem change in various regions, such as the melting of Arctic ice sheets in the Canadian Arctic, will also quite understandably latch onto this stream of thought, which can be divided into those who strove primarily to push ecological (and other nonmilitary) issues onto the agenda of high politics and those invasive alien critical theorists who challenge state legitimacy itself as the state assumes ever greater biocontrol, a concept offered by Michel Foucault and others.[30] This idea derives partially from our relentless (if understandable) drive to categorize all modes of nonhuman life, including IAS, a process that no doubt precedes even Aristotle's great efforts in this direction, informs the evolutionary theory of Charles Darwin and others, refines our definition of being human, and yet also reifies the power and control of the modern state as the main source of authority over the natural world.[31]

Equating the struggle against invasive alien species with a national security project may simply be a natural extension of the themes of invasion and counterinvasion, both of which have animated international relations discourse for centuries. Campaigns against pathogens and IAS lend themselves easily to military metaphor. In the Philippines, writes historian John Farley, "the medical campaigns against cholera and other diseases were barely distinguishable from the military campaigns against the *insurrectos*."[32] After thousands of years of teaching and preaching the values of just war, and hundreds of years of socialization into the state-as-nation building project, such reflexive language should not surprise. It is still strangely comforting to be able to identify the origin of a species by a nationality. The kudzu vine—introduced to the United States in the 1930s to help control soil erosion but that soon became, to the disconcertment of landscape architects, virtually impossible to control at all—is a weed from Japan and not the United States—despite thriving in southeastern US ecosystems for close to a century. The Asian tiger mosquito—which carries a wide variety of human ills, including dengue fever and encephalitis—came to the United States in 1985 in a Japanese ship carrying tires to a Houston, Texas, recapping plant. The problem with the Asian tiger mosquito is the international trade in used automobile tires, not the harmfully infectious threat from Asia, but it may be nice to know it is Asian, not American. African killer bees—*Apis mellifera scutellata*—are another example; in fact, they "escaped" from Brazil, not Africa, and have hybridized with previously introduced European species as they spread northward.

Biosecurity will certainly entail both traditional military and asymmetrical warfare concerns, but it would be counterproductive to even think seriously of a garrison approach to IAS. Yet it may well emerge as a possible framing mechanism to get IAS on the national radar. This would not surprise the realist camp within IR theory, nor for that matter the social constructivists who are interested in identifying additional post–September 11 justifications for foreign policy narratives.[33] It would, of course, disappoint liberal institutionalists, who may see collaboration on IAS as another conduit toward the international pursuit of enlightened self-interest. But, with notable and empirically grounded exceptions such as New Zealand and Australia, it is unlikely that the ideal of national natural security will take serious root in contemporary thinking informed by scientific observation and the realization that globalization (and climate change) has been (re)shaping current ecosystem characteristics for many centuries. More likely, the economic costs of IAS will dominate the national security debate, and this reflects almost directly the cost of contemporary global trade.

IAS as Market Failures: Costs and Trade Issues

Ecological economics, which views nature as capital, is still considered an impertinent young sibling by mainstream economics, but it is gaining ground as the sheer magnitude of the climate change issue begins to overshadow even current economic crises. Many prominent analysts have argued passionately that the biggest obstacle to dealing with invasive alien species is, in fact, the lightly regulated international trade sector.[34] This is a logical deduction, given the historical path of many incidental invasions that simply would not have been possible without ocean-crossing vessels. The cases of mussel invasions, which have received prominent media coverage in North America owing to the zebra mussel infestation, demonstrate the importance of trade and shipping routes, and the role of ballast water exchange: cleanup costs are estimated at over $600 million per year, and they have barely scratched the surface of the problem.[35] Michael Margolis suggests invasions "constitute a market failure rooted in international trade" and mentions the "impossibility of distinguishing legitimate public-goods protection from protectionism without full knowledge of the public-goods value."[36]

