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The World Conservation Union (IUCN)
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O P P O R T U N I T Y

Op·por·tu·ni·ty [op-er-**too**-ni-tee, -**tyoo**-] noun, plural -ties.

1. favorable or advantageous chance or opening.
2. a situation or condition favorable for attainment of a goal.
3. a good position, chance, or prospect, as for advancement or success.

Origin: 1350–1400; ME opportunite < MF < L opport nit s convenience, fitness, equiv. to opport n(us)

UPON reading an early draft of this report one reviewer suggested that it come with a label: "Warning. Reading this report may cause depression." As authors, however, we have chosen the path of optimists, believing that the information contained herein points towards significant opportunities for advancing US biosecurity — a goal in every American's best interest. Where we point to inadequacies, may the reader envision great leadership potential. When we remark on challenges, may the reader dwell on innovation. Where we discuss inconsistencies, may the reader be inspired to think strategically. And where we observe successes, may the reader believe many more are possible.

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Photo courtesy of Pennsylvania Department of Conservation and Natural Resources—Forestry Archive, Pennsylvania Department of Conservation and Natural Resources, Bugwood.org

The Asian longhorned beetle (*Anoplophora glabripennis* Motschulsky) was first discovered in the US in 1996 in the New York City metropolitan area. It is thought to have been introduced in untreated wooden packing materials from commodities originating in China. Estimates have been made of potential loss from the uncontrolled spread of this invasive species in excess of $650 billion.

Actionable pest: A quarantine pest for which specific mitigation actions are required by the Animal and Plant Health Inspection Service (APHIS).

Alien species: a species, subspecies or lower taxon, introduced outside its natural past or present distribution; includes any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce. (CBD VI/23)

Biological diversity (biodiversity): the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems. (IUCN 2000)

Biological invasion: for the purpose of this study, biological invasion is a process which includes: a) entry into the US, b) introduction into one or more ecosystems, c) establishment of at least one reproducing population, and eventual d) spread and e) impact on one or more aspects of the environment, economy, and human health.

Biosecurity: the collective strategy, efforts, and planning to protect human, animal, and environmental health against biological threats (those posed by diseases and other living organisms). Biosecurity is the sum of risk management practices in defense against biological threats. (NASDA 2001)

Environmental Impact Review: Interagency process established by Executive Order 13141 which requires the US Trade Representative and Chair of the Council on Environmental Quality, in conjunction with members of the Trade Policy Staff Committee (TPSC), to assess the impact of certain types of trade agreements on the US environment.

Establishment: the process of an alien species in a new habitat successfully producing viable offspring with the likelihood of continued survival. (CBD VI/23)

Free trade agreement: a binding policy established between or among nations that enables the exchange of goods and services without protective customs tariffs.

Injurious wildlife: non-domesticated animals that can cause substantial harm to native wildlife and/or their habitats.

Interception (of a pest): The detection of a pest during inspection or testing of an imported container or commodity.

Introduction: the movement by human agency, indirect or direct, of an alien species outside of its natural range (past or present). This movement can be either within a country or between countries or areas beyond national jurisdiction. (CBD VI/23)

Intentional Introduction: the deliberate movement and/or release by humans of a species outside its natural range. (CBD VI/23)

Invasive alien species: see invasive species.

Invasive species: a non-native (alien) species that causes or has the potential to cause harm to the environment, economy, or human health (US Executive Order 13112; Federal Register 1999).

Market access agreement: a written agreement made between two or more countries that enables those countries to have certain understandings and gain specific permissions and rights for the exchange of market goods and services.

Non-actionable pest: A subset of reportable pests that, according to APHIS guidelines, do not always require specific mitigation measures.

Non-native species: see alien species.

Non-reportable pest: An organism that does not qualify as a quarantine pest and thus need not be reported to APHIS. Typically, non-reportable pests pose no known threat or have already become naturalized in the United States (APHIS 2004).

Propagule pressure: (also termed "introduction effort") is a composite measure of the number of individual organisms (and/or their reproductive units, e.g., seeds) released into an ecosystem to which they are not native. It incorporates estimates of the absolute number of individuals involved in any one release event (propagule size) and the number of discrete release events (propagule number). (Lockwood et al. 2005)

Quarantine pest: A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (NAPPO).

Regulated non-quarantine pest: An organism whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing party. (NAPPO)

Reportable pest: A quarantine pest. All quarantine pests found by inspectors are to be reported to the Animal and Plant Health Inspection Service (APHIS) via specific procedures.

Risk analysis: (1) the assessment of the consequences of the introduction and of the likelihood of establishment of an alien species using science-based information (i.e., **risk assessment**), and (2) the identification of measures that can be implemented to reduce or manage these risks (i.e., **risk management**), taking into account socio-economic and cultural considerations. (CBD VI/23)

Unintentional Introduction: all other introductions which are not intentional. (CBD VI/23)

User Fees: fees that the Secretary of Agriculture may prescribe and collect from agriculture importers (based on conveyance type) and travelers in sufficient quantity to cover the costs of agriculture inspection and quarantine.

Wildlife: any wild animal, whether alive or dead, including any wild mammal, bird, reptile, amphibian, fish, mollusk (i.e., clam, snail, squid, octopus), crustacean (i.e., crab, lobster, crayfish), insect, sponges, corals, or other invertebrate, whether or not bred, hatched, or born in captivity, and including any part, product (including manufactured products and processed food products), egg, or offspring (USFWS 2006a).

ACRONYMS

ABI	Customs Automated Broker Interface
ACS	Customs Automated Commercial System
ANSTF	Aquatic Nuisance Species Taskforce
APHIS	Animal and Plant Health Inspection Service
AQI	Agriculture Quarantine Inspection
AQIM	Agriculture Quarantine Inspection Monitoring
ATS	Customs Automated Targeting System
CEQ	Council for Environmental Quality
CBP	Customs and Border Protection
CITES	The Convention on International Trade in Endangered Species of Wild Fauna and Flora
DHS	Department of Homeland Security
DOI	Department of the Interior
EPA	Environmental Protection Agency
EPA-OIA	Environmental Protection Agency – Office of International Affairs
FACA	Federal Advisory Committee Act
FDA	Food and Drug Administration
FIS	Federal Inspection Service
FLETC	Federal Law Enforcement Training Center
FTA	Free Trade Agreement
GAO	Government Accountability Office (formerly General Accounting Office)

HHS	Health and Human Services
IBIS	Interagency Border Inspection System
ISAC	Invasive Species Advisory Committee
ITIS	Integrated Taxonomic Information System
IUCN	The World Conservation Union
LEMIS	Law Enforcement Management Information System
NAPPO	North American Plant Protection Organization
NISC	National Invasive Species Council
NMP	National Management Plan
PestID	Pest Identification Database
PIN	Port Information Network
SITC	Smuggling Interdiction and Trade Compliance
TECS	Treasury Enforcement Communications System
TDY	Tour of Duty
TPSC	Trade Policy Support Committee
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USTR	United States Office of the Trade Representative
VACIS	Vehicle and Cargo Inspection System
WADS	Work Accomplishment Data System

INVASIVE SPECIES (non-native, harmful organisms) undermine human health and safety, food and water security, and economic development. Consequently, invasive species can have significant socio-economic impacts and warrant attention as a public policy priority. Trade and travel are the primary drivers of biological invasion both into and within the United States and prevention measures have been identified as the most cost-effective means of minimizing the introduction and thus impact of invasive species.

Staff in the Environmental Protection Agency's Office of International Affairs (EPA-OIA) have recognized a gap in the US government's knowledge of the role that trade has played in the introduction of invasive species into the US. This makes it impossible to answer seemingly straightforward questions, such as: How have US market access agreements influenced the introduction of invasive species into the US? How are US market access agreements likely to influence the introduction of invasive species into the US in the future? Under future US market access agreements, should certain countries/regions, commodities, and modes of transportation (i.e., pathways) be monitored more carefully, addressed through capacity building initiatives (e.g., through environmental side agreements), or restricted in some way because they present significant risks of invasive species introduction? In September 2005, the EPA-OIA and IUCN-The World Conservation Union (hereafter IUCN) entered into a cooperative agreement to evaluate the barriers to and opportunities for a routine empirical evaluation of the probable linkages between US market access agreements and invasive species. In short, we set out to identify the resources, strategies, and policies necessary to create, maintain, and make accessible one or more commodity/invasive species databases that EPA and other relevant agencies can apply to trade policy decision-making in a timely and scientifically-based manner.

For the purposes of this study, we only examined issues and data directly pertaining to US cargo/commodity imports at maritime ports of entry. Furthermore, since environmental reviews of free trade agreements are primarily intended to focus on domestic impacts, we did not evaluate procedures for ensuring that US exports are free of potentially invasive species. Further studies will be required to consider management of outbound cargoes, and the efficacy of border protection in other nations.

Gaps and Inconsistencies

Procedural Challenges

- There is a lack of consensus regarding the difference between screening and risk assessment (or risk analysis), and little guidance (per the National Management Plan) to differentiate the goals, objectives, and processes.
- No specific mechanism and, at least prior to this meeting, little intent exists to significantly increase process clarity, coordination, and delivery schedule.
- Resources are being drained from agencies for risk assessments that are not necessarily the highest priorities in terms of policy-maker information needs. Scientific inquiry should flow from policy priorities, not visa-versa.
- The branches of government responsible for trade regulation have not made it a priority to conduct invasive species-relevant Environmental Impact Reviews of market access agreements in a timely and scientifically-defensible manner. Nor has it invested in the infrastructure and processes that would make this possible.

Data Issues

- The data currently being collected from potential invasive species pathways is largely inadequate (due to type, quality, quantity, and term of maintenance) to answer the questions that researchers need to ask to aid in policy decision-making.
- Several of the federal datasets that could be applied to pathways analysis and decision-making are not publicly available.

Between November 2005 and August 2006, we visited nine major (based on commodity volume/year) US maritime ports of entry among the top 20 major ports of entry based on the volume of import commodities managed annually. At each port we interviewed Customs and Border Protection (CBP) officers and agriculture specialists (primarily), and at US Fish and Wildlife Service (USFWS) designated ports (5/9) we also interviewed USFWS wildlife inspectors. The interviews focused on questions regarding the procedures and policies for commodity inspection, pest (invasive species) interception identification and information collection, database management, barriers to and gaps in best practices, and perceived needs for operational improvement. In order to assess the current application of pest (invasive species) interception data, we also interviewed and reviewed the publications of Federal and academic scientists who had worked with relevant datasets.

On November 17, 2005, we convened a one-day workshop of 14 invasive species experts working in the US on pathways of biological invasion. The purpose of the meeting was to: 1) exchange information on their research/programs, 2) map out progress in assessing risk of invasion by pathway, 3) analyze gaps in knowledge and institutional partners, and 4) identify shared problems and lessons learned (especially regarding data and information systems) from work to date. Nearly all of the participants were staff of National Invasive Species Council member agencies or members (past or present) of the Invasive Species Advisory Committee, and their work was intended to advance implementation of the National Management Plan.

Our study indicates that neither data collected by Customs and Border Protection (Department of Homeland Security) in conjunction with the US Department of Agriculture's Animal and Plant Health Inspection Service (APHIS), nor the US Fish and

Wildlife Service (USFWS), is suitable for use in trade policy decision making where the goal is to project the potential consequences of market access agreements on biological invasion.

Our findings regarding CBP data collection and processing (i.e., inspection) procedures are generally consistent with those reported by the Government Accountability Office (GAO) in its evaluation of US vulnerabilities to foreign agricultural pests and disease following the transfer of inspection duties from USDA to DHS. Since the transfer of APHIS inspection responsibilities to CBP, the agriculture inspection and quarantine system has benefited from improvements in classified information access and the establishment of pest risk committees. Two aspects of program "enhancement" received mixed reviews by the CBP staff we met with: establishment of an Agriculture Liaison and cross-training initiatives. The following issues were identified as limitations on data quality, quantity, and accessibility: agriculture as other than the top priority; a largely opportunistic inspection strategy; conflicts between policy priorities and scientific-based approaches; decline in inspector experience levels; poor information sharing between CBP and APHIS; reduction in canine units; lack of risk-based staffing procedures; failure of user fees to reach the ports; low morale among inspection teams; gaps in inspection and mitigation authority for certain invasion pathways and potential pests; poor system for self evaluation and feedback; and specific issues of the PestID database, including limited variables; no record of special operations activities; and inadequate data access among key personnel, correction capacities, and feedback loops. Despite the limitations of the PestID system for trade policy analysis, the data can be useful in coarse-scale analyses of historic trends, emerging trends, and changes in trends brought about through the implementation of new regulatory requirements.

While the majority of the USFWS' wildlife management and conservation work is conducted in natural areas, the Office of Law Enforcement regulates wildlife trade, investigates wildlife crimes, helps Americans understand and obey wildlife protections laws, and works in partnership with international, state, and tribal counterparts to conserve wildlife resources. Our study focused only on trade regulation duties and associated data collection and management.

This report is not the first to cite concerns over the integrity of the data collected by USFWS inspectors and maintained in the LEMIS database and even the USFWS acknowledges the challenges and limits of LEMIS data interpretation. However, to the best of our knowledge, we are the first to link the problems associated with the database directly to specific issues that undermine the wildlife inspection program as a whole. The following is a brief list of issues and concerns that were raised during our interview process: lack of resources (human, financial, etc), lack of access to information needed to ensure high-quality inspection services, uninspected and under-inspected pathways of invasion, high financial and political pressure, low electronic capacity for data entry (resulting in high probability of input error and lag times in data entry), challenges in identifying new species in trade, limited data collection and retention, lack of species-specific identification for many organisms, generalization and dynamics of data codes, misidentification and mislabeling of organisms, non-specificity of organism's country of origin, and lack of data review procedures for species other than those listed by CITES.

Unfortunately, given these institutional and informational limitations, it is impossible to use LEMIS data to make precise or accurate statements regarding the quantity of wildlife and wildlife products, and some nontimber forest products that are

being traded by type, location, or time period. Not only do the problems with data collection and storage limit trade pattern analyses, they undermine the ability of the USFWS to justify necessary budget increases. In short, many of the institutional problems that undermine the integrity of LEMIS are in turn further hampered by the Services' inability to mine LEMIS data on its own behalf.

Given the importance of agriculture and other natural resources (particularly fish and wildlife) to the US economy, it is paramount that the government proactively assess the risks and take all necessary precautions to prevent deliberate and unintentional introductions of potentially harmful organisms. Thus, effective quarantine inspection programs across multiple agencies are necessary to ensure that natural resources and agriculture are well protected even as agencies work to pursue government's top priorities: to prevent terrorists and their weapons gaining US entry and facilitate the flow of legitimate trade and travel.

The factors that limit the utility of the PestID and LEMIS systems, as well as the development of pathway analyses and screening tools, are largely administrative and political in nature, rather than scientific and technical (although the latter issues are present and in some cases quite significant). Because so many of the problems are in fact "institutionalized," moving toward an inspection system that could effectively contribute data applicable to accurate trade projections and effective trade policy decision making will require a sea change in the way the US approaches pest entry prevention. Numerous opportunities for envisioning and implementing an effective inspection system and associated data acquisition and management programs do exist.

RECOMMENDATIONS

General

The current failure of specific agencies to provide databases that permit policy makers to conduct Environmental Impact Reviews of market access agreements for invasive species risk and for interagency task teams to fully develop invasion pathway and screening tools that could enhance these Environmental Impact Reviews is a by-product of US government policies and priorities as a whole. All of the Departments that house inspection agencies or that rely on data arising from inspections for policy decision making need to work more closely to address key coordination and management weaknesses, and to increase the scientific and technical capacities of the commodity inspection program government-wide.

We hope that the member Departments of the National Invasive Species Council (NISC) will implement the following recommendations in their ongoing efforts to improve data collection and refine data entry and quality control for accuracy, precision, reliability, and accessibility. Only by adopting a comprehensive biosecurity approach and making a greater investment in its front-line defenses will the US government be able to adequately minimize the introduction of invasive species.

Inter-Departmental Cooperation

Information-sharing and cross-training for mission reinforcement are as yet poorly developed. This leaves significant gaps in coverage among a wide range of actors. The DHS, USDA, and DOI should work with all other Departments housing inspection agencies (e.g., Health and Human Services; HHS), as well as agencies (e.g., US Office of the Trade Representative, EPA) that make policy decisions based on data arising from inspections to:

- Create a comprehensive **biosecurity plan**[1] and associated **cross-cut budget** in order to integrate and adequately resource all commodity/product inspection services. These services need not be under the authority of a single department, but clear definitions of legal authority (including shared authorities where relevant), co-housing of staff, inter-agency action committees, and the inter-operability of information and financial systems are highly likely to enhance effectiveness (see below).
- Develop a "**clearinghouse mechanism**[2] " and "**learning network**[3] " that has both public and clearance-required portals (for particularly sensitive trade information) and houses a wide array of **informational tools** intended to build the capacity of inspectors to conduct the high quality inspections (and thus collect high quality data). A learning network would facilitate a process of continuous improvement by permitting inspectors to communicate peer-to-peer on new techniques, new problems identified, and potential solutions. Peer-to-peer communication, when linked to emergency response, provides the basis for an international early-warning mechanism. The clearinghouse mechanism should provide direct access to existing information systems on invasive species (e.g., Global Invasive Species Database of IUCN, Plants Database of USDA, and the Inter-

[1] An early detection/rapid response (aka "incident or command response") system should be a key component of this plan. Thus, the information tools and systems recommended herein need to be developed consistent with the early detection and rapid response strategies outlined in the National Management Plan and subsequent support documents (e.g., NISC 2003).
[2] A network of stakeholders working together to facilitate implementation a specific mission and goals. In general, it facilitates access to and the exchange of information on relevant issues.
[3] A peer-to-peer system for the exchange of information to solve problems.

American Biodiversity Information Network) (IABIN)[4] . The following are examples of resources to be included in a clearinghouse mechanism and associated learning network: a directory of all inspection service personnel; invasive species identification keys, photos, expert directories, and bibliographies; invasive species interception newsletters; automated invasive species e-alerts; and invasive species question bulletin boards (perhaps by taxonomic group).

- Designate and implement standards, formats, and protocols that will enable establishment of an **inter-operable database** network linking all commodity/product inspection datasets. Apply lessons learned from the successful sharing of information through the Treasury Enforcement Communications System.
- Conduct a thorough inter-agency **needs assessment** to determine which inspectors need access to which automated databases in order to enhance inspection targeting and reporting. Fully engage inspection staff in the design, implementation, and evaluation of the assessment.
- Based on this needs assessment, establish **security clearances** for relevant inspection personnel that will give them easy access to the secured automated information systems, as well as the clearinghouse/learning network and inter-operable database to be developed.
- Establish **scientifically-and risk-based sampling protocols** and implement them consistently at each port. Ideally, these protocols will include data collection on all ship-

[4] http://www.issg.org/database/; http://plants.usda.gov; http://www.iabin.net, respectively. For an extensive list of relevant databases see: http://www.invasivespeciesinfo.gov/resources/main.shtml.

ments, including the records of all interceptions (regardless of proven pest risk) and inspections in which no potential invasive species were detected (i.e., "0" records).

