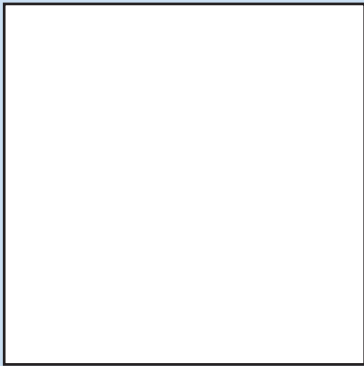


INVASIVE SPECIES STAKEHOLDERS

Collecting, Sharing and Using Information



weeds and result in more effective prevention and management programs that mitigate the impacts caused by noxious weed species.

A Risk Analysis Process for Non-Native Species

Richard L. Orr

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Formal risk analysis began in the late 1960s to early 1970s when the National Research Council (NRC) addressed a communication problem between government agencies and scientists. Scientists felt that their science was not being used wisely by the policymakers. On the other hand, policymakers responded that scientists were sending information that was either conflicting or not useful in helping them make regulatory decisions. Unfortunately, at times both statements were true. The need to facilitate communication between the two groups became what is now referred to as a risk assessment.

In general, risk is the likelihood and magnitude of an adverse event, risk assessment is an estimation of risk, risk management is the decision-making process concerned with what to do about that risk and risk analysis is the process of information gathering for risk assessment and risk management. The basic function of risk assessment is to organize information or data into a format that can be understood and used by policymakers. This is best done in a two-prong approach of estimating the likelihood of an adverse event and estimating the consequences of that event, if it happens.

Criteria. In addition to meeting the basic definition of estimating the likelihood and probability of an adverse event, the following criteria are essential for a risk assessment:

- Comprehensive - detailed review of the subject with sources of uncertainty identified in the data
- Logically sound - up-to-date, justifiable, unbiased and sensitive to different aspects of the problem
- Practical - commensurate with the available resources

- Conducive to learning - enough scope to have carry-over value for similar assessments
- Open to evaluation - sufficiently detailed record so that the process can be reviewed and challenged by qualified independent reviewers
- Flexible and dynamic - accommodates a variety of approaches to risk depending on the resources available, accessibility of the biological information and the state of the risk methodology at the time of the assessment

Therefore, when completed, a risk assessment should provide a reasonable estimation of the risk, communicate effectively the amount of uncertainty involved, and if appropriate, provide recommendations for the mitigation measures that would reduce the risk.

It is important to include scientific uncertainty in a risk assessment because it is an unavoidable limit that is inherent in the knowledge and methods by which scientific facts are established. Fundamentally, the three types of uncertainty that show up in a risk assessment are the uncertainty of the process (or methodology), uncertainty of the assessors (or human error) and the uncertainty associated with the biology of the organism and the environment in which it is introduced. Because scientific knowledge is basically probabilistic rather than absolute, and provisional rather than final, it can never be devoid of uncertainty or the possibility of inaccuracy or incompleteness. Thus, the dream of a risk assessment based on science that eliminates uncertainty is not attainable. However, the ability of a risk assessment to effectively communicate the degree of uncertainty surrounding an invasive species issue is a feasible goal.

Risk Assessment for Invasive Species. The evolution of risk analysis as associated with non-native species began in the early 1990s with the NRC's workshops associated with the development of *Issues in Risk Management*. Much of the focus was put on the development of a *Paradigm for Ecological Risk Assessment*, which included non-native species.

There was little time for future development of a non-indigenous species risk process, since a new trade route was opening to allow shiploads of

untreated Siberian logs (more than 30,000 per ship) from Siberia to the Pacific Northwest. Considering that trees are an ecosystem in themselves containing an array of associated organisms, there was concern that forest pests from Siberia would establish and cause extensive damage to forests of the Pacific Northwest. It was with this assessment that the principles gleaned from the NRC's workshops were first tested and refined.

Concurrently with the Siberian Log Risk Assessment, the U.S. Environmental Protection Agency (EPA) had started to look into how to conduct an ecological risk framework that included non-native species, or what they referred to as biological stressors. Thus, the EPA ecological framework provided additional input to the Siberian log risk process and the NRC's *Paradigm for Ecological Risk Assessment* for the development of a non-native species risk process.

Risk Model. From the review process, a risk model is applied for evaluating a pathway carrying unwanted invasive species. This model is broken down into seven elements dealing with the probability of introduction and magnitude of damage expected if a non-native species becomes established. The elements that relate to the probability of establishment include the likelihood of the organism or organisms of concern (1) being in the pathway, (2) surviving the journey, (3) becoming established in the new environment and (4) spreading beyond their initial establishment. The elements composing the consequential portion of the risk model include the likelihood of the organism or organisms of concern, if they become established, to produce (5) economic, (6) environmental and/or (7) social damage. With this model, the assessors can then organize the available information on the exotic organisms and convey it to policymakers.