This is certainly one of the approaches currently favored by the Global Invasive Species Program (GISP), whose latest publication of advice is entitled *A Toolkit for the Economic Analysis of Invasive Species*, and whose authors argue that "it is now widely recognized that economics is to do with much more than just understanding the costs of invasives or the benefits of managing them. It also concerns understanding the complex causes of the introduction and spread of invasives, the links between human behavior and natural processes, and finding solutions."[37] Surely, IAS are more than the externalities

of market transactions; and market prices of commodity trading do not accurately reflect the full social and economic costs associated with bioinvasions. These commodities include not just timber, oil, ornamental plants, aquarium fish, disposable waste, and other tradable goods, but the profits gained from the transport, travel, and tourism industries as well.

Though serious methodological disputes persist, efforts to measure the real costs of IAS are now commonplace. Indeed, one organization invested in counterinvasion work claims the worldwide cost of invasive species, including water hyacinth in North America, Asia, Australia, Africa, and Europe, is "around 1 trillion dollars worth of damage each year globally."[38] The GISP has used an even higher estimate, based on a 2004 report, of "5% of the global economy, or US$1.4 trillion" annually;[39] this is derived from a study conducted in 1999 of losses associated with non-native species invasions in the United States, United Kingdom, Australia, South Africa, India, and Brazil that placed the figure at $314 billion.[40] As its authors concede, however, it is impossible to assert complete accuracy; controversies remain over definitions of IAS, especially microbial invasions; and some invasive species may have positive (if controversial) economic impacts, including GMOs and other introductions. The point remains: invasive alien species cost incredible sums of money, including opportunity costs, and someone always has to pay.

This is language that commercial liberals, as described by Michael Doyle and others,[41] can understand. Though it would be at best premature to conclude that the existence of a problem will lead to related cooperative efforts, there is certainly great potential for cooperation between trading partners on the twin themes of conservation and IAS prevention; indeed, unique programs of cooperation between even China and the United States are currently underway.[42] Put bluntly, the prevention of IAS will often entail the disruption of trade, and the focus thus falls on whether controls for invasive introductions constitute unfair trade barriers. We thus enter the world of international trade law and the related agreements constituted for notable exceptions to the drive toward ongoing trade liberalization, itself a strong narrative in the post-WWII story of globalization. This includes, most notably, the WTO Agreement on the Application of Sanitary and Phytosanitary (SPS) Measures, which stipulates that any such measures must be applied "only to the extent necessary to protect human, animal, or plant life or health, be based on scientific principles, and not be maintained without sufficient scientific evidence."[43] The SPS Committee recognizes three organizations for international standard-setting: the International Plant Protection Convention, the World Organization for Animal Health, and, for food safety standards, the Codex Alimentarius Commission; it is legally capable of recognizing others, however, such as the GISP, though it has not done so. However, "experience to date shows that collective negotiation of standards generally reflects a lower common denominator of protective-

ness with trade facilitation as the main objective. Developing countries may lack the resources, expertise, or scientific information to participate effectively in standard development and ensure their concerns are taken into account."[44]

The Agreement on Technical Barriers to Trade (TBT) is also highly relevant because it gives more space to the construction of barriers to prevent national harm. Michael Margolis, Jason Shogren, and Carolyn Fischer conclude that in general,

> it is easier to defend a regulation if it can be brought under the TBT rather than the SPS. The transparency and nondiscrimination features of the two agreements are almost the same. The major difference is that an SPS measure must be backed by scientific evidence that advances its goal, and the measure can be applied only to the extent necessary to achieve the proclaimed level of risk reduction. Measures subject to the TBT Agreement do not, as a rule, have any equally verifiable purpose, so there is no equivalent requirement for scientific assessment.[45]

Regional trade agreements may offer more latitude as well; for example, "NAFTA allows national governments more latitude over their technical standards and SPS measures."[46] Nonetheless, one can anticipate considerable resistance to any further effort to regulate what may seem an ambiguous category of trade; for example, both GMOs and biofuels can be seen as invasive species.

