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# The tragedy of the commons revisited: Invasive Species

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In the classic paper “The tragedy of the commons,” Garret Hardin (1968) explored the conflict that arises when an individual benefits from actions that may bring harm to others. He challenged the philosophical assumption of Adam Smith (1776, reprinted in 1936) that decisions reached individually will be the best decisions for an entire society and advocated “social arrangements” that produce responsibility. These arrangements might include some form of “mutually agreed upon coercion,” although perhaps “coercion and incentives” more accurately describes his intentions.

Just as an individual who benefits from grazing cattle on the village commons may be depleting the resource for others, importers generally benefit from introduced invasive species that may cause harm in some way. These introduced species cause enormous economic (Pimental *et al.* 2000) and environmental (Mack *et al.* 2000) problems, including competition for resources, alteration of ecosystem properties such as nutrient cycling and hydrology, and increased disturbances. Controlling problem species often requires application of pesticides and mechanical controls that are harmful to non-target species. Economic damage includes the loss of fisheries, forests, and suitable farmland, and the cost of control.

Many species that become invasive are introduced intentionally as pets, garden or aquarium plants, for recreational fishing, or for agricultural use. Others arrive accidentally as a by-product of commerce, for instance through ballast water discharge or as stowaways in shipping materials. Those choosing to import the pets or plants benefit financially. People engaged in international trade also benefit financially and risk allowing harmful pests to hitchhike from country

to country. Unfortunately, the choice that those individuals make – to profit by importing biological organisms – may impact others far removed from them. Ranchers in the western states battle introduced weeds, forests needed for forest products, recreational use, and wildlife habitat are decimated by pathogens and diseases, and near-shore environments are irrevocably altered by contaminated ballast discharge. One party benefits, while others suffer the consequences.

How do we determine an acceptable “social arrangement?” One solution might be to ask those importing biological organisms or engaged in international shipping to voluntarily take responsibility for the choices they make. This could include developing and implementing best management practices for their industry, and integrating them into daily routines. For instance, the International Chamber of Shipping developed its first voluntary environmental code, dealing

primarily with marine and atmospheric pollution, in 1993. When it was later revised they cited improvements; for example, the amount of oil lost was halved after these voluntary policies were adopted, despite a 76% increase in oil transporting tonnage during that time (ICS 1999). They acknowledged that better regulatory control was a factor in this improvement, but claimed that increased environmental awareness among shippers and seafarers, in addition to the actual recommended practices, also contributed. This pinpoints one problem with such voluntary practices: their direct effects are difficult to quantify.

Many invasive plants were originally introduced for horticultural use, using appropriate plant introduction methods of the time (Reichard and White 2001). It is clear, however, that those methods failed to recognize the consequences to the commons. In 2001, representatives from nurseries, botanic gardens, land-

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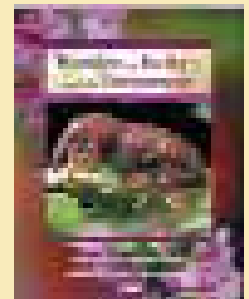
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scape architects, the gardening public, and local, state, and federal government met at the Missouri Botanical Garden to develop codes of conduct for their constituents. The resulting codes have been endorsed by the professional organizations of these disciplines and approximately 30 other organizations. Some of these groups have begun the often difficult process of implementing the codes, but whether industry support will be sufficient for change is unknown; it is still a "social arrangement experiment" in progress.

If the environmental community wants industry to change their practices, we must be ready to assist them; we have

the expertise industry needs. For instance, almost all of the codes of conduct for plants call for interdisciplinary groups to determine which new species are likely to become invasive and which already problematic species should be removed from inventories and gardens. Many botanists have essential knowledge about plant life histories and disturbance ecology, and a greater access to peer-reviewed literature that could be invaluable in affecting these changes. This can be our contribution to the social arrangement.

But to what extent can we expect these voluntary efforts to work? Is it

inevitable that they will be insufficient to produce a satisfactory level of change because irresponsible people within an industry will not follow them? How long will it take to learn whether these measures will be successful and, more importantly, how can we determine success? The best solution is to begin developing and implementing a more restrictive regulatory framework along with the voluntary efforts, conforming with the National Management Plan developed by the National Invasive Species Council (NISC 2001). This will include expanding our base of relevant science, determining what agencies should be involved and whether the current agency responsibilities should be adjusted. It could increase funding for inspections, assessments, and early detection of, and rapid response to, new invasions. As these steps are taken, the voluntary efforts should be assessed and the regulations adjusted to provide an appropriate social arrangement between those introducing species and those battling them.

We must take steps now to prevent the introduction of new pest species. Finding solutions that provide protection for the environment, while respecting the needs of industry, will require open minds and committed individuals.

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