- Enact procedures for the **routine review (monitoring) and correction** of sampling protocols and their resultant data.
- Establish mandates and procedures for improving technologies and sharing **high-tech equipment** (e.g., VACIS) as needed among inspection agencies.
- Expand **training and other capacity-building opportunities** for all inspectors by creating regular group meetings (e.g., local monthly meetings and an annual retreat), interagency personnel exchanges, tours of duty (TDY) focused on invasive species issues, and taxonomic fellowships for doctoral candidates and post-docs that enable them to join inspection teams at ports of entry for 1–2 years.
- Increase the **income potential** of inspection staff via grade increases and make pay-levels commensurate with both experience and locality.
- Harmonize **trade reporting protocols and systems** across inspection agencies.
- Enact FACA (Federal Advisory Committee Act) sanctioned, **peer-review committees** to annually review the integrity of inspection programs and resultant data, including implementation of action items in the National Management Plan, and this and other relevant reports (e.g., GAO 2006a; USFWS 2005). Priority managerial issues for review should include relevant[5] : budgetary priorities; financial management system policies and procedures (including interagency transfers); user fee income levels and distribution

[5] In random order.

mechanisms; program performance measures; risk-based staffing models and procedures; inter-agency communications and information access; employment of scientific, technological, and other capacity building (e.g., canine unit) tools/approaches; pathway coverage; training quality and staff competence; and staff morale.

In addition to the above, we recommend the following immediate efforts:

Customs and Border Protection

- Recognize that **reduction of agroterrorism and bioterrorism risk** requires resources (financial and human) and capacity building (training and informational resources) at levels equal to that of risk reduction associated with weapons of mass effect and that harmful organisms are already entering the US daily as a result of deliberate and unintentional introductions.
- **Invest adequate resources and political will in invasive species prevention** and control programs in order to safeguard homeland security from organisms that threaten the environment, economy, food supply, and human health within the US via both deliberate and unintentional introductions.
- Take the lead in a process to **evaluate DHS, USDA, and FWS authorities** in order to identify gaps and inconsistencies in policies and programs to prevent and rapidly respond to the introduction of invasive species. Engage inspection staff in development and implementation of a plan to fill gaps and fully address inconsistencies.
- Foster stronger policies and programs for protecting agriculture security by **hiring agriculture experts at all**

staffing levels, including positions of senior leadership within DHS/CBP management.

- **Establish listening sessions** (at least two per year) for DHS and USDA officials to receive briefings directly from port inspectors on issues of concern related to their ability to accomplish effective data gathering. These listening sessions can be accomplished via conference calls or video conferences with representatives from all designated ports.
- Work with inspection staff, NISC representatives, and outside consultants to **identify pathways of biological invasion and groups of harmful organisms (e.g., pests of infrastructure)** that are not currently addressed by other Departments and establish prevention policies and response measures (based on the science of propagule pressure) in order to minimize this growing threat to homeland security.
- Fully engage **DHS staff in NISC activities** (esp., with regard to issues related to pathways of invasion not currently addressed by other Departments).

US Fish and Wildlife Service

- Identify in LEMIS all traded **commodities/products to species level**.
- Employ **ITIS (Integrated Taxonomic Information System[6]) codes** to standardize the coding of fish and wildlife species and their products.
- Establish a **national seizure facility** has the capacity to house confiscated fish, wildlife, and wildlife products

[6] http://www.itis.gov

based on their status as endangered or injurious. Ideally, the cost of the facility will be shared among border protection agencies and will enable inspectors to seize (and thus report) fish and wildlife without the concern of port-specific budgetary or facilities limitations.

- **Establish listening sessions** (at least two per year) for DOI officials to receive briefings directly from port inspectors on issues of concern. These listening sessions can be accomplished via conference calls or video conferences with representatives from all designated ports.
- Fully engage senior **FWS staff in NISC activities** and ensure that inspection teams receive relevant information and capacity building tools developed by DOI and other Departments (e.g., US Army Corps of Engineer's species identification keys)

NOTES

INVASIVE SPECIES can hinder the ability of ecosystems to function properly and thus limit their capacity to provision natural resources for human use (McNeely et al. 2001; Mack et. al. 2000; Sala et al. 2000; Mooney & Hobbs 2000; Vitousek et al. 1997). They have contributed to the endangerment of numerous species (Wilcove et al. 1998); degradation of aquatic, marine, and terrestrial environments (Carlton 2001; Magee et al. 2001; Chapin et al. 2000; Mooney & Hobbs 2000); and the alteration of biogeochemical cycles (D'Antonio 2000; Green et al. 1999; Mack & D'Antonio 1998; D'Antonio & Vitousek 1992). Invasive species are known to impact infrastructure, natural resource access and availability, and human health and safety (Reaser et al. 2003a; Meyerson & Reaser 2003, 2002a; NISC 2001). Consequently, invasive species can have significant socio-economic impacts (GAO 2006b; Reaser et al. 2003b; Pimentel 2002; Naylor 2002; Pimentel et al. 2001, 2000; McNeely 2001; Perrings 2000; Parker et al. 1999) and warrant attention as a public policy priority (Burgiel et al. 2006; Reaser et al. 2003a; Meyerson & Reaser 2002b; McNeely et. al. 2001, Waage & Reaser 2001; Shine et al. 2000).

The process of biological invasion can be facilitated by any activity that results in the movement of goods (commodities) and services (including people and equipment) between evolutionarily-isolated ecosystems[7] (Burgiel et al. 2006; McNeely et al. 2001; Mack et al. 2000). The risks of a non-native species becoming invasive are especially high if the ecosystem of origin and ecosystem of introduction are ecologically and climatically similar (National Research Council 2002; Lonsdale 1999), propagule pressure is sufficient to enable introduction of a viable population (Drake & Lodge 2006; Duggan et al. 2006; Von Holle & Simberloff 2005; Lockwood et al. 2005), and the ecosystem into

[7] Ecosystems that are separated by distance and/or geologic barriers (e.g., mountain ranges) to the degree that organisms cannot be exchanged among without human intervention.

which the non-native species is introduced is lacking in other species (predators, competitors, pathogens, and parasites) capable of controlling its population growth (Blumenthal 2005; Colautti et al. 2005; Green et al. 2004; Mack et al. 2001; Lake & O'Dowd 1991). Pathways for the movement of organisms between ecosystems, such as global trade and tourism (Burgiel 2006, McNeely et al. 2001), military operations (Westbrook et al. 2005), and development assistance activities (Gutierrez & Reaser 2005; Naylor 2002) are often cited as socio-political drivers of biological invasion.

Prevention measures (e.g., risk assessments, inspection, quarantine, trade regulations, voluntary codes of conduct, and education) have been identified as the most cost-effective[8] means of minimizing the introduction and thus impact of invasive species (Keller et al. 2006; Leung et al. 2002; National Research Council 2002; McNeely et. 2001; NISC 2001). However, in the US and other countries the practice of prevention often receives far less public attention and engagement than efforts aimed at the eradication and control of established invasive species. Furthermore, it is notoriously difficult to prove the effectiveness of prevention programs (i.e., to illustrate when and how problems did not occur) and public policy makers tend to be reluctant to support efforts absent a clear measure of success. For these reasons, the human and financial resources dedicated to the implementation of prevention measures are often inadequate. Thus, ***the inadequacy of existing prevention measures increases the need for public attention to costly eradication and control programs, and drives a vicious circle of inefficiency that can only be broken by sufficient investments in prevention.***

[8] USDA has budgeted over $420 million to control and eradicate just three plant pests that have established in the US and has told the US Government Accountability Office (GAO) that even this level of funding has proven insufficient (GAO 2006b).

When Prevention Fails

Examples of invasive, commodity "hitchhikers" that have already had profound negative impacts on the environment, economy, and human health in the US. Collectively, invasive species impacts and control measures cost the US more than $100 billion/year.

Prevention is a wise investment!

Asian Long-horned Beetle (*Anolophora glabripennis*); Environment & Industry

Asian Tiger Mosquito (*Aedes albopictus*); Human & Animal Health

Brown Tree Snake (*Boiga irregularis*); Environment, Infrastructure, Human Health

Chytrid Fungus (*Batrachochytrium dendrobatidis*); Environment

Dutch Elm Disease (*Ophiostoma ulmi*); Environment & Industry

Emerald Ash Borer (*Agrilus planipennis*); Environment & Industry

Giant African Snail (*Achatina fulica*); Environment, Industry, Human Health

Gypsy Moth (*Lymantria dispar*); Environment & Industry

Norway Rat (*Rattus norvegicus*); Environment, Infrastructure, Human & Animal Health

Red Imported Fire Ant (*Solenopsis invicta*); Environment & Human Health

On February 3, 1999, US Executive Order 13112 established the federal National Invasive Species Council (NISC; Federal Register 1999a) and charged it with creation of a non-federal Invasive Species Advisory Committee (ISAC), as well as a National Management Plan for Invasive Species (to be revised every two years[9]). The National Management Plan places a strong emphasis on prevention strategies and Item 39 of the National Management Plan (under International Cooperation) states that, "By December 2001, the Council co-chair agencies and State, in conjunction with the US Office of the Trade Representative (USTR), will establish an ongoing process to consider the risks of invasive species during the development of US trade agreements and ensure that US trade agreements facilitate a country's abilities to prevent the movement of invasive species in a manner that is transparent, non-discriminating, and based on sound science."

On November 16, 1999 the President signed into effect Executive Order 13141 (Environmental Review of Trade Agreements; Federal Register 1999) in which he called on the US Trade Representative (USTR) and the Chair of the Council on Environmental Quality (CEQ) to oversee Executive Order 13141 implementation and, in particular, to conduct environmental reviews of proposed trade agreements through an interagency Trade Policy Staff Committee (TPSC). Section 4 of Executive Order 13141 requires the TPSC to conduct environment reviews for comprehensive multilateral trade rounds, bilateral or plurilateral free trade agreements, and major new trade liberalization agreements in natural resource sectors. In general, environmental reviews are not required for other types of trade agreements,

[9] The National Invasive Species Management Plan was released January 18, 2001 and is available at http://www.invasivespeciesinfo.gov. It has not yet been revised. See bibliography citation "NISC 2005" for a progress report on implementation of Executive Order 13112.

including most agreements focused on specific sectors (known as "sectoral liberalization agreements"). However, Executive Order 13141 grants the Trade Representative, through the TPSC, flexibility to determine whether an environmental review of an agreement or category of agreements is warranted based on such factors as the significance of reasonably foreseeable environmental impacts. Implementing Guidelines for Executive Order 13141 were passed in 2000 (Federal Register 2000) and the Trade Act of 2002 (US Congress 2002b) confirmed the Executive Order 13141 mandate.

Following the attacks on the World Trade Center on September 11, 2001, and subsequent anthrax scares, the US government created the Department of Homeland Security (DHS; Homeland Security Act of 2002; US Congress 2002a) and reorganized the authorities and daily responsibilities of some of the federal agencies engaged in import inspection and information management. For example, in March 2003, more than 1,800 agriculture specialist positions[10] were transferred from the US Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) to the DHS Customs and Border Protection (CBP) service and assigned to 161 of the 317 ports of entry under CBP jurisdiction (GAO 2006a). Thus, several of the authorities and implementation duties called for in the National Management Plan and related executive orders initially directed toward USDA are now under the jurisdiction and discretion of DHS (Federal Register 2003). The Secretaries of DHS and USDA signed a memorandum of agreement in February 2003 in which they agreed to work cooperatively to implement the relevant provisions of the Homeland Security Act and to ensure the effectiveness of agricultural quarantine inspection (AQI) functions (GAO 2006a).

[10] USDA was authorized to transfer up to 3,200 agriculture quarantine inspection (AQI) personnel.

The trade in wildlife and products derived from wildlife, as well as non-timber forest products, is worth billions of dollars annually (CITES 2006). The US is one of the world's leading importers of wildlife and wildlife products, with the number of shipments into the country increasing 41% from 1998 to 2003 (USFWS 2005; see USFWS trade patterns Appendix V) and the current trade value standing at over a billion dollars per year (USFWS 2006c). The US Fish and Wildlife Service (USFWS) regulates wildlife imports (including wildlife parts and products) and provides inspection services at 18 designated ports[11] of entry. The primary duty of Fish and Wildlife Inspectors is to clear and facilitate the importation of legal shipments and seize and legally process shipments that are in violation of domestic and/or international law (USFWS 2006c). These inspectors are thus the United States' front-line defense against the illegal wildlife trade, as well as the introduction of invasive species that enter the US as commodities (e.g., species that are listed as "injurious wildlife")[12]. Wildlife inspectors are expected to know and enforce both domestic laws (e.g., US Endangered Species Act and Lacey Act) and international agreements to which the US is a Party (e.g., under the Convention on International Trade in Endangered Species of Wild Fauna and Flora or CITES) (CITES 2006).

[11] See: http://www.fws.gov/le/ImpExp/Designated_Ports.htm. Note: Elsewhere the USFWS states that all shipments must come through 17 designated ports (http://www.fws.gov/le/aboutle/wildlife_inspectors.htm). These designates ports of entry include international airports (primarily) and maritime ports. Inspectors staff an additional 11 border crossings at the margins of Mexico and Canada, as well as five additional ports that handle specific wildlife species (USFWS 2006c).

[12] Note: The USFWS has a sole focus on wildlife. Other Departments focus on livestock and pests of importance to agriculture that might be associated with any animal or animal product import. For example, CBP is responsible for clearing trophy shipments for USDA Veterinary Service regulations and inspecting for hitchhiking pests on skins and hides or other animal parts.

The US Environmental Protection Agency (EPA) is a founding member of NISC and is identified as an implementing agency in the National Management Plan. It is also a member of the TPSC and its Office of International Affairs (EPA-OIA) takes an active role in the environmental review (hereafter Environmental Impact Reviews) of trade agreements with a particular interest in the implications of trade liberalization on biological invasion.

> Another invasion-prone form of economic behavior emerges from the ideology of the world trading system: "free trade" has become a global and social ideal. At present, there is no comprehensive international effort to slow—or even monitor—the invasions released through trade, and the power of the free trade ideal is obviously not going to be conducive to any such effort.
>
> Chris Bright, *Life Out Of Bounds; Bioinvasion In a Borderless World*. 1998

EPA-OIA's staff has recognized a gap in the US government's knowledge of the role that trade has played in the introduction of invasive species into the United States (Gilbreath 2005). While the media and academic community frequently presuppose that opening domestic markets to foreign products has increased and will continue to increase the risk of invasive species entering into US territory, the potential linkages between market access and biological invasion have not been empirically tested. This lack of quantitative assessment creates a barrier for policy decision-making; the EPA and other Federal agencies are unable to answer seemingly straightforward questions, such as:

- How have US market access agreements (Appendix I) influenced the introduction of invasive species into the US?
- How are US market access agreements likely to influence the introduction of invasive species into the US in the future?
- Under future US market access agreements, should certain countries/regions, commodities, and modes of transportation (i.e., pathways) be monitored more carefully, addressed through capacity building initiatives (e.g., through environmental side agreements), or restricted in some way because they present significant risks of invasive species introduction?

In September 2005, the EPA-OIA and the World Conservation Union (hereafter IUCN; Appendix II) entered into a cooperative agreement to evaluate the barriers to and opportunities for a routine empirical evaluation of the probable linkages between US market access agreements and invasive species. In particular, IUCN was asked to:

1. Assess the ability of the US commodity import information systems (databases) to provide reliable, accessible data for EPA-OIA's applications [Current Status];

2. Review the progress of NISC working groups focused on invasion pathways/risk assessment (per National Management Plan implementation) and assess the implications for strengthening Environmental Impact Reviews of market access agreements [Current Mandate/Progress]; and

3. Identify the resources, strategies, and policies necessary to create, maintain, and make accessible one or more commodity/invasive species databases that EPA and other relevant agencies can apply to trade policy decision-making in a timely and scientifically-based manner [Needs/Recommendations].

Here we report the findings of this study, conducted between September 2005 and December 2006. The conclusions and recommendations are those of the authors and do not necessarily reflect the policies of the EPA, IUCN, or other agencies or organizations whose staff contributed to this project.

For the purposes of this study, we only examined issues and data directly pertaining to US cargo/commodity imports at maritime ports of entry. Analyses of ballast water and hull fouling pathways, while very important, were outside the scope of this study. Furthermore, since environmental reviews of free trade agreements are primarily intended to focus on domestic impacts, we did not evaluate procedures for ensuring that US exports are free of potentially invasive species. This is not to imply that the risks of invasive species introductions in international trade are in any way asymmetrical. Further studies will be required to consider management of outbound cargoes, and the efficacy of border protection in other nations.

NOTES

OBJECTIVE 1: *Assess the ability of the US commodity import information systems to provide reliable, accessible data for EPA's Office of International Affairs applications [Current Status]*:

Between November 2005 and August 2006, we visited nine US maritime ports of entry (Appendix III). The National Maritime Administration considers all but two of these ports (Gulfport and Mobile) to be among the top 20 major ports of entry based on the volume of import commodities managed annually. At each port we interviewed Customs and Border Protection (CBP) officers and agriculture specialists (primarily), and at US Fish and Wildlife Service (USFWS) designated ports (5/9) we also interviewed USFWS wildlife inspectors. The interviews focused on questions regarding the procedures and policies for commodity inspection, pest (invasive species) interception identification and information collection, database management, barriers to and gaps in best practices, and perceived needs for operational improvement.

Examples of specific questions included:

- What data are collected?
- What are the criteria and procedures for collection?
- In what database(s) are the data entered and maintained?
- What is the lag time from data collection to entry and access?
- What procedures exist for data quality review and correction?
- How long are the data maintained?
- Who has access to the data?
- What are the access procedures?
- What are the challenges to data quality and how might they be overcome?

At most of the ports, agency staff provided tours of port facilities and permitted us the opportunity to observe commodity inspections and data processing in progress. In order to assess the current application of pest (invasive species) interception data, we also interviewed and reviewed the publications of Federal and academic scientists who had worked with APHIS and USFWS datasets (e.g., Bludell and Mascia 2005; McCullough et al. 2001, 2005).

