International Agricultural Trade and Policy Center

ECONOMIC DIMENSIONS OF THE PROBLEM OF INVASIVE SPECIES

By

E. A. Evans

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OBJECTIVES:

The Center's objectives are to:

- Serve as a university-wide focal point and resource base for research on international agricultural trade and trade policy issues
- Facilitate dissemination of agricultural trade related research results and publications
- Encourage interaction between researchers, business and industry groups, state and federal agencies, and policymakers in the examination and discussion of agricultural trade policy questions
- Provide support to initiatives that enable a better understanding of trade and policy issues that impact the competitiveness of Florida and southeastern agriculture specialty crops and livestock in the U.S. and international markets

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Introduction

With the events of September 11, 2001, the anthrax mail attacks, and the establishment of the Office of Homeland Security to develop and coordinate the implementation of a comprehensive national strategy to secure the United States from attacks, many individuals have become aware of the threat of biological weapons directed towards people. However, few realize how vulnerable the U.S. agricultural infrastructure is, and has been, to pests and disease outbreaks resulting from accidental or deliberate introductions, and the constant battle that is being waged to prevent and/or mitigate the spread of invasive species. Over the past 200 years or so, more than 50,000 foreign plant and animal species have become established in the United States. About one in seven has become invasive,[1] with damage and control costs estimated at more than $138 billon each year (USDA/APHIS, 2001). The problem of invasive species has intensified within the last few years, making it a serious challenge to globalized trade. “Animals, plants, and microbes can now migrate across the planet to new homes with unprecedented ease” (The Economist, 2000, p.118).

The problems of biological invasives and the decision-making framework established to prevent their introduction and spread have traditionally been the domain of the biological scientific community. However, as present management systems have become overwhelmed by the increase in the introduction and spread of invasives, the

[1] An "invasive species" is defined as a species that is non-native (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health. (Executive Order 13112). Invasive species can be plants, animals, and other organisms (e.g., microbes) [http://www.invasivespecies.gov/].

scientific community is now calling for input by economics and other social science disciplines to answer questions and carry out strategic actions to address the problems.

The economic dimension of the problem of invasive species is growing from at least two perspectives. First, economics is central to the cause of biological invasiveness, and the consequences of pest incursions go far beyond direct damages or control costs. Most cases of invasiveness can be linked to the intended or unintended consequences of economic activities (Perrings et al., 2002). Consequently, economic applications are essential to understand the problem and provide more accurate and comprehensive assessments of the benefits and costs of control alternatives to increase the effectiveness and efficiency of publicly funded programs.

Second, modeling the economic and trade impacts of technical trade barriers is becoming more important. Common among such barriers are those dealing with trade restrictions that can be imposed by a country in an attempt to prevent entry of invasive species. Such measures are within the rights of a country and often can be justified on the grounds of economic and social prosperity. However, they can also impose unnecessary social costs, thwart commercial opportunities, and reduce competition and economic growth. The challenge is how best to incorporate economics in sanitary and phytosanitary policy analyses to ensure that the benefits of the measures enacted exceed their costs.

The purpose of this article is to highlight aspects of the economic dimensions of the problem of invasive species.

Evidence of Increased Incidence of Invasives and Cost Implications

The increased spread of invasive species reflects rapid globalization and trade liberalization. These developments have spawned greater long-distance hitchhiking by invasive species of pests and diseases, especially in the trading of live animals, and horticultural and raw animal products. The U.S. Animal and Plant Health Inspection Service (USDA/APHIS, 2001) has cited a dramatic increase in the incidence of invasive pests and diseases in the United States. Specifically, the study noted increased outbreaks of exotic fruit fly infestations in California and Florida, entry of the Asian longhorn beetle into New York and Illinois, the introduction of the Asian gypsy moth in North Carolina and Oregon, and citrus canker infestations in Florida (USDA/APHIS, 2001).

Invasive species can cause considerable damages and costs for eradication and control for societies; however, the full extent of the costs of damages caused by pest incursions has only recently received greater appreciation. They can harm agricultural systems and native plants and animals, particularly endemic species, because their natural predators and parasites in their native land are usually not present in the new environment. Thus, an invasive species that is not a pest in its native land could cause significant damage in a new environment. In the extreme, such damage could lead to the loss of biodiversity. For example, the Asian longhorn beetles that were first discovered in the United States, in New York in 1996 and Chicago in 1998, are expected to damage millions of acres of hardwood trees throughout U.S. forests and suburban landscapes. The states of Illinois and New York City and local governments have already invested more than $30 million to eradicate this pest and protect 6.7 million trees in the infested regions.