Framing IAS as a market failure issue offers enticing prospects to those who wish to stress the importance of preventive measures and provides fuel for scientific efforts to use the "nascent science of predicting invasiveness [for] the creation and application of formal, detailed scientific analytical systems for determining whether a species should be allowed."[47] It may be swallowed by the grander debates over the benefits and disadvantages of globalization, and the power discrepancies inherent in an international trading system that, many argue, is already biased against the less industrialized participants. If taken on its own, it runs the risk of overlooking other factors, such as clandestine trade in hazardous waste, energy production, food security, development assistance, military trade, and even natural disaster relief, which are not generally subsumed within the WTO universe. The discussion could be in turn dominated by the ranks of trade lawyers and foreign investment consultants with little if any ecological expertise or environmentalist inclinations; conversely, antiglobalization activists could raise the loudest voices as IAS become poster species. But it is a vital component of the overall picture that cannot be ignored, and more work needs to be done in this area.

There is a final economic aspect to IAS: cleaning them up can actually contribute to job creation. For example, the much-vaunted Working for Water Programme in South Africa has contributed to substantial temporary job cre-

ation in underemployed rural areas. This Keynesian advantage will not, however, be much of an incentive to engage in prevention programs.

IAS as a Global Governance Issue

Though all of the frames discussed above are arguably well established, with historical paths and contemporary temptations, global governance in this area remains relatively embryonic. Of course, if we equate global governance with effective political control then we are far from the mark; but a transnational policy network on IAS is certainly forming, complete with public- and private-sector participants. Similarly, efforts at global epidemiology surveillance and prevention are slowly evolving,[48] despite the enormous risks to human health of inaction. In terms of governance architecture, there are no short-cuts available in the field of IAS prevention. Although international standard-setting and information exchange is vital, and the GISP seems the most logical place to undertake this work, the real work of prevention will take place in both public- and private-sector diligence at the local and community levels. This should not surprise observers of global environmental governance, because it is quite normal that international regimes need to engage in regulatory capacity-building if they are to have a serious impact. It can be argued, however, that there is a desperate need for a broader statement of principles and that normative space should be created for a global approach to this vexing problem.

A World Bank report refers to the GISP, which was formed in 1998 by the International Union for the Conservation of Nature (IUCN), the Centre for Applied Biosciences International (CABI), and the Scientific Committee for Problems of the Environment (SCOPE) as an "informal but highly effective partnership to promote urgent and necessary action on invasives."[49] Were it to receive commensurate support, both moral and financial, from interested governments, it could form the hub of an extensive network of international conventions and agencies that deal with IAS-related issues. A very partial list of such conventions and agencies would include the CBD; the World Conservation Union (IUCN); the International Plant Protection Convention (IPPPC); the Global Environmental Facility; and the United Nations Environmental Programme, CABI, and numerous regional agreements, including the Southern African Development Community (SADC) Fisheries Protocol of 2001; the Commission for Environmental Cooperation (CEC) of NAFTA; and the Convention on the Conservation of European Wildlife and Natural Resources (Bern Convention, 1979).

Such arrangements not only boost policy implementation capacity but also provide badly needed publicity for both the general and specific issue areas associated with IAS. Some efforts at publicity are in retrospect lamented, because they simplify the issue; a good example of this is the IUCN Invasive Species Specialist Group's "100 of the World's Worst Invasive Alien Species"

list published in 2000, which distracted from other species of concern and suggested to the public that an authoritative, exhaustive, and effective list of IAS actually exists (it does not, though both the GISP and the IUCN are in the process of building extensive databases). But there is widespread agreement that IAS remain an underpublicized issue-area, and that global efforts are needed in this regard. Again, it is a framing question: can local needs and problems benefit from the promotion of a global image of IAS as a problem of the commons? I believe they can, assuming we do not fall into the trap of systematically ignoring local needs in the process, and that providing the climate change, human health, national security, and market failure thematic frames are all taken into account.