OBJECTIVE 2: ***Review the progress of NISC working groups focused on invasion pathways/risk assessment (per National Management Plan implementation) and assess the implications for strengthening Environmental Impact Reviews of market access agreements [Current Mandate/Progress]:***

On November 17, 2005, IUCN convened a one-day workshop of 14 invasive species experts working in the US on pathways of biological invasion. The purpose of the meeting was to: 1) exchange information on their research/programs, 2) map out progress in assessing risk of invasion by pathway, 3) analyze gaps in knowledge and institutional partners, and 4) identify shared problems and lessons learned (especially regarding data and information systems) from work to date. Nearly all of the participants were staff of NISC member agencies or members (past or present) of ISAC, and their work was intended to advance implementation of the National Management Plan (See Appendix IV).

OBJECTIVE 3: ***Identify the resources, strategies, and policies necessary to create, maintain, and make accessible one or more commodity/invasive species databases that EPA and other relevant agencies can apply to trade policy decision-making in a timely and scientifically-based manner [Needs/Recommendations]:***

The recommendations contained within this report primarily arise from the findings of parts 1 and 2, as well as interviews

with a) data management experts (especially pertaining to living organisms and trade) and b) members of NISC, ISAC, and Aquatic Nuisance Species Taskforce (ANSTF). They have been informed by a workshop on propagule pressure hosted by EPA's National Center for Environmental Assessment (*The Link Between Propagule Pressure and Aquatic Nonnative Invasion Success and Impacts*; July 24–25, 2006, Washington, DC)(NCEA), an intergovernmental meeting on aquatic invasive species risk assessment held under the auspices of the Commission for Environmental Cooperation (CEC), (*Meeting of the Trinational Aquatic Invasive Species Risk Assessment Guidelines Task Force*; October 26–27, 2006, Orlando, Florida)(CEC), and related studies arising from the US Government Accountability Office (GAO), USFWS, and others outside the government.

NOTES

OBJECTIVE 1: Assess the ability of the US commodity import information systems to provide reliable, accessible data for EPA's Office of International Affairs applications [Current Status]:

Our study indicates that neither data collected by CBP in conjunction with APHIS (e.g., Pest Identification Database (PestID) system, formerly the PIN database)[13] nor the USFWS (Law Enforcement Management Information System; LEMIS) is suitable for use in trade policy decision making where the goal is to project the potential consequences of market access agreements on biological invasion[14]. Factors that limit the application of data collected by both agencies are outlined in this section and recommendations for increasing data integrity follow at the end of this report.

The US government's ability to quantify the risks of biological invasion[15] associated with trade largely depends upon the quality and quantity of invasive species (generally referred to as "plant pests" or "injurious wildlife") inspection data collected by CBP (regarding plant pests) and the USFWS (regarding fish and other wildlife). Data quality is determined by the inspection

[13] From 1984-2007, pest identification data were housed in the Port Information Network (PIN) database maintained by USDA-APHIS.
[14] The US International Trade Commission also houses Customs' data in its "dataweb" (http://www.datawebusitc.gov), but analyses of these data were outside the scope of the project. Furthermore, due to security issues, we were unable to obtain the PIN data that would have been necessary for evaluation and Thomas and Albert (2006) state that valid comparisons with USFWS data (at least for CITES species) are not feasible.
[15] For the purpose of this study, biological invasion is a process which includes: a) entry into the US, b) introduction into one or more ecosystems, c) establishment of at least one reproducing population, and eventual d) spread and e) impact on one or more aspects of the environment, economy, and human health. Ideally, the data collected by inspectors is sufficient to support the assessment of risk of entry and introduction and inform models designed to project risks of establishment, spread, and impact.

strategy[16] (ideally following a standardized research-based protocol) and type of data collected (e.g., organism, commodity, point of origin), as well as the accuracy and detail of data collection (e.g., how forms are filled out and the level of specificity of identification codes for commodities, species, etc.), data processing (e.g., how precisely data is transferred into an electronic format), and organism identification (determined by USDA and USFWS identifiers). Data quantity reflects inspection effort (frequency and breadth of coverage of inspection), length of time for data processing (e.g., transferring it from hard copy into electronic format), and the period of data retention. Data accessibility issues (e.g., security clearance requirements) influence which agencies have the ability to analyze data relevant to trade policy questions.

When reviewing our findings, we encourage readers to consider several facts:

1) The CBP and USFWS datasets were not originally designed to provide data for decision-making on market access agreements, but rather to track the interception of certain species of concern (primarily due to agricultural pest or species endangerment status);

2) Because of our interest was in the trade-based movement of commodities rather than passenger travel, we focused our study on maritime (sea) ports of entry and associated staff, but we did visit airports and mail sorting facilities opportunistically;

3) Although human managerial issues drive most of the limits on data integrity, we found the inspection staff we met with at CBP and the USFWS to be highly dedicated professionals working under very difficult circumstances;

[16] The USFWS sets its own inspection strategy. CBP largely responds to an inspection strategy set by APHIS.

4) Maritime ports are highly variable across the country, differing in:

- Physical size and jurisdiction (region of coverage);
- Types and number of facilities (maritime ports, airports, and land border crossings);
- Commodity volumes and types;
- Cargo type (e.g., container, break bulk, ro-ro[17])
- Numbers, time in service, and capacity of inspectors;
- Modes of inspection;
- Staff size, experience, and morale;
- Budgets;
- Inspection and other management procedures;
- Communication and coordination efforts with other ports and agencies; and
- Inspection and interception rates;

5) The CBP and USFWS are not the only agencies with border inspection mandates[18] and thus do not bear the full burden of responsibility for preventing the incursion of potentially harmful organisms; and

[17] "Ro-ro" stands for "roll on – roll off" and refers to vehicles that are driven on and off a vessel (e.g., farm equipment, automobiles), as well as the type of vessel that transports them.

[18] Additional agencies with responsibilities related to border inspection include, *inter alia*, the Animal Plant Health Inspection Service, Bureau of Alcohol, Tobacco and Firearms, Centers for Disease Control, Coast Guard, Customs and Border Protection, Drug Enforcement Administration, Federal Aviation Administration, Federal Bureau of Investigation, Food and Drug Administration, Internal Revenue Service, Secret Service, and the US Postal Service.

6) Policies and procedures are continually evolving within and among the relevant agencies[19].

For these reasons, the remarks below need to be viewed as generalized findings; individual ports might face these challenges in the extreme, on average, or not at all. Furthermore, our study should be viewed as a "snap shot" of a dynamic process influenced by ongoing changes in policy development and priority setting, advances in science and technology, and economic security. The consequences of these changes have the potential to either enhance or further undermine the applicability of data to trade policy decision-making.

Customs and Border Protection

Our findings regarding CBP data collection and processing (i.e., inspection) procedures are generally consistent with those reported by the GAO (GAO 2006a) in its evaluation of US vulnerabilities to foreign agricultural pests and disease following the transfer of inspection duties from USDA to DHS, as well as testimony given by the GAO (GAO 2007) before the Committee on Homeland Security, House of Representatives. Our study did, however, explore additional scientific and technical issues (e.g., application of technologies and specific information systems) that were beyond the scope of the GAO study.

Improvements

The following represent potential improvements to the agriculture inspection (and thus data collection and management) system since the transfer of AQI responsibilities from APHIS to CBP:

[19] Several issues brought to our attention during the course of the interviews are not reported here because the agencies rectified the problems prior to report completion.

Classified Information Access: For many years, APHIS had employed an Agriculture Quarantine Inspection Monitoring (AQIM) system to estimate the number of agriculture pests (quarantine pests) entering the US[20]. Although not yet implemented and facing management challenges (GAO 2006c), DHS is undertaking a multi-billion-dollar, multi-year acquisition of a new trade processing system (Automated Commercial Environment; ACE) to support the movement of legal imports and exports, as well as to strengthen border security. Under CBP, agriculture specialists currently have access to multiple, federally-classified import data systems. The Automated Commercial System (ACS) is used to review shipment manifests. Some agriculture specialists have received training and have access to the Automated Targeting System (ATS; Federal Register 2006) and Interagency Border Inspection System (IBIS; USCBP 2007), enforcement screening modules associated with the Treasury Enforcement Communications System (TECS)[21], to improve their ability to target cargo and passengers for potential agricultural pests prior to their arrival at a US port of entry. Although the TECS system is not yet capable of automatically targeting agricultural imports for inspection (i.e., the data are manually reviewed and risks are assessed subjectively), this capacity is being developed by CBP[22]. Recently, CBP agriculture

[20] At select ports, the AQIM system is still being implemented by CBP agriculture specialists who submit data to APHIS for use in pest/disease pathway analysis.

[21] The ATS and IBIS are primarily used to: 1) focus inspection resources on high-risk passengers and cargo (inbound and outbound) for weapons of mass effect, drugs, currency, and other contraband; 2) expedite the clearance/entry of low-risk cargo and passengers; and 3) enable data analysis for related research. Targeting is largely based on a track record of violation.

[22] APHIS has assigned a permanent liaison to the CBP National Training Center to help develop criteria (rule set) that will automatically identify companies or individuals that pose a significant agroterrorism threat to the US Supposedly, the criteria will eventually enable agricultural specialists to identify smuggled and non-compliant agricultural commodities as well (GAO 2006a).

inspection officers completed a preliminary study, "Operation High Sky," that employed the passenger manifest portion of the TECS to target air passengers for inspection. Findings indicate that there is strong potential for using the system to accurately target passengers for inspection who are high risk for prohibited agricultural product imports. In theory, increased targeting efficiency will eventually translate into a higher inspection/pest interception ratio and thus a better knowledge of pest (invasive species) type. Targeting as a pest interception strategy does have its limitations, however. According to one senior USDA official, APHIS noted that agriculture officers who knew that a reportable pest was associated with a certain commodity tended to target that commodity for inspections, while overlooking or incompletely inspecting other shipments. In contrast, when new, relatively "pest naïve" officers inspected cargo, they covered all the commodities and often picked up new pests on commodities that the more seasoned officers hadn't inspected. ***Clearly, a robust inspection system that includes targeted inspections as well as statistically-viable random sampling is necessary to build a comprehensive understanding of the types of pests entering the US, as well as to elucidate patterns and trends as they relate to specific commodities and containers.***

Pest Risk Committees[23]: In an effort to improve communication, some port officials have established committees comprised of local officers from CBP, APHIS, and other relevant agencies (e.g., USFWS, Food and Drug Administration (FDA), Smuggling Interdiction and Trade Compliance service

[23] Different ports seemed to be using a variety of names for these committees, including "Plant Pest Risk Committees," "Pest Risk Committees," and "Biological Risk Assessment Committees."

(SITC)[24]). These committees meet once a month to share information, discuss pests and pathways of particular concern, and to develop and cooperate in special operations (e.g., operation "Chicken Little" to inspect poultry for avian influenza). Agriculture specialists participating in these committees have found them beneficial, although they report that more frequent meetings would be even more useful (assuming staff levels would be adequate enough to permit more frequent meetings). If these committees are established at all maritime ports of entry in the US, they will likely have a marked positive impact on information exchange, knowledge level, and staff morale.

Mixed Successes

Two aspects of program "enhancement" received mixed reviews by the CBP staff we met with. Senior-level port managers tended to regard them as improvements to the agriculture inspection programs, while inspection staff believed that they warranted further evaluation and greater capacity building.

Agriculture Liaison: Agriculture liaison positions were recently established (May 2005) by CBP for each of its 20 district field offices. The senior port managers that we spoke with believe that these staff will help provide necessary leadership for the agriculture specialist teams and ensure that agriculture issues get sufficient attention within the agency. However, many of the agriculture specialists we spoke with (especially those who had the longest history with APHIS) are skeptical that the agriculture liaison position will be helpful. They report that their ability to communicate their concerns (e.g., regarding certain pest inter-

[24] Since the transfer, SITC personnel report that they have had trouble getting access to the ports of entry in order to do their jobs (GAO 2006a and one interview per this study) and thus the ability to gather information through committee meetings may be particularly important to them and other APHIS staff who previously had routine port access.

ceptions or infested commodities) to USDA species experts and higher-level management has diminished considerably since the transfer of AQI responsibilities to CBP. One senior agriculture specialist reported that he used to be able to make a direct call to the appropriate USDA officials and that he now has to send memos up a considerable "CBP ladder" that ultimately prevents him from being in direct dialogue with former colleagues. Furthermore, he reported that he rarely gets any responses to his memos. For example, he has attempted on a number of occasions to alert APHIS staff to the fact that the new requirements for pre-treatment of solid wood packaging materials (Federal Register 2005) are not working effectively and has no way of knowing if the appropriate staff have been alerted to his concerns. Other agriculture specialists were doubtful that the agriculture liaisons would have much clout in a Department in which agricultural security is not the top priority.

Cross Training: CBP has established a cross-training program under the "One Face at the Border" initiative in which CBP officers, whose primary duty is customs and immigration inspection[25] , receive training in agriculture inspection and CBP agriculture specialists (many of whom are former APHIS staff) receive training in customs and immigration inspection duties. While we found this program to be well-promoted at managerial levels, most of CBP officers and agriculture specialists we spoke to felt that the initiative needs considerable improvement[26]. In fact, agriculture inspection staff at three or more ports believe that the inadequacy of agricultural training is the "weakest link" in inspection capabilities presently and fear that it is going

[25] Specifically, to prevent terrorists, terrorist weapons, contraband, and illegal immigrants from entering the United States.
[26] In contrast, the GAO (2006a) estimated that 75 percent of the agriculture specialists hired by CBP believe they have received sufficient training.

to become an even greater limiting factor as former APHIS inspectors retire. Many agriculture specialists felt the agricultural training for CBP officers (which they report to be considerably less than what was formerly provided by APHIS[27]) is insufficient, and many of the CBP officers admitted to feeling unqualified to engage in agricultural inspections (e.g., even to have the confidence to know when to call an agriculture specialist's attention to a potential actionable pest) despite having received training at the Federal Law Enforcement Training Center (FLETC; Glynco, Georgia) and, in some cases, at their respective ports of entry[28]. Clearly training in agriculture inspection duties does not rank as high a priority with CBP as does training in customs and border protection procedures: staff at one port stated that CBP officers receive 16 hours (2 days) of agricultural training[29], while agriculture specialists receive three and a half weeks of training in customs procedures. It is also apparent that training opportunities and application differ considerably among the ports. For example, at most ports we visited the agriculture inspectors had the opportunity to be trained in use of the mobile VACIS (Vehicle and Cargo Inspection System[30]) and to work alongside CBP officers to conduct VACIS-employed inspections. However, at the Port of Long Beach in California (one of the higher risk ports for agriculture pest importation), the staff do not receive VACIS training and are not allowed to participate in inspections utilizing the VACIS system.

[27] The GAO (2006a) reports that newly hired CBP officers receive 16 hours of training on agricultural issues at FLETC, while under APHIS agriculture courses for Customs and Immigration Officers totaled 4 and 2 hours respectively.
[28] The GAO (2006a) reports that CBP has developed a national standard for in-port training, but this is clearly not being implemented equally among the ports of entry.
[29] The goal is for CBP officers to know when to refer an organism to an agriculture specialist.
[30] A gamma ray imaging system used to help inspectors examine the contents of trucks, containers, cargo, and passenger vehicles for contraband.

Limitations

The following section describes factors that place limits on agriculture inspection capacity and thus data integrity:

Agriculture Not Top Priority: The CBP's explicit mission is to: 1) detect and prevent terrorists and terrorist weapons from entering the US, and 2) facilitate the orderly and efficient flow of legitimate trade and travel (GAO 2006a). All of the CBP staff we met with, regardless of position or rank, noted that efforts to thwart acts of terrorism are the top priority for CBP. The interdiction of drug, human, and counterfeit commodity trafficking were cited as secondary priorities, and the introduction of agricultural pests (including diseases) as third. We found it particularly noteworthy that the CBP perspective on "terrorism as a priority" emphasizes "weapons of mass effect" and that it does not place potential acts of agroterrorism or bioterrorism nearly as high among its defense strategies. Clearly, non-native organisms (esp. pathogens) can be engaged as agents of terrorism (Meyerson & Reaser 2002, 2003). They can also enter the US unintentionally and be just as harmful. If the ultimate intent of CBP is to protect the American people from harm, then it logical that those harmful organisms (invasive species) that are already entering the US on a daily basis and costing the public over a hundred billion dollars annually (Pimentel 2002, 2000) in damages and control costs should receive a much high priority in CBP's homeland defense strategies.

Because agriculture ranks below customs and border protection priorities at the ports, agriculture specialists do not have the same level of targeting authority (i.e., priority for devanning[31] cargo for inspection) and resource access (e.g., to VACIS, warehouse space, vehicles, etc.). Some agriculture specialists reported that they

[31] Devanning is the practice of removing all of the cargo from a container, organizing it within a warehouse, and inspecting a percentage of it for quarantine pests.

often felt like they had to opportunistically inspect cargo targeted by CBP officers and/or "wait in line" in order to attend to agriculture priorities.

Opportunistic Sampling Approach: The AQIM Handbook (APHIS PPQ 2002–01) section on maritime cargo promotes a scientific approach stating that "Random samples can be taken from these populations (cargo) with more intensive [hypergeometric] inspections completed and necessary data recorded about these commodities." It further stresses the importance of selecting a representative sample and inspecting the sample thoroughly. However, most of the inspections we witnessed were not conducted according to this guideline and a number of the senior agriculture specialists we spoke with remarked that while this scientific approach was useful in theory, it was seldom employed as "strict" practice due to situational circumstances such as time constraints, available human resources, access to cargo, lack of data on the available import "population"[32], cargo mixing, and contaminants[33]. The majority of the tailgate inspections[34] that we witnessed were limited to inspection of the most accessible boxes or crates at the rear of the container, complemented with a visual inspection of the interior and exterior surfaces with use of a flashlight. The difference in devanning practices was remarkable among the ports: some ports reported pulling only a small (2% or less) percentage for inspection (typically the most accessible cargo), while others report pulling as much as 100% of certain shipments for random

[32] At ports where staff has very compartmentalized duties, they do not have equal access to manifests and thus the inspectors who open the containers and packages that have been targeted by other teams may not have any knowledge with regard to overall shipment commodity type, numbers, containment, and placement.
[33] Several of the shipments we saw inspected were heavily contaminated with molds and one contained animal feces.
[34] Tailgate inspections are those conducted on containers that have been placed on truck chasses.

sampling. Furthermore, at some ports inspection teams had accesses to high-tech equipment (e.g., VACIS) and to canine units, while others did not. Some of the variation in inspection procedure may be accounted for by different degrees of pest risk targeting, however it was apparent that the majority of the differences related to morale, staffing and other resources levels, and pressures for expediency (discussions to follow), all factors which change not only with location but also over time.