Since 1996, the state of Florida has spent in excess of $300 million dollars trying to eradicate citrus canker.

Invasive species can also adversely affect important environmental service flows such as cropping systems, livestock grazing, and recreational uses. Water systems can be affected when pests clog rivers, irrigation systems, and shorelines. In addition, invasive species can have negative impacts on ecological services provided by one resource for other resources or an entire ecological system (Evans, Spreen, and Knapp, 2002).

What Economics Has To Contribute Towards Resolving The Problem Of Invasiveness

Economics has traditionally been concerned with decision-making, particularly with what decisions are made rather than how they are made—although to some extent the discipline has started to embrace the latter. The discipline has developed a set of analytical capabilities that can aid decision makers in arriving at a set of rational and consistent decisions. The analytical capabilities, as pertain to the problem of invasives, include rationale decision-making over a range of pests threats and management interventions; monetary valuations; cost-benefit analysis as a tool to evaluate public intervention strategies; allocation of scarce resources; and formal consideration of risk and uncertainty. The discipline has also developed several methodologies to assess the value of non-marketed environmental and health effects. With increasing demand for transparency in decision-making, due to commitments to international agreements and pressure from various interest groups, effective and convincing communication is essential to implement desired strategies. When such communications are based on sound economic analysis, efficiency in bargaining can be greatly enhanced.

Assessing the Economic Consequences of Invasive Pests and Diseases

Considerable effort is being devoted to assessing the full economic impacts of invasive pests and diseases. The goal is to develop effective management programs to help prevent, control, or mitigate such invasions. Previously, the focus was on identifying the most cost-effective means of treatment for of an outbreak. Now the emphasis is on the benefits and costs of treatments to determine how best to manage the particular pest and/or disease.

Assessing the impact is challenging and imprecise. First, as noted earlier, the full range of economic costs of biological invasions goes beyond the immediate impacts on the affected agricultural producers. Often included are secondary and tertiary effects such as shifts in consumer demands, changes in the relative prices of inputs, loss of important biodiversity, and other natural resource and environmental amenities. The range of economic impacts can be broadly classified into two categories: direct and indirect impacts (Bigsby and Whyte, 2001). The direct impacts reflect the effects of the particular pest or disease on the host while the indirect impacts are non-host specific. The latter would be the general effects that are created by the presence of a pest but not specific to the pest-host dynamics that could affect public health issues such as compromising key ecosystem functions; general market effects, including possible changes in consumers attitude toward a given product; research requirements; market access problem; and impacts on tourism and other sectors of an economy.

Alternatively, six types of impacts can be identified: (1) production; (2) price and market effects; (3) trade; (4) food security and nutrition; (5) human health and the environment; and (6) financial costs impacts (FAO, 2001).

Production Impacts—These are considered the most direct economic impacts associated with the host, resulting in the loss or reduced efficiency of agricultural production (such as yield decline). Even though such impacts may be relatively easy to identify, they can be difficult to measure. Disease can have lasting effects on the host in ways that are not always obvious. In livestock, for example, there could be delays in reproduction, resulting in fewer offspring. Pesticides applied to treat a given pest could pollute soil and surface water. Also, distinguishing the impacts of the pests from other impacts such as climate could be difficult.

Price and Market Impacts—Outbreaks of pests and diseases can directly affect the quantities of a commodity demanded or supplied. The exact impact on the market and the duration of the impact depend on several factors, including the nature of the pests and diseases, market size, and the relative elasticities of demand and supply. In cases where consumer health is involved, as in the recent outbreak of bovine spongiform encephalopahy (BSE), consumer perceptions about an implicated product and the ability of a country to produce safe food after an outbreak or illness are usually slow to recover and can have a lasting influence on food demand and global trade. In addition, a range of secondary effects may result from the multiplier effect.

Trade Impacts—The introduction and/or spread of invasive species can have major trade implications that could outweigh direct production losses. Such trade impacts will depend on a number of factors, including the policy response of trading partners to news about outbreaks, the importance of traded commodities, the extent of the damage, and the demand and supply elasticities. Important are the prospects of losing competitive advantage in an export market and possibly the premium from supplying disease-free

products. Such concerns are real because unaffected countries will either prohibit entry of the commodities from the affected country or establish a set of precautionary measures. In either case, the competitive trade advantage could be lost.