Another important point is that though global governance is generally a public affair, private industry will remain central here. One cannot implement any of the conventions discussed herewith without the cooperation of the private sector; in fact, it is a decisive element of any strategic plan. For example, preliminary research suggests that whereas companies with international interests are ready to take the plunge and adjust to new international arrangements such as the IMO's Ballast Water Convention, shipping firms that work primarily within the Great Lakes were initially quite reluctant to do so (though they have released a supplemental voluntary ballast water management plan for the control of the hemorrhagic *septicemia* virus, which destroys the circulatory system of fish).[50] It is necessary to stress the human dimension of the issue to avoid both the market-driven pursuit of exploitative profits and the domination of technocratic corporatist bureaucracies, but it would be churlish to imagine effective action without private-sector participation, on both the prevention and eradication side of the coin.

Do we need an International Convention on IAS? A recent cross-national Internet survey of IAS specialists indicates that there is support for the idea, but it is cautious: there are already conventions that can deal with the issue, and convention fatigue has set in among ecologists and others concerned with environmental governance.[51] My impression at this point is that it would be a very long, arduous road to negotiate such a thing, given the complexity of this multi-framed issue. There is little open support from governments for such a convention. It would not escape the usual dilemmas of authority and resource competition with extant trade (and, even, environmental) agreements; if it did not supersede the biodiversity perspective, then it would be as well to stick with the CBD on this issue, though even here an effort to establish a formal IAS protocol has sputtered. But if a new convention could embrace to some extent the other perspectives offered in this article, it would have a much broader mandate and legitimacy.

Of course, such an instrument would be denounced by some as a desperate attempt to manage business-as-usual, as opposed to a more concerted effort to change the overconsumptive international political economy; and the

time and money spent constructing it may be better spent on the ground fighting IAS. Yet it certainly remains a logical option. It would bring perhaps unprecedented publicity to the issue, especially if a summit accompanied the final negotiations. And, given the propelling force of the various optical and intellectual frames discussed previously, such a convention would perhaps escape the confines of global environmental governance and emerge as a global governance instrument linking science, human rights, and trade. A refashioned GISP could serve as a secretariat and encourage regular ministerial-level meetings and regional commissions. A global list of IAS could be established, perhaps in a format similar to that of the CITES Appendices, to regulate trade and tourism. It could also channel adaptation, eradication, and restoration funding in an equitable manner, so that those most affected by IAS would not be the subjects of blatant environmental injustice. It could address security concerns, promoting open dialogue instead of garrison-like approaches. It is a tantalizing, if highly unlikely, possibility.

Conclusion

The proponents of the various frames explicated above are not necessarily in conflict, and many of them will benefit from mutual action. This article has attempted to expose their underlying assumptions and suggests that fissures between them are more visible at the level of global governance efforts. Nonetheless, the active framing and construction of invasive alien species is taking shape before our very eyes, and the need for concerted action on this global issue is as self-apparent as it is complicated. Much future action will be contingent on the public framing of bioinvasion, and its subsequent implementation by a variety of human agents in the public and private sectors, as well as community groups and NGOs.

Fire ants and giant jellyfish may be painful reminders of how interconnected global ecology and the marketplaces of commodities and ideas truly are. All of the conceptual frames explicated above present tempting opportunities and raise inherent problems for those concerned with this issue. Given the surprising relative paucity of attention IAS have received, we would be remiss to dismiss any of them as unworthy of future scholarly attention and policy development. But it is most valuable to reinforce the need for international collaboration in this challenging field and to give the GISP a fighting chance to have an impact.

Notes

Peter Stoett is chair and associate professor of international relations in the Department of Political Science, Concordia University, Montreal. He has also taught environmental security at the University for Peace in Costa Rica. He is the author of *Human and*

Global Security (2000) and the *International Politics of Whaling* (1997). Recent edited books include *Bilateral Ecopolitics: Canadian-American Environmental Relations* (with Philippe Le Prestre, 2006) and *International Ecopolitical Theory: Critical Reflections* (with Eric Laferrière, 2006). Research for this article was funded by the Social Science and Humanities Research Council of Canada. Leah Mohammed provided valuable research assistance.

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