Policy versus Science: Many of the agriculture specialists that we spoke with stated that they routinely experience pressure to expedite cargo while undertaking their duties and that this pressure has increased substantially since the transfer of AQI responsibilities to CBP. In some cases, this was directly attributed to political pressure emanating from shippers or owners of cargo; in others it was a matter of priority being given to other CBP functions. In general, the pressure acts on specialists to get them to: 1) give intentional violations of the law the utmost priority, 2) move all commodities into and out of the port in as brief a time as possible (typically hours), and 3) prioritize the clearance of perishable items above other commodities. Some of the agriculture specialists admitted to feeling so much pressure at times that they rushed inspections or gave a cursory inspection in instances where they felt a more thorough, risk-based inspection would have been appropriate. ***They further stated that the amount of pressure they receive varies with the country of origin and the commodity, and that free trade agreements have codified this pressure in inconsistent and illogical ways***. For example, the same insect might be considered reportable and actionable[35] on

[35] A reportable pest is a quarantine pest. All quarantine pests found by inspectors are to be reported to APHIS via specific procedures. An actionable pest is a quarantine pest for which specific mitigation actions are required by APHIS. A reportable pest is not necessarily an actionable pest.

one type of fruit (pineapple), but not another (bananas), or the same fruit coming from different ports of origin. A given plant might be reportable but not actionable depending on its putative end use (even though it is imported in the same condition regardless of end use[36]). In short, agriculture specialists at all the ports we visited remarked that they do their best to balance their principal mission of effective inspection with competing priorities, but that actual balance was very difficult to achieve due to an incoherent system and inadequate resources for the task. A recent article in *USA Today* reporting that six agriculture specialists serving the Orlando Sanford International Airport were ordered by supervisor's to falsify data for the sake of expediency indicates that these issues are not limited to maritime ports of entry (*USA Today 2007*).

Decline in Experience Levels. According to our interviews, many APHIS staff resigned rather than being transferred to CBP and many[37] more resigned after the transfer, choosing to take positions with other agencies (e.g., USFWS or elsewhere in USDA). Thus, more than one-third of CBP agriculture specialists have been hired since 2003 (GAO 2006a). At least half of the ports we visited reported extremely low retention rates (less than three years[38]) and senior agriculture specialists generally agreed that it took approximately three years on-the-job for an agriculture specialist to be fully proficient. Furthermore, most senior agriculture specialists will be retiring within the next five years.

[36] For example wild asparagus is regulated when it is declared for use as a food item, but not as a cut flower.
[37] We were unable to obtain data on the number of resignations, but CBP agricultural specialists felt that the descriptor "many" was far more accurate than a "few." The GAO (2006a) provides one example: The Port of San Francisco lost 19 specialists since 2003, but gained only 14 new hires or transfers, leaving 24 vacancies at the end of fiscal year 2005.
[38] At least one senior agriculture specialist believes that CBP has become a "training ground for other agency's future personnel."

CBP/APHIS Information Sharing: APHIS and CBP have an interagency agreement for sharing information related to changes in APHIS AQI policy manuals and pest alerts (e.g., Emergency Action Notifications; EAN), however CBP agriculture specialists (especially those who used to work for APHIS) routinely reported that they feel "divorced" from the information and capacities that exist within APHIS. For example, many of them said that they no longer receive pest alerts or notification of inspection policy changes in an effective time frame, if at all[39]. This is consistent with the GAO's finding that only 21 percent of CBP agriculture specialists receive urgent alerts in a timely manner (GAO 2006a). At one port, staff admitted that they found a USDA website containing pest alerts, policy modifications, and newsletters purely by chance. CBP agriculture specialists also noted that there is no published contact list or list-serve of agriculture specialists serving the ports of entry and that this makes it difficult for them to communicate amongst themselves, as well as for APHIS staff to reach out to them effectively. Several agriculture specialists (both senior and recently hired) noted that "historical colleagueship" (i.e., the personal relationships that exist between current APHIS staff and former APHIS staff now with CBP) is the primary mechanism for constructive communication between CBP and APHIS. ***Furthermore, they report that the informal sharing of information through this network makes a significant difference in interception rates on commodities, including those not typically considered as risky (e.g., steel cable, ceramic tiles)***. Many of the CBP agriculture specialists fear that as APHIS-and former-APHIS personnel retire, the communication gap will widen considerably, further limiting information access.

[39] Before the transfer, APHIS e-mailed policy updates and pest alters directly to its agriculture specialists. Now it notifies CBP headquarters personnel and relies on them to get the information to the agricultural specialists.

Information Access: In addition to problems with information sharing, many agriculture specialists reported having problems with access to on-line AQI resources, such as the policy manuals written by APHIS[40], pest interception data (e.g., the former PestID system, PIN), and newsletters which frequently contain information on such topics as policy changes, new pests reports, and special operations. This finding is consistent with the GAO's (2006a) survey results in which only 50 percent of the agriculture specialists reported having consistent access to APHIS' on-line inspection policy manuals. We were told at some ports that former APHIS staff is still relying on printed manuals that have not been updated since 2003.

Reduction in Canine Units: Dogs trained to detect agriculture products in cargo or on passengers were a fundamental aspect of APHIS' inspection program. Only one port that we visited (Oakland) still had canine units (two Labrador retrievers) working the cargo area to detect agriculture violations. The agriculture specialists at this port believe the dogs significantly improve detection capabilities, especially in break-bulk[41] cargo. Agriculture specialists at ports that have lost their canine units remarked that their inspection/interception ratio has declined without the assistance of the dog teams. The GAO (2006a) reports that not only has the number of canine units declined[42], but the proficiency scores of the remaining canine units have also diminished[43]. APHIS has tried to help rectify the situation by offering canine specialist training classes but has had to cancel multiple classes because CBP did not provide an adequate

[40] http://www.aphis.usda.gov (PPQ manuals to port programs to AQIM Handbook)
[41] Shipments of goods packed in small, separable units.
[42] The 120 canine units that were in place pre APHIS-CBP transfer had been reduce to 80, 20 percent of which are new hires, leaving 12 units vacant at the time of their study.
[43] In 2005, 60 percent of the 43 agriculture canine teams tested failed the USDA proficiency test (GAO 2006a).

number of student/dog teams. The current and former dog handlers also noted that: 1) in some cases, they no longer report to supervisors who have canine training expertise and do not consider the canine program as high a priority as the APHIS canine coordinators did, 2) current dog teams are not getting sufficient working time (a likely contribution to declining competency) because the handlers are being directed to participate in non-canine inspections as well as their regular duties, 3) while dog units were being employed for use in terrorism-prevention roles, the breeds being selected for these duties are not as appropriate as Labradors for cargo inspection[44], and 4) there has been a reluctance to train the dogs to multi-task (i.e., develop the capability to detected "weapons of mass effect," as well as agricultural violations).

No Risk-based Staffing Procedures: The GAO reports (2006a) that CBP has hired more than 630 agriculture specialists since the position transfers from APHIS to CBP. However, it was apparent during our visits that the number of staff, seniority and training of staff, as well as the division of staff duties not only varied considerably among the ports, but also differed in a manner that was often inconsistent with levels of pest risk. For example, teams at some ports reported that they had responsibility for all aspects of the inspection process (from targeting to inspection to report writing) and that they had to severely limit their inspection basic duties (e.g., number of inspections per day and length of time per inspection) due to understaffing, while at other ports staff where assigned to only one aspect of the inspection process (e.g., opening and inspecting bulk cargo) and often found themselves with time to spare while they waited for the next delivery of pallets containing commodities that had

[44] Due to their size and "personality," beagles are preferred for passenger and airline baggage inspection.

been targeted by other inspectors. Both types of staffing models appeared to be inefficient and to have negative consequences for morale (discussion to follow).

Failure of User Fees to Reach Ports: The Food, Agriculture, Conservation and Trade Act of 1990 (FACT; as amended) authorizes, but does not require, APHIS to collect user fees[45] to cover all of the costs associated with agricultural inspection[46]. Agriculture specialists reported that since the transfer of AQI duties from APHIS to CBP, the operational budgets at the ports have not been adequate because the user fees are not being appropriately and/or sufficiently transferred into port accounts. As a result, the agriculture inspection teams have had to reduce spending on equipment and supplies, delay hires, reduce overtime[47], and divert incoming vessels to other ports. Simultaneously, they are being asked to take on an increasing number of special operations[48] and to work the associated costs into their existing budgets. At one port we were told that the budget situation was so bad that the agriculture specialists were unable to purchase a vehicle they needed to reach inspection points and were thus either forced to use their personal vehicles in violation of port policy or to decline to inspect what they believed to be high-risk cargo. The GAO (2006a) study reports

[45] The AQI user fees are assessed on international air passengers, as well as commercial aircraft, vessels, trucks, truck decals, and railroad cars. They are collected through passenger taxes or paid directly by the shipping companies.
[46] Specifically, 1) providing AQI services for commercial conveyances (see footnote above), cargo, and passengers, 2) providing preclearance or preinspection abroad for international passengers and commercial conveyances, and 3) administering the AQI user fee program.
[47] At some ports overtime rates were unaffected because the CBP agriculture specialists were being covered under the CBP officer overtime budgets. Staff at other ports stated that they have no inspection staff on duty on Saturday and/or Sundays even though shipments arrive seven days a week.
[48] Due to concerns regarding avian influenza, mad cow disease, etc.

that the issue over user fee availability stems from: 1) poor communication between CBP and APHIS (i.e., CBP being unable to report the costs of the AQI program by user fee type) and 2) the inability of APHIS to transfer user fees to CBP in a timely and consistent manner. Both the GAO report and the senior port officials we met with indicated that CBP and APHIS are "undertaking measures" to address this problem and hoped to have it resolved in 2006.

Low Morale: Levels of morale greatly differed among the ports. Contributing factors to low morale were cited as: 1) a strong sense that CBP does not consider agriculture security a high priority, 2) lack of equity between CBP officers and agriculture specialists in all aspects of job opportunity and respect, 3) low income earning potential[49], 4) fractionation of inspector duties (i.e., being limited in job scope to only a subset of the inspection process), 5) inability to directly communicate and collaborate with APHIS colleagues, and 6) a feeling of inefficiency and ineffectiveness due to under-resourcing of staff, funds, and equipment. Morale appeared to be highest at ports led by senior agriculture staff who emphasized a "pride in service versus production line attitude;" where personnel from CBP, APHIS, and FDA shared facilities that enabled close interaction; and at ports where daily "musters"[50] took place among the agriculture-oriented staff of one or more agencies. Although low morale certainly has an influence on staff retention rates (discussion to follow), we noted that some personnel weighed port location (i.e., the part of the country they wanted to live in) over personal job satisfaction. In general, we observed an inverse correlation between the size of the port and the level of morale. Because the

[49] The highest civil service grade for inspection jobs is GS 11. Overtime opportunities have been significantly reduced since the transfer to CBP, and the busiest ports are in major cities with high costs of living.
[50] Meetings in which staff provide a short synopsis of their activities and findings.

larger ports typically represent a higher degree of risk for the introduction of agricultural pests, this means that the riskiest ports often exhibited the poorest staff morale. In late 2006, the GAO (GAO 2006d) reported to Congressman Bob Goodlatte, Chairman of the Committee on Agriculture, US House of Representatives, that few of the CBP agriculture specialists they surveyed have positive feelings about their current work situation and 64 percent do not believe that CBP management respects their work. In response to a question about what was going well in their jobs, the second most frequent response from the agriculture specialists was "Nothing is going well." In total, only an estimated six percent of the agricultural specialists stated that they were generally satisfied with their jobs.

Pathway Gaps: At designated ports of entry, CBP agriculture specialists have the authority to inspect cargo, passengers, baggage, and mail entering the US in airplanes, ships, trucks, and railcars for prohibited agricultural materials and any pests or diseases they might carry. According to the GAO (2006a), they are not able to inspect commercial aircraft, vessels, and truck cargo. We are aware that limited inspections of vessels (e.g., checks for improperly stowed fruit and vegetable food wastes, and dunnage) are occurring at some of the ports, while at other ports agriculture specialists reported that they are strictly prohibited from boarding vessels[51]. Although DHS' mission is to protect homeland security, its broadly- defined mandate has not been applied to address the pathways and impacts of biological invasion that do not already fall under the jurisdiction of other Departments. For example:

[51] One maritime port reported that under USDA they were able to board all arriving vessels. However, they estimate that in 2005 they missed boarding 1,000 vessels due to limits on vehicles, overtime, and safety.

A) Urban Pathways/Infrastructure Impacts:

Two of the most noteworthy gaps in authority are for: 1) those species that infest urban environments (where they are most likely to impact infrastructure, human and domestic animal health and safety, and consequently the economy) and 2) species that impact infrastructure (in any environment). For example, the Port of Houston and surrounding areas in Harris County, Texas are currently being invaded by a type of tramp ant (*Paratrechina* sp.) that is attracted to and destroys electrical circuitry (Holden 2006; Reaser 2006). Researchers in the area believe that the ant is already responsible for millions of dollars in property damage (J. Meyers, pers. comm.), the Port of Houston's radiation detection equipment has been compromised (R. Karstrom, pers. comm.), and staff at NASA is concerned about the space program's security (S. Candler, pers. comm.). Although the ant has yet to be identified to species, USDA considers it non-reportable and non-actionable due to its morphological similarity to other ants listed as non-reportable/non-actionable (Colpetzer 2005), and because the ant has yet to have a negative impact on wildlife[52], the USFWS does not have the authority to enact eradication and control measures. Although we are not aware of any study that analyzes unintentional introductions in the US in relationship to an "entry environment," we strongly suspect that the majority of species enter through urban-based ports and that these urban settings are thus the initial source environments for many species that eventually impact agriculture, wildlife and native plants. The USDA apparently has recognized this risk[53]

[52] Due to its biting and swarming behavior, it is anticipated that this ant will have a significant impact on ground nesting birds and other terrestrial species, possibly putting the endangered whooping cranes at Arkansas National Wildlife Refuge at great risk.
[53] Some of the worst forest pests in the US (e.g., the Asian long-horned beetle (*Anoplophora glabripennis*;(http://www.aphis.usda.gov/lpa/pubs/fsheet_faq_notice/fs_phalb.html) were first detected in urban areas).

and established pilot health monitoring programs in some urban areas, and the GAO has recommended to the Secretary of the Department of Agriculture that these urban programs be expanded because urban environments are "common destination points for internationally traded cargo that is a frequent pathway of pests" (GAO 2006b). Nevertheless, these USDA programs, while focused on early detection and rapid response, are still reactive, under-resourced initiatives. The prevention, early detection, and rapid response measures called for in the National Management Plan (NISC 2001) need to be fully enabled and comprehensively enacted by DHS in urban environments, in cooperation with other relevant Departments, as soon as possible.

B) Additional Gaps in Propagule Pressure-Based Policy:

Inspectors reported frustration that certain commodities (e.g., tiles from Italy containing snails, molds, and other organisms) are not mandatory for fumigation or other treatment as a condition of entry into the US, despite a high association with hitchhiking organisms of various species. The inspectors believe that the sheer number and diversity of organisms entering the US via these pathways creates a strong potential for future impacts on one or more sectors. Yet, under current policies, organisms entering the US are generally considered "innocent until proven guilty." Basic scientific principles, however, support the position of the agriculture specialists. There is strong evidence that the number of individuals and introduction events (collectively termed propagule pressure) of a certain species determines both the scale of invasion extent and impact; the greater the propagule pressure, the greater the associated risks and implications (Lockwood et al. 2005, Von Holle and Simberloff 2005). Although APHIS determines which species are plant pests and how commodities are

to be managed for plant pest risk, the inspectors felt the potential risks posed by hitchhikers along these pathways extend beyond plant health and that, under the broad mandate to protect homeland security, CBP should ensure that these commodities are routinely treated as part of a comprehensive pest prevention strategy.

Lack of Self Evaluation/Feedback: In fiscal year 2005, CBP and APHIS established a review process (Joint Agency Quality Assurance Reviews) for assessing port compliance with AQI policy. However, a number of the staff we met with felt that there was no particular motivation or appropriate strategy for CBP management to evaluate the effectiveness of their managerial decisions (e.g., staff numbers and assignments, training adequacy) and they were thus unable to make improvements to the CBP agriculture specialist program in a manner that would ultimately increase the pest inspection/interception ratio. The GAO (2006a) reports that CBP lacks adequate performance measures for AQI inspections[54] and that it has not used the AQI data input by agriculture specialists into the Work Accomplishment Data System (WADS)[55] to evaluate program performance. Furthermore, the GAO study reveals that performance varies greatly among the ports of entry and that average inspection/interception rates have changed significantly in some geographic regions since the APHIS-CBP transfer, declining at some ports and increasing at others (Appendix III).

In 2007, APHIS transferred information formerly housed with-

[54] The Government Performance and Results Act of 1993 requires federal agencies to identify and evaluate measures to ensure program performance.
[55] The Work Accomplishment Data System (WADS) is maintained by APHIS but data are input by agricultural specialists as part of their routine inspection duties. The information in the system could be used to assess the performance inspection personnel by evaluating the frequency with which prohibited agricultural materials and reportable pests are intercepted.

in the PIN database into a new database known as the PestID system[56]. PIN data, collected since 1984, is comprised of records of quarantine pests intercepted at US ports of entry and border crossings during inspections of persons, baggage, cargo, and conveyances. Typically, each record includes pest taxonomic identity, country of origin, and information related to commodity and interception location (McCullough et al. 2006). The following agriculture inspection issues contribute directly to limits on the analysis and interpretation of the pest interception data:

Limited Variables: The PIN database only contained information on quarantine pests that have been deemed reportable by APHIS. It is not uncommon for plant pests to be identified only as far as family or genus level, and information on their abundance is not recorded. No data were maintained on organisms (e.g., all spiders) that have not been previously declared plant pests. Thus, a shipment might arrive that is infested with a wide variety of insects and other organisms but unless the inspection procedure results in collection of one or more that are already known to be plant pests for the US, there will be no record of the shipment in the database. We are only aware of one port (Gulfport) that has taken it upon itself to create and maintain a database with information on all interceptions associated with all port vessels. The agriculture specialists at this port routinely use the database to assess the patterns of trends of commodities and associated pests and to design special operations to investi-

[56] Currently, most of the data on the intercept of potential pests are collected by CBP agriculture specialists who then send a sample and relevant information to USDA Plant Protection and Quarantine (PPQ) Identifiers. If the organism is indeed a quarantine pest, the Identifiers enter the information into the PestID system and the data are maintained by APHIS. In the future, CBP intends for inspectors to enter intercept information directly into the PestID system. Note: USDA Plant Protection and Quarantine (PPQ) personnel also contribute data on pest interceptions associated with their activities, including inspections of imported propagative material and items confiscated during smuggling interdiction work.

gate the presence of potential pests (those not yet officially recognized by APHIS as problematic). Under the new PestID system, CBP indicates that inspectors will eventually be required to record information on all organisms intercepted, including quarantine and non-quarantine pests. Both the inspectors and APHIS staff we talked to on this subject believe that such a task will be impossible to accomplish without considerable increases in political, staffing, and financial support to the agriculture inspection programs.