Food Security and Nutrition Impacts—The extent to which invasive pests and diseases either reduce the domestic supply of foods directly or restrict a country's international trade could harm its food security, especially for developing countries.

Human Health and the Environment Impacts—Assessing the human health and environmental impacts of invasive pests and diseases are difficult since, in many cases, the impacts are not fully understood. Available evidence does suggest, however, that the incidence of invasive food-borne diseases is growing and that their health and socio-economic impacts are increasingly being felt in both developed and developing countries.

Financial Costs Impacts—Measures taken at the individual, collective, and international levels to control, eradicate, or mitigate invasive pests and diseases may have budgetary implications. Such costs could include the costs of inspections, monitoring, prevention, and response.

Estimating these economic impacts requires a considerable amount of biological and non-biological information that involves considerable time and expense. Most studies have easily calculated impacts such as costs of control, eradication, and prevention and the expected loss in productivity of the enterprise. However, such an approach is shortsighted since, in several cases, the indirect effects arising from (say) the trade impacts could easily outweigh production loss impacts. A recent GAO report commented on the problem in its observation that:

> The scope of existing studies on the economic impact of invasive species in the United States range from narrow to comprehensive, and most are of

> limited use for guiding decision makers formulating federal policies on prevention and control. Narrowly focused estimates include analyses of past damages that are limited to a certain commercial activities such as agricultural crop production and simple accounting of the money spent to combat a particular invasive species. These estimates typically do not examine economic damage done to natural ecosystems, the expected costs and benefits of alternative control measures, or the impact of possible invasions by other species in the future…. In general the more comprehensive the approach used to assess the economic impacts of invasive species, the greater its potential usefulness to decision makers for identifying potential invasive species, prioritizing their economic threat, and allocating resources to minimize overall damages (U.S. GAO, 2002, p. 3).

Valuing the non-market impacts can be challenging. In this regard, economists are employing such tools as dynamic optimization and ex-ante simulation analyses to assist decision makers (Evans, Spreen, and Knapp, 2002). Use is also being made of methods such as "contingent valuation" and "willingness-to-pay to obtain or avoid similar benefits or losses."

A more general measurement problem is the unavailability of data, especially when there is no disease history. Complications also may arise from the uncertainty of the scientific evidence about the probability of entry and establishment, rate of spread, and the extent of damage. Closer collaboration between economists and biological scientists as well as the increased availability of computer software programs (such as the Excel @RISK program that combines dynamic simulation procedures with probability distribution) allow analysts to combine actual, but limited, data with theoretical modeling in determining potential impacts.

Modeling the Impacts of Sanitary and Phytosanitary Regulations

The need for a government to protect its citizens and environment against imported externalities (such as invasive pests and diseases) is embraced by the WTO Agreement,[2] which promotes increased trade among countries. When legitimate externalities or other market failures are addressed through technical trade barriers, for instance, in a commodity with the potential to introduce disruptive pests and diseases, they can safeguard national welfare. However, when such measures are imposed to isolate domestic producers from international competition, they are welfare-decreasing. This dual nature of the SPS measures – providing externality-based protection versus economic-based protection – adds to the importance of comprehensive economic analysis of the issues of invasive pests and diseases.

As a consequence, many economists are busy trying to develop a framework for assessing the trade and welfare implications of trading a particular commodity under different management options when there is the potential for introduction of an invasive pest or disease. Developing such a framework, however, is far easier in theory than in practice. Although not insurmountable, the involvement of externalities in the form of unwanted pests and diseases, and specifically the risks and uncertainty associated with them, complicate the standard economic policy analysis.

Concluding Remarks

The invasive species problem is posing a serious challenge in an era of increased globalization and trade liberalization. The problem has as much to do with economics as with ecology. Any solutions advanced must be firmly grounded in both science and

economics. Our economic discipline possesses the capability of valuing various market and non-market impacts and provides a means for assessing important trade-offs among various management alternatives, which can improve greatly the decision-making process for managing such risks. In addition, it can improve the transparency of the decision making process by providing justifications for the measures implemented. The true value of economics should therefore not be seen solely in the precision of the numbers generated, albeit this is important, but the extent to which the discipline aids decision makers to formulate consistent and rationale decisions.

[2] A separate agreement governing sanitary and phytosanitary issues, Agreement on the Application of Sanitary and Pytosanitary Measures, was negotiated during the 1986-1994 Uruguay Round multilateral trade negotiations.

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