Special Operations: Special operations are inspections, usually involving more than one agency, specifically designed to provide information on pest types and levels associated with specific commodities and/or pathways. Special operations can be established at national, regional, and port-specific levels and are usually established by one or more agencies of USDA. Typically, the information gathered during a special operation is used to assess risks to agriculture or human health and develop or modify US policies accordingly. For example, agencies recently cooperated in special operation "Big Bird" to assess the risk of avian influenza in smuggled or non-manifested poultry goods. The data collected during special operations are not specifically coded as such in the PestID system, creating the potential that data miners will interpret them to indicate a sudden rise in infestations of a certain pest associated with a specific commodity, while in reality the increase in reportable interceptions is due to increased inspection effort. Furthermore, agriculture specialists are often pulled away from their routine inspection duties in order to staff a special operation and thus interception data for organisms associated with routinely inspected commodities is likely to diminish.

Data Access, Correction, and Feedback Loops: A number of the agriculture specialists that we spoke with expressed frustration

that they were unable to gain access to the PIN database and are therefore unable to verify the accuracy of the data and provide feedback when mistakes were found. One specialist said that while undertaking a brief tour of duty in Washington, DC he made a point to get access to and review the database records associated with his port. He found numerous errors during his assessment and reported these to the database managers but did not know if the corrections had been made. According to APHIS personnel, CBP inspectors can get access to the PestID system if they contact the National Identification Service's Plant Safeguarding & Pest Identification office and present their request and name. Although staff from this office are the only ones authorized to alter records in the database, they welcome CBP inspectors to alert them to any errors in record keeping. While CBP claims that their inspectors are gaining greater access to the new PestID system, it is too early to evaluate whether such access will be broadly available to inspectors and enable them to routinely monitor and upgrade data.

Data Implications

In summary, pest interception data collected by CBP in conjunction with APHIS is not suitable for use in trade policy decision making where the goal is to project the potential consequences of market access agreements on biological invasion because:

- In general, the data collection approach employed by agriculture specialists more closely resembles "opportunistic" sampling than a scientifically-based, random sampling strategy. And, it is impossible to estimate what proportion of the plant pests entering the US was intercepted by inspectors. Data in the PestID system are thus very unlikely to reflect actual pest risk (presence) by numbers or type and cannot be used to predict actual abundance, diversity, or frequency of the arrival of non-native plant pests (invasive species).

- The database only includes a subset of the organisms actually associated with US imports and thus it is impossible to assess risks associated with a diversity of "potential pests" (e.g., those not yet known to science and/or not yet demonstrated to be plant pests in the US) by type, commodity, conveyance, or country.
- Pest interception data are being generated by agriculture specialists with varying degrees of experience. At least one third of the specialists lack sufficient experience to be proficient at their job. Data accuracy is likely to reflect this lack of experience. Unless retention rates and training are significantly improved, CBP data quality is likely to decline further as senior agriculture specialists retire.
- Political pressure, lack of training, and morale issues can contribute to CBP officers and agriculture specialists turning a blind eye to import "hitchhikers" (even ones known to be reportable and actionable) in order to expedite shipments.
- At this time, there is no direct, streamlined process through which agriculture specialists can routinely review and correct data in the PestID system.

Despite the limitations of the PestID system for trade policy analysis, the data can be useful in coarse-scale analyses of historic trends, emerging trends, and changes in trends brought about through the implementation of new regulatory requirements. APHIS scientists and colleagues have mined the database in order to conduct risk assessments (e.g., Davis et al. 2005), provide time series analyses for specific species (e.g., Haack 2002), and analyze specific pathways (e.g., Marshall et al. 2003; Liebhold et al. 2006). Recently, Work and colleagues (2005) and McCullough and colleagues (2006) conducted broader analyses,

reporting on the arrival rate of non-native insects into the US through foreign trade and on non-native plant pest interceptions at US ports of entry and border crossings over a 17 year period, respectively. For the purposes of the study, it is interesting to note that McCullough and colleagues (2006) found that increased trade between the USA and countries such as Vietnam and China were correlated with increases in pest interceptions over time.

Nevertheless, several of the agriculture specialists we spoke to about these studies urged extreme caution in application of the findings and were quite concerned that inaccurate conclusions would foster ineffectual and unnecessary policies and policy modifications. Mack (National Research Council 2002) notes that the PIN database [PestID system] is a potentially valuable source for understanding invasion pathways, but that the utility and availability of the data need to be substantially improved. And, the authors of some of the papers based on PIN data appropriately acknowledge that the database is "unwieldy and queries must be carefully designed to extract appropriate data" (McCullough et al. 2001). APHIS staff quite familiar with both the PestID system and the PIN database believe that the new system is unlikely to overcome many of the limits on data application historically associated with the PIN (Joe Cavey, pers. comm.).

US Fish and Wildlife Service

The US Fish and Wildlife Service's (USFWS) mission is to "work with others, to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people." While the majority of the USFWS' wildlife management and conservation work is conducted in natural areas, the Office of Law Enforcement regulates wildlife trade, investigates wildlife crimes, helps Americans understand and obey wildlife protections laws, and works in partnership with

international, state, and tribal counterparts to conserve wildlife resources. Our study focused only on trade regulation duties and associated data collection and management.

This report is not the first to cite concerns over the integrity of the data collected by USFWS inspectors and maintained in the LEMIS database (e.g., Blundell & Mascia 2005[57], 2006), and even the USFWS acknowledges the challenges (Thomas & Albert 2006) and limits of LEMIS data interpretation (USFWS 2005). However, to the best of our knowledge, we are the first to link the problems associated with the database directly to specific issues that undermine the wildlife inspection program as a whole. The following section provides a summary of the issues and concerns that were raised during our interview process.

Under Resourced: The USFWS struggles with many of the same resource issues that CBP does but on scale that is even more program-limiting because: 1) USFWS budgets are inherently smaller than agriculture inspection budgets and 2) concerns over wildlife endangerment and the introduction of injurious wildlife rank well behind CBP's customs, border protection, and agriculture priorities and thus attention to the USFWS' current needs is a lower federal priority. Although the total number of USFWS wildlife inspectors and budget has increased each year since 2002[58], these increases have not kept pace with the growing number of imports. ***Thus, the average case load/inspector has increased at the same time the number of special agents has decreased*** (Appendix VI). Some of the staff we met with reported port-specific budgets that were so inadequate that the inspectors were purchasing office supplies, filling gas tanks, and caring for seized wildlife out of their own pockets. Other inspectors

[57] This study reviewed data that had been derived from the LEMIS database.
[58] Many of the new inspectors are former APHIS agriculture inspectors who left USDA during the transition or who have left CBP since the transition went into effect.

reported having to turn seized wildlife back over to the importers under terms of "conditional release"[59] or have them temporarily held and cared for by local volunteers (e.g., public aquaria or herpetological clubs) because they did not have proper holding facilities or animal care budgets. The wildlife inspectors also reported that their inspection coverage (typically less than 25 percent of shipments, and declining) is limited by a lack of overtime pay and that morale[60] and on-the-job training opportunities, particularly for new staff, were declining as a result. They stated that they are currently facing mandatory retirement and thus a situation in which the most qualified inspectors must leave the inspection service whether or not they wish to give up their jobs. The wildlife inspectors whom we interviewed tended to agree that the USFWS needed to at least double the number of inspectors in order to meet the demands of the growing number of imports and import locations[61].

Lack of Access to Information: Aside from a general need for additional resources, USFWS inspectors cited information access as the greatest limitation to inspection coverage (and thus the quantity of data that is entered into LEMIS per percentage of imports). Unlike CBP, the USFWS does not have access to classified information systems, even for accessing the on-line manifest information that would enable them to target

[59] Agents admitted that there had been cases in which the importers failed to turn the seized animals back over to USFWS at the appropriate time, claiming that the animals had been stolen or escaped.

[60] It appears that morale issues are linked to financial stress in some of the most costly cities.
The USFWS inspection ladder ranges from GS 5-11, and with little or no overtime income, the cost of living demands force inspectors to live on very restrictive budgets.

[61] Although the number of USFWS ports has increased since 2002 (Appendix VI), the volume of wildlife shipments that are moving through nondesignated ports has also increased and some importers intentionally "port shop" in order to locate ports that have the weakest USFWS inspection coverage.

incoming shipments of concern. At this time, they either have to wait to be notified by another agency's (e.g., CBP, Food and Drug Administration; FDA) inspector of a shipment that may have relevance to fish and wildlife concerns or "hang around" the port waiting for potentially relevant shipments to arrive[62]. Many of the inspectors we met with said that the information exchange with agriculture inspectors was much better when the agriculture inspection teams were with APHIS. For example, prior to the transfer they used to have access to US Customs' Automated Broker Interface (ABI)[63] system and participated in monthly Federal Inspection Service (FIS) meetings that engaged inspection service personnel across the Departments[64]. Furthermore, the agriculture inspectors had a "search image" focused on live commodities and a broader array of countries than they do now under the terrorist-priority directive. Therefore, many of the wildlife inspectors we spoke with believe the emphasis on customs and border protection as the top priority for all CBP inspectors has had a fundamental impact on USFWS information access and exchange, and thus job performance.

[62] The schedule for some of the large importers/distributors can be predicted based on their routine trade patterns, but importations by most other importers are not predictable and some deliberately import at times (weekends and evenings) when the USFWS is unlikely to have staff on duty. Note: a few inspectors reported having greater difficulty accessing the maritime port area in order to conduct "uninvited" inspections due to port clearance requirements.

[63] The Automated Broker Interface (ABI) is a component of the US Customs Service's Automated Commercial System that permits qualified participants to electronically file required import data with Customs. ABI is a voluntary program available to brokers, importers, carriers, port authorities, and independent service centers. Currently, over 96% of all entries filed with Customs are filed through ABI. See http://www.cbp.gov/xp/cgov/import/operations_support/automated_systems/abi/

[64] Although CBP staff claimed that Pest Risk Committees meetings were inclusive to USFWS staff, most of the wildlife inspectors we met with were unaware of these Committees and had not participated in regular inter-agency meetings since the agriculture specialist transfer.

Uninspected and Under-Inspected Pathways: USFWS wildlife inspectors report that, due to limited staffing, budget shortfalls, and port-clearance issues, they are unable to inspect a number of potential pathways of biological invasion that they believe merit thorough inspections based on risk. Some of the examples we were provided with include: household goods, military shipments, harvested game (e.g., duck carcasses brought back from Mexico on commercial aircraft), and cruise ships that have visited certain destinations (e.g., Latin American and Caribbean ports). Furthermore, they do not have access to any of the high-tech equipment (e.g., VACIS) used by CBP to inspect containerized or other types of high-density cargo that limited mandates, time, budgets, and political priorities prevents them for devanning for complete inspection.

High Financial and Political Pressure: Because many of the fish and wildlife shipments are imported alive, there is intense political pressure for agents to clear the shipments as soon as possible in order to ensure animal welfare and importer income. Furthermore, many of the wildlife products are of high monetary (e.g., exotic animal skins) or sentimental value (e.g., hunting trophies) to the importers and some of the agents have reported that they received considerable scrutiny and reprimand for creating delays in their clearance in order to fully inspect the items for endangered species, injurious wildlife (which might be or include invasive species) or other legal violations. Given the trend of some types of products to have hidden compartments (e.g., wooden totems from West Africa) that contain live animals or wildlife parts (e.g., monkey skulls) or insect infestations (e.g., trophy skins, wood mounts, and packaging), the inspectors we spoke with feel that anything less than a thorough inspection would be ineffectual. Nevertheless, some of them admit to having to clear imports based on a cursory inspection due to political pressure to facilitate distribution. They echoed the CBP agri-

culture specialist statement that they find it difficult to jointly facilitate trade flow, law enforcement, and the scientific integrity of risk-based inspections.

Electronic Capacity Low: Unlike CBP, the USFWS has been very slow to implement an electronic system for data input at the ports. A few ports now have this capacity (primarily with a focus on CITES species), but most still have to send their data in hard copy to a consultant in North Dakota who inputs it by hand into LEMIS. This situation undermines LEMIS data integrity in two ways:

- **High Probability for Input Error**: The translation of data from hard copy to electronic format is fraught with potential mistakes (e.g., random typographical errors) even when the person doing the electronic entry is the same person that originally collected the data. However, third party data entry increases the probably of database error as a result of misjudgments in handwriting interpretation, for example. See following discussion on data review.
- **Time Lag in Data Entry**: The inspectors that we spoke with reported that they waited to accumulate a certain amount of report forms before sending them to the data entry consultant. Depending on the port, the time lag between data collection and shipment ranged between 3–6 months, with an additional delay in data entry dependent on the consultant's backlog. It is possible then that it may take as much to a year (although longer delays have been reported) for LEMIS data to be available for analysis.

New Species Problematic: Due to difficulties in determining the species-specific identity of live animal data maintained in the LEMIS database (discussion to follow), it is impossible to estimate the number of new species of any taxonomic group that

are being imported into the US annually. Based on our interviews, it is clear that the types and number of new species that are imported each year varies greatly among the ports (with the most significant changes being seen at the ports of Miami and Los Angeles/Long Beach)[65] and that the ports differ in their capacities to identify and thus regulate these species new to the wildlife trade. Some inspectors have, on their own volition, developed on-site libraries, web-site directories, and contacts with local wildlife specialists that enable them to identify (at least to genus) most new wildlife imports within hours, although it would not be unusual for an identification of new fish, reptiles, or amphibians to take days. Other wildlife inspectors were poorly resourced to make rapid identifications and reported relatively low confidence in their ability to correctly identify some groups (fishes and reptiles in particular). Barriers to identification create time lags that increase the political pressure (see previous discussion), on the inspection teams and undermine the integrity of the data collected (see following discussion on misidentifications/miscoding).

The design of USFWS import regulations and forms, and associated LEMIS database fields, further limit the potential for LEMIS data to be used to project the linkages between invasive species introduction and fish and wildlife trade patterns and trends. Examples of the problems include:

Limited Data Collection: LEMIS records for wildlife imports and exports include: a) shipment purpose code (e.g., commercial, personal, scientific, hunting trophy), wildlife type (i.e., taxonomic identification), the amount of wildlife (in number of individuals or weight), the commodity form (e.g., live animal, meat, trophy,

[65] Wildlife inspection staff at the Port of San Francisco/Oakland were able to estimate that they receive one new amphibian species every other week, a few new species of fish per year, and 2-4 new reptile species per month. In the year that the inspector had been on duty, he had not seen a new species of mammal imported.

leather or bone product), origin and destination, and transport method (e.g., vessel or aircraft). Fields are not explicitly included for hitchhiking plants, animals, or pathogens[66], nor does the database in any way indicate which species are considered injurious wildlife[67].

Limited Data Retention: LEMIS data are maintained in an electronic format for only seven years, after which they are purged from the database and extremely difficult to obtain and analyze in a timely manner. For this reason, the time series analyses typically of interest to those looking to make trade implication projections are very limited.

Identification Level Too General: Only CITES imports require species-level (and sometimes subspecies-level) identification[68]. Non-regulated wildlife and wildlife products are more typically identified to genera (although some ports reported an attempt to move toward species-level identification). Furthermore, the degree to which organisms are specifically identified (i.e., recognized by scientific name) varies greatly among taxonomic groups, ranging from naming of approximately two percent of the number of individual fish and insects to ninety and ninety-nine percent of the amphibians and annelids (worms), respectively (Appendix V). Thus, the ability to determine the identity of invasive species and potentially invasive species in the LEMIS database is masked by higher order identifications that vary among taxonomic groups.

[66] Note: some of these data may be captured in databases maintained by other agencies (e.g., the PestID system for hitchhiking non-native plant pests), but such information is not cross-reference in LEMIS.
[67] Unlike CITES species which are color-coded in the database.
[68] The correct identity and country of origin of the wildlife must be established by the owner, importer, exporter, consignor, or consignee by scientific name to the species level, or if any subspecies if protected by US laws or laws of the country of origin to the subspecies level (USFWS 2002).

Coding Too General and Changing: Several different criteria with multiple codes are assigned to each wildlife shipment. Perhaps the greatest limits on data interpretation stem from the fact that there are often multiple species codes that can be assigned for a single species at different taxonomic levels. And, regarding the type of commodity/product, there are, for example, 79 different description codes to choose among, as well as 10 different units of measure codes that reflect the quantity of the commodity/product being imported or exported. Those interested in analyzing US export patterns are challenged by the fact that exports and re-exports are not distinguished in LEMIS. Furthermore, although new codes are added or change over time as taxonomic nomenclature changes and new policies dictate the changes in the types of shipments entered into LEMIS, these modifications are not readily apparent within the database (USFWS 2005).

Misidentification/Miscategorization/Mislabeling: There are numerous possibilities for wildlife commodities/products to be misidentified within the database as a result of their intentional and accidental misidentification and miscategorization on documents and mislabeling of their packaging materials. USFWS wildlife inspectors routinely look for these discrepancies (often as an indicator of smuggling), but admit to making mistakes themselves when processing imports that have not been sufficiently identified or coded by the importer or their representative. One advisor to this project reports that, several years ago, a truck driver who was due to pick up a shipment of fish was told that he could not do so unless the scientific name of the species was furnish on associated documentation. The driver thus proceeded to spell "hockey stick" backwards and the commodities were cleared without further issue. Hopefully, improvements in inspection procedures made since that time prevent such deliberate acts of mislabeling.

Country of Origin: The country of origin listed in the LEMIS database does not necessarily indicate the country from which the commodity/product was collected or produced, but rather the country of most direct export to the US. So, for example, fish from a wide variety of locations in Asia are often sent to Singapore as a distribution hub and thus the origin code would designate Singapore and not indicate the amount of trade reaching the US from any of the other source countries. Furthermore, although the USFWS is supposed to enforce the laws of the country from which it receives its imports, inspectors said that they do not have access to a database or other reference of foreign laws. They reported that this made it difficult for them to be informed of changes in wildlife protection status that occur at national levels and closely inspect for those newly protected species, especially when they might be moving under the "umbrella" of a "co-mingled country of origin."

No Data Review Procedures: Wildlife inspectors do not have direct access to the LEMIS database and are therefore unable to review the data they send to the data entry contractor in North Dakota for errors, or correct mistakes of their own that they might have later discovered. One senior wildlife inspector reported that she had a brief opportunity to review the dataset a couple of years ago while on business in USFWS headquarters and was astonished to find entire sections relevant to her port that were "unrecognizable." Another senior USFWS manager did report, however, that there is extensive cross-checking and correction of LEMIS data with respect to CITES species as the US prepares its annual reports.

Unfortunately, given these institutional and informational limitations, it is impossible to use LEMIS data to make precise or accurate statements regarding the quantity of wildlife and wildlife products, and some nontimber forest products, which

are being traded by type, location, or time period (USFWS 2005). However, ***not only do the problems with data collection and storage limit trade pattern analyses, they undermine the ability of the USFWS to justify necessary budget increases*** and thus increase opportunities for smuggling success (resulting in the under-reporting of trade), which is known to be widespread for at least some species (Raymakers & Hoover 2002). In short, many of the institutional problems that undermine the integrity of LEMIS are in turn further hampered by the Services' inability to mine LEMIS data on its own behalf.

OBJECTIVE 2: *Review the progress of NISC working groups focused on invasion pathways/risk assessment (per National Management Plan implementation) and assess the implications for strengthening Environmental Impact Reports of market access agreements [Current Mandate/Progress]:*

The final report of the workshop entitled, "*Invasive Alien Species: a Review of Risk Analysis/Screening Projects*," can be found in Appendix IV. In general, the meeting revealed that the US Government has, through internal process (working groups and committees) or external sponsorship, numerous efforts underway to develop models and tools for invasive species screening and risk assessment. However, these efforts have thus far been slow to make progress (per National Management Plan deadlines; NISC 2005) and poor coordination exists among the working group/committee leads and between interagency coordinating bodies (e.g., NISC and the ANSTF). As a result, significant gaps, inconsistencies, and challenges to future progress were readily identifiable. The meeting provided a forum for participants to identify opportunities to overcome the existing challenges and to determine the key needs for strengthening Environmental Impact Reviews of market access agreements:

KEY NEEDS

Opportunities for NISC member agencies to improve screening and risk assessments of invasive species in the context of trade policy decision making:

- Increase the understanding within US agencies, especially among high-level decision makers, of the potential linkages between trade policy and biological invasion.
- Clearly define the goals and processes for screening and risk assessment (or risk analysis more broadly).
- Prioritize screening and risk assessment work based upon high-risk pathways and commodities.
- Establish better linkages between data that are being collected and the policy decisions that need to be made (i.e., data are being collected for reasons other than trade policy decision making and are not readily applicable).
- Build and maintain relevant datasets continually so as to increase the capacity for trend and predictive analyses.
- Catalogue US-relevant information resources that provide data for trade-associated risk assessment and make this catalog readily available to (at a minimum) those conducting Environmental Impact Reviews of market access agreements.
- In order to assess potential risk management strategies (e.g., for inclusion in environmental side agreements), catalogue the best management practices for minimizing risk via pathway and commodity and make this catalogue publicly available.
- Enhance capabilities to share information, minimize duplication of effort, and work cooperatively among agencies

and between agencies and scientists (both biological and social).

- Create and routinely update on-line species identification guides, newsletters, pest alerts and other tools in order to build the capacity of inspectors to conduct thorough and accurate inspections and make the data available in a timely manner.

The participants agreed that until these key needs are met, it will continue to be impractical, if not impossible, for the US government to effectively manage the risk of biological invasion associated with trade in a timely, transparent, scientifically-based manner.

OBJECTIVE 3: ***Identify the resources, strategies, and policies necessary to create, maintain, and make accessible one or more commodity/invasive species databases that EPA and other relevant agencies can apply to trade policy in a timely and scientifically-based manner [Needs/Recommendations]:***

The conclusions of this report fulfill the needs/recommendations called for in Objective Three. A discussion of the findings can be found on pages 94–104 and specific needs for improving data on invasive species to apply to trade policy decision making can be found on page 100."

DISCUSSION

The globalization of trade, travel, and transport has greatly increased the number of pathways for the introduction of invasive pests and diseases into the United States, as well as other countries. ***Given the importance of agriculture and other natural resources (particularly fish and wildlife) to the US economy, it***

is paramount that the government proactively assess the risks and take all necessary precautions to prevent deliberate and unintentional introductions of potentially harmful organisms. Thus, effective quarantine inspection programs across multiple agencies are necessary to ensure that natural resources and agriculture are well protected even as agencies work to pursue government's top priorities: to prevent terrorists and their weapons gaining US entry and facilitate the flow of legitimate trade and travel.

Yet, the factors that limit the utility of the PestID and LEMIS systems, as well as the development of pathway analyses and screening tools, are largely administrative and political in nature, rather than scientific and technical (although the latter issues are present and in some cases quite significant). Unfortunately, because so many of the problems are in fact "institutionalized," moving toward an inspection system that could effectively contribute data applicable to accurate trade projections and effective trade policy decision making will require a sea change in the way the US approaches pest entry prevention.

It is not readily apparent that such a change will be feasible in the foreseeable future. There are at least two existing government regulations that already require the federal agencies to be far more effective then they are in establishing and maintaining the integrity of the inspection data. The *Government Accounting Office Standards for Internal Control in the Federal Government* (1999) state that "agencies should have adequate mechanisms in place to identify and analyze risks and determine what actions should be taken to mitigate them." As identified by the EPA Office of International Affairs, such risks include the introduction of the invasive animals, plants, and pathogens associated with changing patterns and trends of traded commodities and

travelers. The *OMB (Office of Management and Budget) Final Information Quality Bulletin for Peer Review* (2004) requires agencies to employ a peer review process to improve the quality of scientific information upon which policy decisions are based. Presumably, effective implementation of a peer review process would have already led to a substantial improvement in inspection data integrity (including the expansion of the type of information collected). Furthermore, many of the relevant prevention and information management action items included in the National Management Plan, which is now four years past its first revision deadline, have yet to be implemented. We thus have to assume that a lack of political will and/or resources are currently preventing CBP, APHIS, and the USFWS from fully implementing these policies and action items.

On the other hand, recent publications state that the USFWS recognizes that, despite the numerous challenges to inspection data collection and quality control, the accurate monitoring of international trade in wild flora and fauna is an essential tool in building the reliable datasets that enable sound policy decisions (Thomas & Albert 2006; USFWS 2005). And, USDA officials were recently quoted as stating that their "protection through inspection" policies had not been adequate and thus they needed to look to build a more comprehensive prevention program (Kahn 2006). In what way CBP intends to take responsibility for and guide a transition to higher quality inspection programs and their resultant data is unknown. They have not yet taken a highly visible and active role in NISC despite their mandate in agricultural pest prevention.

Evidence suggests that the US is not the only country that has had trouble reporting accurate trade patterns relevant to the introduction of invasive species (Hariott 2003; Clark 2002; Gerson 2000), and it is not uncommon for importing and export-

ing countries to report different trade statistics, even with regard to the same shipments (Blundell & Rodan 2003; Clark 2002). However, as one of the leading trading countries in the world, the US should set and adhere to high standards for trade information systems. By overcoming the factors that undermine the integrity of inspection data, the US will be in a better position to protect agriculture and natural resources from the economic harm and threats to human health posed by invasive species. However, as long as the status quo is maintained, US decision makers will be plagued by significant levels of information uncertainty, as well as the risk that their policies will fail to adequately protect the American people, as well as the nation's infrastructure and economy.

NOTES

The failure of specific agencies to provide databases that permit policy makers to conduct Environmental Impact Reviews of market access agreements for invasive species risk and for inter-agency task teams to fully develop invasion pathway and screening tools that could enhance these Environmental Impact Reviews is a by-product of US government policies and priorities as a whole. All of the Departments that house inspection agencies or that rely on data arising from inspections for policy decision making need to work more closely to address key coordination and management weaknesses, and to increase the scientific and technical capacities of the commodity inspection program government-wide.

We hope that the NISC member departments will implement the following recommendations in their ongoing efforts to improve data collection and refine data entry and quality control for accuracy, precision, reliability, and accessibility. Only by adopting a comprehensive biosecurity[69] approach and making a greater invest in its front-line defenses will the US government be able to adequately minimize the introduction of invasive species (Meyerson & Reaser 2002a,b; 2003). ***Fundamentally, the imprecision, inaccuracy, and inaccessibility of inspection data (esp. among inspection agencies) underscores the need for the US government to collectively support the CBP and USFWS inspection services with greater financial, human, informational, and technical resources***. The following recommendations are consis-

[69] "Biosecurity itself is more than a buzzword; it is the vital work of strategy, efforts, and planning to protect human, animal, and environmental health against biological threats. The primary goal of biosecurity is to protect against the risk posed by disease and organisms; the primary tools of biosecurity are exclusion, eradication, and control, supported by expert system management, practical protocols, and the rapid and efficient securing and sharing of vital information. Biosecurity is therefore the sum of risk management practices in defense against biological threats" (The National Association of State Departments of Agriculture 2001).

tent with, further support, and build upon those made previously by other experts on invasive species and/or US policy formulation and implementation (e.g., GAO 2006a, b; Lodge et al. 2006).

Inter-Agency Cooperation

Information-sharing and cross-training for mission reinforcement are as yet poorly developed. This leaves significant gaps in coverage among a wide range of actors. The DHS, USDA, and DOI should work with all other Departments housing inspection agencies (e.g., Health and Human Services; HHS), as well as agencies (e.g., USTR, EPA) that make policy decisions based on data arising from inspections to:

- Create a comprehensive **biosecurity plan**[70] and associated **cross-cut budget** in order to integrate and adequately resource all commodity/product inspection services. These services need not be under the authority of a single department, but clear definitions of legal authority (including shared authorities where relevant), co-housing of staff, inter-agency action committees, and the inter-operability of information and financial systems are highly likely to enhance effectiveness (see below).
- Develop a "**clearinghouse mechanism**[71]" and "**learning network**" that has both public and clearance-required portals (for particularly sensitive trade information) and houses a wide array of **informational tools** intended to build the

[70] An early detection/rapid response (aka "incident or command response") system should be a key component of this plan. Thus, the information tools and systems recommended herein need to be developed consistent with the early detection and rapid response strategies outlined in the National Management Plan and subsequent support documents (e.g., NISC 2003).

[71] A network of stakeholders working together to facilitate implementation a specific mission and goals. In general, it facilitates access to and the exchange of information on relevant issues.

capacity of inspectors to conduct the high quality inspections (and thus collect high quality data). A learning network would facilitate a process of continuous improvement by permitting inspectors to communicate peer-to-peer on new techniques, new problems identified, and potential solutions. Peer-to-peer communication, when linked to emergency response, provides the basis for an international early-warning mechanism. The clearinghouse mechanism should provide direct access to existing information systems on invasive species (e.g., Global Invasive Species Database of IUCN, Plants Database of USDA, and the Inter-American Biodiversity Information Network) (IABIN)[72] . The following are examples of resources to be included in a clearinghouse mechanism and associated learning network: a directory of all inspection service personnel; invasive species identification keys, photos, expert directories, and bibliographies; invasive species interception newsletters; automated invasive species e-alerts; and invasive species question bulletin boards (perhaps by taxonomic group).

- Designate and implement standards, formats, and protocols that will enable establishment of an **inter-operable database** network linking all commodity/product inspection datasets. Apply lessons learned from the successful sharing of information through the TECS system.
- Conduct a thorough inter-agency **needs assessment** to determine which inspectors need access to which automated databases in order to enhance inspection targeting and reporting. Fully engage inspection staff in the design, implementation, and evaluation of the assessment.

[72] http://www.issg.org/database/; http://plants.usda.gov; http://www.iabin.net, respectively. For an extensive list of relevant databases see: http://www.invasivespeciesinfo.gov/resources/main.shtml.

- Based on this needs assessment, establish **security clearances** for relevant inspection personnel that will give them easy access to the secured automated information systems, as well as the clearinghouse/learning network and interoperable database to be developed.
- Establish **scientifically-and risk-based sampling protocols** and implement them consistently at each port. Ideally, these protocols will include data collection on all shipments, including the records of all interceptions (irregardless of proven pest risk) and inspections in which no potential invasive species were detected (i.e., "0" records).
- Enact procedures for the **routine review (monitoring) and correction** of sampling protocols and their resultant data.
- Establish mandates and procedures for improving technologies and sharing **high-tech equipment** (e.g., VACIS) as needed among inspection agencies.
- Expand **training and other capacity-building opportunities** for all inspectors by creating regular group meetings (e.g., local monthly meetings and an annual retreat), interagency personnel exchanges, tours of duty (TDY) focused on invasive species issues, and taxonomic fellowships for doctoral candidates and post-docs that enable them to join inspection teams at ports of entry for 1–2 years.
- Increase the **income potential** of inspection staff via grade increases and make pay-levels commensurate with both experience and locality.
- Harmonize **trade reporting protocols and systems** across inspection agencies.
- Enact FACA (Federal Advisory Committee Act) sanctioned, **peer-review committees** to annually review the integrity of

inspection programs and resultant data, including implementation of action items in the National Management Plan, and this and other relevant reports (e.g., GAO 2006a; USFWS 2005). Priority managerial issues for review should include relevant[73]: budgetary priorities; financial management system policies and procedures (including interagency transfers); user fee income levels and distribution mechanisms; program performance measures; risk-based staffing models and procedures; inter-agency communications and information access; employment of scientific, technological, and other capacity building (e.g., canine unit) tools/approaches; pathway coverage; training quality and staff competence; and staff morale.

In addition to the above, we recommend the following immediate efforts:

Customs and Border Protection

- Recognize that **reduction of agroterrorism and bioterrorism risk** requires resources (financial and human) and capacity building (training and informational resources) at levels equal to that of risk reduction associated with weapons of mass effect and that harmful organisms are already entering the US daily as a result of deliberate and unintentional introductions.
- **Invest adequate resources and political will in invasive species prevention** and control programs in order to safeguard homeland security from organisms that threaten the environment, economy, food supply, and human health within the US via both deliberate and unintentional introductions.

[73] In random order.

- Take the lead in a process to **evaluate DHS, USDA, and FWS authorities** in order to identify gaps and inconsistencies in policies and programs to prevent and rapidly respond to the introduction of invasive species. Engage inspection staff in development and implementation of a plan to fill gaps and fully address inconsistencies.
- Foster stronger policies and programs for protecting agriculture security by **hiring agriculture experts at all staffing levels**, including positions of senior leadership within DHS/CBP management.
- **Establish listening sessions** (at least two per year) for DHS and USDA officials to receive briefings directly from port inspectors on issues of concern as it relates to their ability to accomplish effective data gathering. These listening sessions can be accomplished via conference calls or video conferences with representatives from all designated ports.
- Work with inspection staff, NISC representatives, and outside consultants to **identify pathways of biological invasion and groups of harmful organisms (e.g., pests of infrastructure)** that are not currently addressed by other Departments and establish prevention policies and response measures (based on the science of propagule pressure) in order to minimize this growing threat to homeland security.
- Fully engage **DHS staff in NISC activities** (esp., with regard to issues related to pathways of invasion not currently addressed by other Departments).

US Fish and Wildlife Service

- Identify in LEMIS all traded **commodities/products to species level.**

- Employ **ITIS (Integrated Taxonomic Information System[75]) codes** to standardize the coding of fish and wildlife species and their products.
- Establish a **national seizure facility** with the capacity to house confiscated fish, wildlife, and wildlife products based on their status as endangered or injurious. Ideally, the cost of the facility will be shared among border protection agencies and will enable inspectors to seize (and thus report) fish and wildlife without the concern of port-specific budgetary or facilities limitations.
- **Establish listening sessions** (at least two per year) for DOI officials to receive briefings directly from port inspectors on issues of concern. These listening sessions can be accomplished via conference calls or video conferences with representatives from all designated ports.
- Fully engage senior **FWS staff in NISC activities** and ensure that inspection teams receive relevant information and capacity building tools developed by DOI and other Departments (e.g., US Army Corps of Engineer's species identification keys)

[74] http://www.itis.gov

REFERENCES

APHIS (Animal and Plant Health Inspection Service). 2004. Quantitative analysis of inspections for hitchhiking insect pests on cargo aircraft from targeted countries at Miami International Airport. US Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine Center for Plant Health Science and Technology, Raleigh, North Carolina.

APHIS PPQ (Animal and Plant Health Inspection Service, Plant Protection and Quarantine). 2002–01. Agricultural Quarantine Inspection Monitoring (AQIM) Handbook 10/2002–01 Edition. US Department of Agriculture, Marketing and Regulatory Programs, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, Washington, DC. (Note: This is the most recently available manual posted online: http://www.aphis.usda.gov/ppq/manuals/port/AQIM_Chapters.htm)

Blumenthal, D. 2005. Interrelated causes of plant invasion. Science 310:243–244.

Blundell, A. G. and M. B. Mascia. 2006. Data on wildlife trade. Conservation Biology 20:598–599.

Blundell, A. G. and M. B. Mascia. 2005. Discrepancies in reported levels of international wildlife trade. Conservation Biology 19:2020–2025.

Blundell, A. G. and Rodan. 2003. Mahogany and CITES: moving beyond the veneer of legality. Oryx 37:85–90.

Bright, C. 1998. Life Out of Bounds: Bioinvasion in a Borderless Word. World Watch Institute, Washington, DC

Burgiel, S., G. Foote, M. Orellana, A. Perrault. 2006. Invasive alien species and trade: integrating prevention measures and international trade rules. Center for International Environmental Law and Defenders of Wildlife, Washington, DC.

Carlton, J.T. 2001. Introduced species in US coastal waters: environmental impacts and management priorities. Pew Oceans Commission, Arlington, Virginia, USA. Available at: http://www.pewoceans.org.

CBD (Convention on Biological Diversity). 2002. Alien Species that Threaten Ecosystems, Habitats, or Species. Decision VI/23. April 19, The Hague, Netherlands. Available at: http://www.biodiv.org/decisions/default.aspx?m=COP-06&id=7197&lg=0

Chapin III, F. S., E. S. Zavaleta, V. T. Eviners, R. L. Naylor, P. M. Vitousek, H. L. Reynolds, D. U. Hooper, S. Lavorel, O.E. Sala, S.E. Hobbie, M.C. Mack, and S. Diaz. 2000. Consequences of changing biodiversity. Nature 405:234–242.

CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). 2006. What is CITES? CITES Secretariat, Geneva, Switzerland. Available at: http://www.cites.org/eng/disc/what.shtml

Clark, S. 2002. Trade in Asian dried seafood: characterization, estimation, and implications for conservation. Wildlife Conservation Society, Bronx, New York.

Colautti, R. I., J. R. Muirhead, R.N. Biswas, and H. J. MacIssac. 2005. Realized versus apparent reduction in enemies of the European starling. Biological Invasions 7: 723–732.

Colpetzer, K. E. 2005. NPAG Preassessment: Paratrechina (Fulva) sp. near pubens Forel, Hymoperta/Formicidae. 28 October 2005. USDA Animal Plant and Health Inspection Service, Washington, DC.

Davis, E. E., S. French, and R. C. Venette. 2005. Mini Risk Assessment Metallic Beetle: Agrillus biguttatus Fabricius [Coleoptera: Buprestidae]. US Department of Agriculture, Forest Service.

D'Antonio, C. 2000. Fire, plant invasions, and global changes. Pages 65–93 in Mooney, H.A. and R.J. Hobbs (eds.). 2000. Invasive species in a changing world. Island Press, Washington, DC.

D'Antonio, C. M. and P. M. Vitousek. 1992. Biological invasions by exotic grasses, the grass/fire cycle, and global change. Annual Review of Ecology and Systematics 23:63–87.

Drake, J. M. and D. M. Lodge. 2006. Allee effects, propagule pressure and the probability of establishment: risk analysis for biological invasions. Biological Invasions 8: 365–375.

Duggan, I. C., C. A. M. Rixon, and H. J. McIssac. 2006. Popularity and propagule pressure: determinants of the introduction and establishment of aquarium fish. Biological Invasions 8:377–382.

Federal Register. 2006. Notice of Privacy Act system of records. Department of Homeland Security, Office of the Secretary. Federal Register 71 (212):64543–64546.

Federal Register. 2005. Importation of wood packaging material. Department of Agriculture, Animal and Plan Health Inspection Service. Federal Register 69 (179):55719–55733.

Federal Register 2003. Executive Order 13286: Amendment of Executive Orders, and Other Actions, in Connection With the Transfer of Certain Functions to the Secretary of Homeland Security. Federal Register 68 (43):10619–10633.

Federal Register 2000. Guidelines for the implementation of Executive Order 13141: Environmental Review of Trade Agreements. Office of the United States Trade Representative, Counsel on Environmental Quality. Federal Register 65 (244): 79442–79449.

Federal Register 1999a. Executive Order 13112: Invasive Species. Office of the President. Federal Register 64 (25):6183–6186.

Federal Register 1999b. Executive Order 13141: Environmental Review of Trade Agreements. Office of the President. Federal Register 64 (222):63169–63170.

GAO (Government Accountability Office) 2007. Homeland Security: Management and Programmatic Challenges Facing the Department of Homeland Security. A testimony before the Committee on Homeland Security, House of Representatives. GAO–07–452T. United States Government Accountability Office, Washington, DC. Available at: http://www.gao.gov/cgi–bin/getrpt?GAO–07–452T.

GAO (Government Accountability Office) 2006a. Homeland Security: Management and Coordination Problems Increase the Vulnerability of US Agriculture to Foreign Pests and Disease. GAO–06–644. United States Government Accountability Office, Washington, DC Available at: http://www.gao.gov/cgi-bin/getrpt?GAO–06–644.

GAO (Government Accountability Office) 2006b. Invasive Forest Pests: Lessons Learned from a Three Recent Infestations May Aid in Managing Future Efforts. GAO–06–353. United States Government Accountability Office, Washington, DC. Available at: http://www.gao.gov/cgi-bin/getrpt?GAO-06–353.

GAO (Government Accountability Office) 2006c. Information Technology: Customs Has Made Progress on Automated Commercial Environment Systems, but It Faces Long-Standing Management Challenges and New Risks. GAO–06–580. United States Government Accountability Office, Washington, DC.
Available at: http://www.gao.gov/cbi-bin/getrpt?GAO–06–580.

GAO (Government Accountability Office) 2006d. Homeland Security: Agriculture Specialists' Views of Their Work Experiences After Transfer to DHS. GAO–070209R. United States Government Accountability Office, Washington, DC.
Available at: http://www.gao.gov/cgi-bin/getrpt?GAO–07–209R.

GAO (General Accounting Office) 1999. Standards for Internal Control in the Federal Government. GAO/AIMD–00–21.3.1. United States General Accounting Office, Washington, DC. Available at: http://www.gao.gov/special.pubs/ai00021p.pdf.

Gerson, H. 2000. An investigation of the tropical timber trade in Canada with emphasis on the compliance, reporting and effectiveness of legislation and regulatory procedures for CITES-listed species. Canada Customs and Revenue Agency, London, Canada.

Gilbreath, J. 2005. Identifying and Characterizing Trade Pathways for Invasive Species. Presentation to the International Association of Impact Assessment, Annual Conference, Boston, MA, June 2, 2005.

Green, P. T., P. S. Lake and D. J. O'Dowd. 2004. Resistance of island rainforest to invasion by alien plants: influence of microhabitat and herbivory on seedling performance. Biological Invasions 6:1–9.

Green, P. T., P. S. Lake, and D. J. O'Dowd. 1999. Monopolization of litter processing by a dominant land crab on a tropical oceanic island. Oecologia 119:435–444.

Gutierrez, A. T. and J. K. Reaser. 2005. Linkages between development assistance and invasive alien species in freshwater systems in Southeast Asia. USAID Asia and Near East Bureau, Washington, DC.

Haack, R. A. 2003. Intercepted Scolytidae (Coleoptera) at US ports of entry: 1985 Integrated Pest Management Reviewers 6:253–282.

Harriot, V.J. 2003. Can corals be harvested sustainably? Ambio 32:130–133.

Holden, C. (ed.). 2006. Move over, fire ants. Science 313:1549.

Kahn, D. (ed.). 2006. Invasive species: federal, state agencies struggle with the best programs to protect forest health. Land Letter: December 7th. Available at: http://www.eenews.net/landletter/print/2006/12/07/01.

Keller, R., D. Lodge, and D. C. Finnoff. 2006. Risk assessment for invasive species produces net economic benefits. Proceedings of the National Academy of Sciences 104:203–207.

IUCN – The World Conservation Union. 2000. IUCN Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species. SSC Invasive Species Specialist Group. Approved by the 51st Meeting of the IUCN Council, Gland Switzerland, February 2000. Available at: http://www.iucn.org/themes/ssc/publications/policy/invasivesEng.htm#anchor392619

Lake, P. S. and D. J. O'Dowd. 1991. Red crabs in rain forest, Christmas Island: biotic resistance to invasion by the giant African land snail. Oikos 62:25–29.

Leung, B. and D.M. Lodge, D. Finnoff, J.F. Shogren, M.A. Lewis, and G. Lamberti. 2002. An ounce of prevention or a pound of cure: bioeconomic risk analysis of invasive species. Proceedings of the Royal Society of London 269:2407–2413.

Liebhold, A. M., T. T. Work, D. G. McCullough and J. F. Cavey. 2006. Airline baggage as a pathway for alien invasive species invading the United States. American Entomologist 52:48–54.

Lockwood, J. L., P. Cassey, and T. Blackburn. 2005. The role of propagule pressure in explaining species invasions. Trends in Ecology & Evolution 20: 223–228.

Lodge, D., S. L. Williams, H. MacIsaac, K. Hayes, B. Leung, S. Reichard, R. N. Mack, P. Moyle, M. Smith, D. A. Andow, J. T. Carlton, and A. McMichael. 2006. Biological Invasions: Recommendations for US Policy and Management. Ecological Applications 16:2035–2054.

Lonsdale, M. 1999. Global patterns of plant invasions and the concept of invisibility. Ecology 80:1522–1536.

Mack, R.N., D. Simberloff, W.M. Lonsdale, H. Evans, M. Clout and F.A. Bazzaz. 2000. Biotic invasions: causes, epidemiology, global consequences and control. Ecological Applications 10:689–710.

Mack, R.N. and C.M. D'Antonio. 1998. Impacts of biological invasions on disturbance regimes. Trends in Ecology and Evolution 13:195–198.

Magee, J., C. K. McMullen J. K. Reaser, E. Spitzer, S. Struve, C. Tufts, A. Tye, G. Woodruff. 2001. Green invaders of the Galapagos Islands. Science 294:1279–1280.

Marshall, D., T.T. Work, and J. F. Cavey. 2003. Invasion pathways of karnal bunt of wheat into the United States. Plant Disease 87:999–1003.

McCullough, D. G., T. Work, J. F. Cavey, A. S. Liebhold, and D. Marshall. 2006. Interceptions of nonindigenous plant pests at US ports of entry and border crossings over a 17 year period. Biological Invasions 8:611–630.

McCullough, D. G., S. Reichard, and J. Cavey. 2001. Pathways of non-indigenous plant pest introductions: how exotic insects, pathogens and weeds arrive in the United States. NCEAS Research Abstract. Available at: http://admindb.nceas.edu/admin/db/web.ppage?projid_in=3741.

McNeely, J. (ed.). 2001. The Great Reshuffling: Human Dimensions of Invasive Alien Species. IUCN, Gland, Switzerland.

McNeely, J. A., H. A. Mooney, L. E. Neville, P. J. Schei, and J. K. Waage (eds.). 2001. Global strategy on invasive alien species. IUCN, Cambridge, U.K., in collaboration with the Global Invasive Species Programme.

Meyerson, L. A. and J. K. Reaser. 2003. Bioinvasions, bioterrorism, and biosecurity. Front. Ecol. Environ. 1:307–314.

Meyerson, L. A. and J. K. Reaser. 2002a. Biosecurity: moving toward a comprehensive approach. BioScience 52:593–600.

Meyerson, L. and J. K. Reaser. 2002b. A unified definition of biosecurity. Science 295:44.

Mooney, H. A. and R. J. Hobbs (eds.). 2000. Invasive Species in a Changing World. Island Press, Washington, DC.

NASDA (National Association of the State Departments of Agriculture). 2001. The Animal Health Safeguarding Review: Results and Recommendations. The National Association of State Departments of Agriculture, Washington, DC

National Research Council 2002. Predicting invasions of nonindigenous plants and plant pests. Committee on the Scientific Basis for Predicting the Invasive Potential of Nonindigenous Plants and Plant Pests in the United States. National Academy Press, Washington, DC.

Naylor, R. 1996. Invasions in agriculture: assessing the cost of the golden apple snail in Asia. Ambio 25:443–448.

NISC (National Invasive Species Council). 2005. Five-year Review of Executive Order 13112 on Invasive Species. Prepared for the Office of Management and Budget by National Invasive Species Council staff, Washington, DC.

NISC (National Invasive Species Council). 2003. General Guidelines for the Establishment & Evaluation of Invasive Species Early Detection & Rapid Response Systems. Version 1. National Invasive Species Council, Washington, DC.

NISC (National Invasive Species Council). 2001. National Invasive Species Management Plan. National Invasive Species Council, Washington, DC. Available at: http://www.invasivespeciesinfo.gov

OMB (Office of Management and Budget). 2004. Memorandum for Heads of Departments and Agencies: Insurance of OMB's "Final Information Quality Bulleting for Peer Review." Executive Office of the President, Office of Management and Budget, Washington, DC Available at: http://www.fws.gov/le/aboutLE/InformationQuality.htm

Parker, I.M., D. Simberloff, W.M. Lonsdale, K. Goodell, M. Wonham, P.M. Kareiva, M.H. Williamson, B.V. Holle, P.B. Moyle, J.E. Byers and L. Goldwasser. 1999. Impact: toward a framework for understanding the ecological effects of invaders. Biological Invasions 1:3–19.

Perrings, C., M. Williamson, and S. Dalmazzone (eds.). 2000. The Economics of Biological Invasions. Edward Elgar, Northampton, MA.

Pimentel, D. (ed.) 2002. Biological invasions: economic and environmental costs of alien plant, animal, and microbe species. CRC Press, Washington, DC, USA.

Pimentel, D., S, McNair, J., Janecka, J. Wightman, C. Simmonds, C. O'Connell, E. Wong, L. Russel, J. Zern, T. Aquino, & T. Tsomondo. 2001. Economic and environmental threats of alien plant, animal, and microbe invasions. Agriculture, Ecosystems & Environment 84:1–20.

Pimentel, D., L. Lach, R. Zuniga, and D. Morrison. 2000. Environmental and Economic Costs of Nonindigenous Species in the United States. BioScience 50: 53–65.

Raymakers, C. and C. Hoover. 2002. Acipenseriformes: CITES implementation from range states to consumer countries. Journal of Applied Ichthyology 18:629–638.

Reaser, J. K. 2006. Case Study: Paratrechina Ant Invasion. Special Report to the EPA Office of International Affairs under the IUCN-led project entitled, Managing Risks from the Introduction of Invasive Species: Focus on Pathways Linked to International Trade. IUCN-World Conservation Union, Washington, DC.

Reaser, J. K., B. B. Yeager, P. R. Phifer, A. K. Hancock, and A. T. Gutierrez. 2003a. Environmental diplomacy and the global movement of invasive alien species: a US Perspective. Pages 362–381 in Ruiz, G.M. and J. T. Carlton (eds.). Invasive species: vectors and management strategies. Island Press, Washington, DC.

Reaser, J. K., A. T. Gutierrez, and L.A. Meyerson. 2003b. Biological invasions: do the costs outweigh the benefits? BioScience 53:598–599.

Sala, O.E., F.S. Chapin III, J.J. Armesto, E. Berlow, J. Bloomfield, R. Dirzo, E. Huber-

Sanwald, L.F. Huenneke, R.B. Jackson, A. Kinzig, R. Leemans, D.M. Lodge,

H.A. Mooney, M. Oesterheld, N.L. Poff, M.T. Sykes, B.H. Walker, M. Walker,

D.H. Hall. 2000. Global Biodiversity Scenarios for the Year 2100. Science 287: 1770–1774.

Shine, C., Williams, N. and L. Gündling. 2000. A Guide to Designing Legal and Institutional Frameworks on Invasive Alien Species. IUCN, Gland, Switzerland Cambridge and Bonn.

Simberloff, D. 2002. The economics of biological invasions. Biodiversity and Conservation 11:553–556.

Thomas, P. O. and M. R. Albert. 2006. Data on wildlife trade. Conservation Biology 20: 597–598.

USCBP (US Customs and Border Protection). 2007. Interagency Border Inspection (IBIS) Fact Sheet. Available at: http://www.cbp.gov.

US Congress. 2002a. An Act to Establish the Department of Homeland Security, and for Other Purposes. H.R. 5005. 107th Congress, Second Session, January 23, 2002, Washington, DC

US Congress. 2002b. Trade Act of 2002. Public Law 107–210. United States Public Laws, 107th Congress, Second Session, August 6, 2002. Washington, DC Pp. 24.

USA Today. 2007. Florida Customs Workers Report Falsifying Data. May 26, 2007. http://www.usatoday.com/news/nation/2007–05–26–florida-customs_N.htm

USFWS (United States Fish and Wildlife Service). 2006a. U.S Fish and Wildlife Service Introduction. USFWS Headquarters, Arlington, Virginia. See: http://www.fws.gov/le/ImpExp/Contact_Info_Ports.htm

USFWS (United States Fish and Wildlife Service). 2006b. U.S Fish and Wildlife Service Mission Statement. USFWS Headquarters, Arlington, Virginia. See: http://www.fws.gov/help/mission.cfm

USFWS (United States Fish and Wildlife Service). 2006c. Wildlife Inspectors. USFWS Headquarters, Arlington, Virginia. See: http://www.fws.gov/le/AboutLE/wildlife_inspectors.htm

USFWS (United States Fish and Wildlife Service). 2005. US Wildlife Trade: An Overview for 1997–2002. US Fish and Wildlife Service Office of Law Enforcement Intelligence Unit, Arlington, Virginia. Pp. 64.

USFWS (United States Fish and Wildlife Service). 2002. Chapter I: United States Fish and Wildlife Service, Department of the Interior, Part 14: Importation, Exportation, and Transportation of Wildlife. CFR Title 50, Volume 1. U. S. Fish and Wildlife Service, Arlington, Virginia. See: http://www.access.gpo.gov/nara/cfr/waisidx_02/50cfr14_02.html

Vitousek, P.M., C.M. D'Antonio, L.L. Loope, M. Rejmanek, and R. Westbrooks. 1997. Introduced species: a significant component of human-caused global

change. New Zealand Journal of Ecology 21:1–16.

Von Holle, B. and D. Simberloff. 2005. Ecological resistance to biological invasion overwhelmed by propagule pressure. Ecology 86:3212–3218.

Waage, J. K. and J. K. Reaser. 2001. A global strategy to defeat invasive species. Science 292:1486.

Westbrook, C., K. Ramos, and M. La. 2005. Under siege: invasive species on military bases. National Wildlife Federation, Washington, DC.

Wilcove, D.S., D. Rothstien, J. Dubow, A. Phillips, and E. Losos. 1998. Quantifying threats to imperiled species in the United States. BioScience 48:607–615.

Work, T., D. G. McCullough, J. F. Cavey, and R. Komsa. 2005. Arrival of nonindigenous insect species into the United States through foreign trade. Biological Invasions 7:323–332.

APPENDIX I. US Free Trade Agreements

U.S. Bilateral or Regional Free Trade Agreements		
Country/region	**Date**	**Status**
Israel	1985	in force
Canada	1989	superseded by the North American Free Trade Agreement
North American Free Trade Agreement (NAFTA)	1994	in force
Jordan	2001	in force
Chile	2004	in force
Singapore	2004	in force
Australia	2005	in force
Morocco	2005	in force
Bahrain	2006	in force
Oman	2006	pending implementation
Central America-Dominican Republic (CAFTA/DR)	2006	in force for Guatemala, Honduras, El Salvador, Nicaragua, Dominican Republic
Peru	2007	signed, but not approved by US Congress at time of publication
Panama	2007	signed, but not approved by US Congress at time of publication
Korea	2007	signed, but not approved by US Congress at time of publication
Colombia	2007	signed, but not approved by US Congress at time of publication

APPENDIX II. IUCN Competencies

IUCN is an international organization with a long history of objectively assisting governments around the world to identify and resolve the scientific and technical challenges that place limits on policy decision making at national and international levels. Now known as the World Conservation Union, its previous name was the International Union for the Conservation of Nature and Natural Resources. This is still its legal name in the USA.

IUCN has been actively working on IAS issues since 1993. The IUCN Invasive Species Specialist Group (ISSG) currently consists of approximately 150 scientific and policy experts on IAS from more than 40 countries. The group provides a forum for expert consultation on IAS issues and has published several scientific documents and policy guidelines, such as the Guidelines for the Prevention of Biodiversity Loss caused by Invasive Alien Species (Shine et al. 2000). IUCN was also one of the founding partners, with the Scientific Committee on Problems of the Environment (SCOPE), the United Nations Environment Programme (UNEP), and CAB International (CABI), of the Global Invasive Species Programme (GISP) in 1997.

IUCN's contribution to GISP (through the efforts of the ISSG) include McNeely (2001), McNeely et al. (2001), Shine et al. (2000), the Global Invasive Species Database (http://www.issg.org/database/welcome/) and the Cooperative Islands Initiative on Invasive Species (http://www.issg.org/cii/).

The US Office of IUCN in located in Washington, DC Contact:

Scott Hajost, Executive Director
IUCN-US
1630 Connecticut Ave, NW 3rd Floor
Washington, DC 20009-1053 USA
shajost@iucnus.org
tel +1 (202) 518.2047

Major* US Ports by Vessel Calls/Vessel Type, with changes in rates of inspection

PORTS	General Cargo	Roll on-Roll off	Combo	Dry Bulk	Container	inspection rate change***	intercept rate change***	Date visited
Houston**	2	10	1	4	8	-11	0.4	6/1/06
Los Angeles/ Long Beach	4	4	8	5	1	-2.1	1.3	8/31/06
New York**	8	2	4	11	2	-0.2	-7.9	
New Orleans	3		5	1	16	4.3	-2.4	5/31/06
Oakland/ San Francisco**	6	8		3	3	-21.4	0.1	8/28/06
Philadelphia/ Delaware River	1	14	6	3	7			4/19/06
Norfolk	14	16	3	7	4			
Columbia River	10	13	20	2	18			
Savannah	7	12		14	6			
Charleston	5	11		18	5			
Baltimore**	9	1	7	8	13	-8.2	2.8	11/18/05
Port Arthur	16		10	16				
Jacksonville	17	3	14	15	17			
Miami**		6			7	-12.7	0.4	5/15/06
Tacoma	5			12	10	0.8	16.4	
San Juan	5	9			11	-4.8	-2.5	
Port Everglades	19	18	12	19	14			
Corpus Christi		2	17					
Gulfport								6/2/06
Mobile								6/2/06

Source for ports, US Maritime Organization, 2005
Source for inspection and intercept changes, GAO 2006a
* lower number equals higher rank
** US Fish and Wildlife Service designated port, http://www.fws.gov/le/ImpExp/designatedports.htm
*** Transfer occurred 3/2003, figures are for corresponding District Field Offices of DHS Customs and Border Protection

APPENDIX IV: Risk Analysis/Screening Workshop

Report of "Invasive Alien Species: A Review of Risk Analysis/Screening Projects"

November 17, 2005

Convened by IUCN-The World Conservation Union

Introduction

On November 17, 2005, IUCN convened a one-day workshop of 15 invasive species experts working in the US on pathways of biological invasion. The purpose of the meeting was to: 1) exchange information on their research, 2) map out progress in assessing risk of invasion by pathway, 3) analyze gaps in knowledge and institutional partners, and 4) identify shared problems and lessons learned from work to date.

Presentations were given by:

Penny Kriesch	USDA APHIS
David Lodge	University of Notre Dame
Richard Orr	NISC
Jeff Morisette	NASA Goddard Space Flight Center
Jamie K. Reaser	Ecos Systems Institute on behalf of IUCN
Anne Sergent	Environmental Protection Agency
Pam Thibodeaux	US Fish and Wildlife Service

Additional participants included:

Gordon Brown	NISC
Stas Burgiel	Defenders of Wildlife
Sharon Gross	USGS

Marshall Meyers	PIJAC
John Randall	The Nature Conservancy (by phone)
John Waugh	IUCN-US
Betsy Von Holle	AAAS Fellow - EPA

Presentation Summaries

Penny Kreisch, of the USDA Animal and Plant Health Inspection Service, presented on invasive species pathways definition and prioritization. Kreisch is chair of the Pathways Working Group of the National Invasive Species Council's Prevention Committee. The Pathways Working Group has developed methods for stratifying and evaluating pathways, using pathway diagrams, qualitative assessment instruments and pathway databases. Pathways are characterized as either transportation related or living industry related (with some miscellaneous cases). These pathways are being analyzed qualitatively through an interdisciplinary expert process and through mining data to produce a quantitative analysis. Once fully developed, the data mining matrix will collect benchmark and trend data for predictive analysis, the next step. The need for continuous data building was flagged as key to the success of the project. Other key factors to success include involvement of all vested parties for each pathway, and an open system in which new pathways and pathway evaluation factors can be added or revised.

David Lodge of the University of Notre Dame discussed priority-setting for risk assessment and risk management of aquatic invasive species. Lodge characterized risk assessment as the process of determining what harm has or is likely to result from a species, under given assumptions of current human behavior,

and risk management as identifying management options and determining which of these are likely to be cost-effective in changing the behavior of humans or other organisms. He showed the strong correlations between imports and alien species, and reviewed the concept of propagule pressure and the Allee effect, and the correlation between species traits and successful introductions. Based upon this analysis Lodge and colleagues developed a decision tree to evaluate species establishment that is useful as a screening tool. The accuracy of trait-based screening appears to be uniformly high. Recommendations for further work include:

- the development of trait-based risk assessment tools for more taxa and more ecosystems, with explicit attention to trading partners
- improvements in tools and applications to better forecast secondary spread (gravity models for aquatics, niche modeling)
- integrated ecological and economic forecasting to identify cost effective risk management alternatives
- engagement of bioeconomic analysts and policy makers

Jeff Morisette of NASA's Goddard Spaceflight Center presented a report on his collaboration with Tom Stohlgren of USGS on the Invasive Species Forecasting System. This project involves the development of modeling techniques and the use of space-based remote sensing data layers to create a habitat suitability map. Using tamarisk as a case study, this project has demonstrated the effectiveness of predictive models.

Richard Orr of NISC provided a general overview of US government activities focused on invasive species screening, giving

particular emphasis to work being undertaken through intergovernmental cooperation. The Commission for Environmental Cooperation (CEC) and the North American Plant Protection Organization (NAPPO) are advancing work on invasive species screening regionally. The International Plant Protection Convention (IPPC) and Convention on Biological Diversity (CBD) have also recognized the need for better screening tools and standards and are addressing the issue through formal and informal means among their Parties.

Jamie K. Reaser, representing IUCN, described the IUCN project, funded by EPA, examining pathways for invasive species related to international trade, and particularly to bilateral and multilateral free trade agreements. Screening of the potential environmental impacts of trade agreements has not yet translated into effective decision-making. This is due to limited understanding and lack of communication on invasive species issues, especially relating to pathway dynamics and key actors, a paucity of data and limited data access, questionable data quality, the lack of an overall strategic approach to assessment of trade. Free trade agreements may not in all cases result in sharp spikes in imports to the US. But in some cases the increased pressure from trade argues in favor of measures to address invasive species risks. The challenge to determine in which cases trade agreements will increase the risk of introduction of invasive species, and what measures can minimize that risk through best practices. This requires the identification of pathways of highest risk. Information resources are needed that provide data on known linkages between specific commodities, packaging materials, containers and modes of transport. A decision support tool is envisioned that could, with reliable data, enable reviewers of trade agreements to spotlight activities that could present increased risks for further study and management measures that could be addressed under side-agreements.

Anne Sergent, of the Environmental Protection Agency¸ presented revisions to the Aquatic Nuisance Species Task Force (ANSTF) risk analysis review process. The process, which originally focused upon risk assessment and management for aquatic species, has been broadened to address more species, uncertainty and data quality issues, and new technical concepts. The emphasis has moved away from decision support to expert elicitation for risk assessment, taking into account characteristics of the ecosystem and of alien species to determine the probability and the ecological consequences of establishment and spread. Improvements have been made to stakeholder engagement to address alternative responses. Keys to success of the new approach will be improved ways to frame questions for experts and for stakeholders, and methods for addressing scientific uncertainty, where data may not be completely accurate or relevant.

Pamela Thibodeaux of the US Fish and Wildlife Service provided a review of the work of the Aquatic Organism Screening working group of the ANSTF. This working group will provide recommendations to the National Invasive Species Council on the preferred method for screening proposals for the introduction of non-native aquatic organisms within the continental United States. An expert process is envisioned for initial screening to determine if the organism is acceptable for import, or if a full risk assessment process is required. The criteria for the process are that it must be transparent, realistic, and address uncertainty. The working group will develop and test a model screen during 2006. Issues being addressed include the balance between quantitative and qualitative assessment, degree of rigor (is it closer to an assessment of a quick screen?), and the best means for addressing uncertainty.

The presentations elucidated several challenges and constraints in screening for invasive species and in assessing risk. Key issues raised in the presentations included:

Procedural Challenges

- There is a lack of consensus regarding the difference between screening and risk assessment (or risk analysis), and little guidance (per the NMP) to differentiate the goals, objectives, and processes.
- No specific mechanism and, at least prior to this meeting, little intent exists to significantly increase process clarity, coordination, and delivery schedule.
- Resources are being drained from agencies for risk assessments that are not necessarily the highest priorities in terms of policy-maker information needs. Scientific inquiry should flow from policy priorities, not visa-versa.
- The trade sector has not made it a political priority to conduct invasive species-relevant Environmental Impact Reviews of market access agreements in a timely and scientifically-defensible manner and to invest in the infrastructure and processes that would make this eventually feasible.

Data Issues

- The data currently being collected from potential invasive species pathways is largely inadequate (due to type, quality, quantity, and term of maintenance) to answer the questions that researchers need to ask to aid in policy decision-making.
- Several of the federal datasets that could be applied to pathways analysis and decision making are not publicly available.

The meeting provided the opportunity for participants to identify opportunities to overcome the existing challenges and to determine the key needs for strengthening Environmental Impact Reviews of market access agreements:

Key Needs

Opportunities for NISC member agencies to improve screening and risk assessments of invasive species in the context of trade policy decision making:

- Increase the understanding within US agencies, especially among high-level decision makers, of the potential linkages between trade policy and biological invasion.
- Clearly define the goals and processes for screening and risk assessment (or risk analysis more broadly).
- Prioritize screening and risk assessment work based upon high-risk pathways and commodities.
- Establish better linkages between data that are being collected and the policy decisions that need to be made (i.e., data are being collected for reasons other than trade policy decision making and are not readily applicable).
- Build and maintain relevant datasets continually so as to increase the capacity for trend and predictive analyses.
- Catalogue US-relevant information resources that provide data for trade-associated risk assessment and make this catalog readily available to (at a minimum) those conducting Environmental Impact Reviews of market access agreements.
- In order to assess potential risk management strategies (e.g., for inclusion in environmental side agreements), catalogue the best management practices for minimizing risk

via pathway and commodity and make this catalogue publicly available.

- Enhance capabilities to share information, minimize duplication of effort, and work cooperatively among agencies and between agencies and scientists (both biological and social).
- Create and routinely update on-line species identification guides, newsletters, pest alerts and other tools in order to build the capacity of inspectors to conduct thorough and accurate inspections and make the data available in a timely manner.

Discussion

Participants stressed the importance of translating new information on invasive species risk to make it more accessible to decision-makers. They recommended that a forward looking and optimistic brief on the trade and invasive species interface be prepared for senior decision-makers, including a charge to action, and that there be a concerted effort to broaden our interaction with trade interests beyond the "usual suspects" (horticulture, pet industry, ship ballast).

A key message of the meeting is that trade is demonstrated to be a strong correlate and predictor of biological invasion. While there was a lot of talk about science-based assessment in international processes, there was little science, although there is significant material that is available now and could be used, and we should be making data available and building the capacity for analysis. General tools that can be applied include:

- Global environmental matching trade analysis
- Environmental niche modeling
- Diffusion modeling

- Spatial interaction modeling
- Trait based modeling

Propagule pressure (a measure of the number of individuals introduced) and Allee effect (the positive relationship between population density and reproduction rates), are key components in the understanding of the risk of invasive species establishment. Current research points to a strong correlation between these forces and introduction success. Propagule pressure can also be correlated to trade. For this reason, an important need is to improve our understanding of the volume of trade and the intensity of trade pathways. One presentation called for more information to quantify trade, including data on shipping sufficient to permit forecasting of shipping trends and the use of risk matrix of the connections between countries, including data on security and terrorism, quotas, economic and policy conditions, currency valuations, etc. assessing the likelihood of change, and by extension the likelihood of changes in trade. This information, weighted by ecological similarities between ports, would provide a value for risk of invasive species introductions.

Summary

The workshop sought answers to four questions:

Question 1. How does current research fit together to address the invasion trajectory from point of origin to establishment? Is there duplication and overlap between pathways and risk assessment research?

A considerable gap was identified in research between pathways and risk assessment. Some very important work is being done on the assessment of species traits hat would indicate high risk, and on the identification of high risk pathways. Little analysis was being undertaken of the characterization of the pathways—the factors that would cause them to intensify and

weaken; what guides their establishment and growth—information essential for effective management of invasive alien species.

Question 2. What is the scope of current research? Do projects address commodities, modes of transport, packaging and containers, recipient ecosystems, and regions? Where do we have coverage and where do gaps exist?

Some work is being undertaken to address commodities, modes of transport, etc. The constraint facing those seeking to study these issues, as opposed to a species focus, is the poor quality and general inaccessibility of data.

Question 3. What processes are likely to provide timely input and influence decision-making?

The processes likely to provide timely input and influence decision-making involve better characterization of the environment in which invasions occur. This requires additional analytical tools, such as described above.

Question 4. How do we do accomplish a lot with a little (in terms of time and information)? Can we create new partnerships to help advance our understanding and our capacity to assist decision-making?

To accomplish a lot with limited resources necessitates that we work together to create a partnership with borders and ports authorities to collect better information, facilitating stronger and more responsive analysis. Information in this case is a two way street; scientists will depend upon the authorities to provide better information, and borders and ports authorities should have some mechanism to get early warning on new findings and new developments in trade patterns that could help them to focus limited resources on high risk areas.

The key message from this discussion was that risk is best understood as a function of the biological traits of the organism plus the volume and intensity of exposure from the organism. An important step in making international trade safe from biological invasions is organizing data in ways that facilitate evaluation of the risk based upon this combination of factors. In order for this to occur there must be better coordination in data collection, in order that the right kind of data is collected and shared between invasive species management, science, and border and port security efforts.

USFWS Declared Imports Identification 2000-2004						
	Number of Individual Animals Imported			Weight of Imports (for imports not counted individually, in kilos)		
	Identified Species	Unidentified Species	Proportion Identified	Identified Species	Unidentified Species	Proportion Identified
VERTEBRATES						
Amphibians	23,780,548	2,577,619	90%	1,288,908	9,839	99%
Birds	1,470,703	693,647	68%	350	0	100%
Fish	15,218,584	876,792,759	2%	1,760,016	980,830	64%
Mammals	214,871	23,450	90%	11,833	915	93%
Reptiles	6,733,326	2,364,015	74%	0	0	-
INVERTEBRATES						
Annelids	2,294,190	9,094	99%	101,510	0	100%
Arachnids	746,910	422,840	64%	0	0	-
Cnidarians	983,983	1,988,055	33%	139,804	106,044	57%
Crustaceans	10,504,429	117,443,164	8%	551,047	71,022	89%
Insects	57,400	3,164,021	2%	933	161	85%
Mollusks	1,808,791	4,364,258	29%	119,299	42,938	74%
Porifera	29,005	39,261	42%	224	520	30%
Other	13,353	58,460	19%	112	341	25%
TOTALS						
All Taxa	63,856,093	1,009,940,642	6%	3,974,035 kilos	1,212,609 kilos	77%
All Taxa Excluding Fish	48,637,509	133,147,883	27%	2,214,019 kilos	231,779 kilos	91%

APPENDIX VI:
USFWS Office of Law Enforcement Summary Statistics 2002-2007

USFWS Declared Imports Identification 2000-2004								
Fiscal Year	Request	Enacted	Number of Special Agents	Investi-gation Caseload	Number of Wildlife Inspectors at Ports	Number of Designated Wildlife Ports	Total Shipments Inspected at Ports	Average Shipments Per Inspector
2002	$50.4m	$50.4m	238	8055	91	14	117612	1292
2003	$51.9m	$51.6m	229	9941	94	14	118632	1262
2004	$52.7m	$53.6m	231	10250	95	14	148303	1561
2005	$51.3m	$55.6m	218	13980	105	17	171874	1637
2006	$57.6m	$56.1m	201	15422	113	17		
2007	$47.3m	(House: $57.5m, Senate: $57.8m)						
Change from 2002 to Latest Figure	**14%**	**+11% (2006 enacted)**	**-16%**	**93%**	**24%**	**21.50%**	**46%**	**27%**

APPENDIX VII: Primary Port Contacts

Customs and Border Protection

Baltimore: David Ng (Agriculture Specialist), Hal Fingerman (Chief, Agriculture Operations Pennsylvania, Delaware & Southern New Jersey)

Gulfport: Patricia Coto (CBP Supervisor Agriculture Specialist)

Houston: Rick Karstrom (Supervisory Agriculture Specialist), Tom Roeschen (Agriculture Specialist), George Grindle (Agriculture Specialist), Isiah Carden (Agriculture Specialist), Virginia Post (Agriculture Specialist)

Miami: Robert Stykes (Agriculture Specialist)

Mobile: Jan Clark (National Recruiter, Assistant Port Director)

Los Angeles/Long Beach: Aileen Suliveras (Assistant Port Director), Mark Altenstradter (Deputy Assistant Port Director), Gabriel Padilla (Agriculture Specialist), Rueben Green, Pete Butsook (Agriculture Specialist), Terry London, David Joyce

New Orleans: Stan Pirtle (Operations Specialist)

Philadelphia-Wilmington: Hal Fingerman (Chief, Agriculture Operations

Pennsylvania, Delaware & Southern New Jersey)

San Francisco/Oakland: Dickins Chun (Chief Inspector), Edmund Miera (SITC Officer)

US Fish and Wildlife Service

Houston: Kimberly Osborne (Supervisory Wildlife Inspector), Amy Bailey (Wildlife Inspector)

Los Angeles/Long Beach (Torrence): Mike Osborne (Supervisory Wildlife Inspector)

Miami: Vicky Vina (Supervisory Wildlife Inspector), Harris Spenser (Wildlife Inspector), Bruce Walker (Wildlife Inspector)

New Orleans: Beverly Buisson (Wildlife Inspector)

San Francisco/Oakland (Burlingame): Phet Souphanya (Wildlife Inspector)

APPENDIX VIII

The National Invasive Species Council Membership

Co-Chairs
US Department of Agriculture
US Department of the Interior
US Department of Commerce

Additional Members
US Department of Defense
US Environmental Protection Agency
US Department of Health and Human Services
US Department of Homeland Security
US National Aeronautics and Space Administration
Office of the US Trade Representative
US Department of State
US Department of Transportation
US Department of Treasury
US Agency for International Development

IUCN
The World Conservation Union

World Headquarters

Rue Mauverney 28
CH-1196 Gland
Switzerland
tel +41 22 999 00 00
fax +41 22 999 00 02
mail@hq.iucn.org

www.iucn.org