It is important to recognize that under the colonization potential, the ability of an introduced organism to become established involves a mixture of the characteristics of the organism and the environment in which it is introduced. In reality, the level of complexity between the organism and the new environment is such that the species success can be based on minute idiosyncrasies of that interaction. In many cases, the turbulence

and chaos of the ecological dynamics hinder accurate prediction of future ecological events. Furthermore, if the species becomes established, the magnitude of damage can affect the degree of acceptable risk that is based on the probability of introduction.

Operational Steps. The following four risk management operational steps should be accomplished when addressing non-native species: (1) maintain communication and input from interested parties, (2) maintain open communication between risk managers and risk assessors without attempting to drive or influence the outcome of the assessment, (3) match the available mitigation options with the identified risks and (4) develop an achievable operational approach that balances resource protection and utilization. At an operational level, regulations and policies must be based on sound, verifiable and unbiased scientific data. Preventing the establishment of invasive species through an existing pathway requires that each one of the steps in the process be examined with the risk assessment as a foundation. We also must evaluate the current conditions covering the pathway including industry and regulatory standards. After that, mitigation measures should be evaluated for feasibility and applied to ensure that the identified invasive species are effectively being stopped from entry. Finally, a system should be developed to monitor and ensure that all mitigation requirements are maintained.

Decision Making. Clearly we wish to make a decision that will benefit the American people overall. However, many decisions involving invasive species are multifaceted. While most would agree that sound science should be the basis for decisions involving invasive species, the political world is much more complex. In a society as fragmented in thought and values as the United States, any action will impact negatively on some individuals. If those individuals or special interest groups have clout, then political pressure enters into the decision formula.

Also, if we are going to enjoy our current lead position in international trade, we will have to learn to live with an acceptable level of risk or tolerance when it comes to non-native species. This will be a tough task, because the degree of risk an

individual will take in a value judgment can not be directly answered by the scientific method. We also need to learn how best to compare the benefits of non-native species with the risks of them becoming invasive.

While risk assessment is an effective tool for relating science to policy, risk assessment does not, and should not, replace the need for good scientific or other types of information, nor does it

replace the need for someone to make a decision. Even with a good risk assessment in hand, a tough problem can still generate a difficult decision-making process. Furthermore, when it comes to predicting which exotic species will establish and, for those that do so, which will cause unacceptable economic and/or environmental damage, we as risk assessors, scientists and stewards of our natural heritage, still have a long way to go.

NON-FEDERAL STAKEHOLDER PERSPECTIVES

Introduction

At the roundtable, we placed a special emphasis on the concerns, needs and opportunities from the perspectives of state and private stakeholders. Representatives from eight organizations including three trade groups, a commercial interest, an association of state governments, a regional commission and two non-governmental organizations representing environmental and conservation interests were asked to provide their perspectives. Although the perspectives presented may vary in some aspects, they all recognize that invasive species management is a major problem that needs attention. The expanded summaries of eight individual presentations follow:

American Nursery and Landscape Association

Craig J. Regelbrugge
Senior Director of Government Relations

The invasive species issue, broadly defined, is of growing significance and concern in the U.S. nursery industry. As background, the industry is considered by the U.S. Department of Agriculture (USDA) to be perhaps the fastest growing segment of agriculture. It now represents 11% of agricultural crop value at the farm gate, and at retail, the nursery and landscape industry is over a \$40 billion industry, not counting related supplies, materials and services. That makes us bigger than the motion picture industry! The industry has long

played a major role in improving crop and forestry production, the quality of the “built environment” and our quality of life. Increasingly, the industry is being looked to as the source of the plant material needed for environmental remediation, restoration and environmental enhancement.

The nursery industry is diverse in terms of business focus and geography. It has historically relied a good bit on plant introduction and plant improvement. In fact, the very fabric of our food, fiber, plant and animal agriculture is based on species introduction and improvement. The desire for the new and different, for tough and adaptable plants, is a cultural reality to which the commercial industry is trying to respond.

Along with the movement of people and products come pests, and the industry has long been concerned with the introduction of harmful plant pests. When new pests gain a foothold and become established, they nearly always pose production problems and trigger market-disrupting quarantines for plant producers. As a result, the nursery industry strongly supports coherent and effective measures to exclude, detect and eradicate invading plant pests of all types.

The American Nursery and Landscape Association (ANLA) was grateful for the opportunity to play a meaningful role in the development of last year's *Safeguarding American Plant Resources* stakeholder review of the pest safeguarding system that is overseen by USDA's Animal and Plant Health Inspection Service (APHIS). That review produced

a report that covers in detail a number of issues relevant to today's roundtable discussion. Those issues include the need for functional databases and database linkages to aid decision-making. International partnerships beyond what we have seen to date will be key. Countries such as Australia were found by the review team to be leaders in the plant protection field simply because they have succeeded at capturing and using information.

For the United States to succeed equally, functional federal/state relationships will be critical. More than ever, decision-making at all levels of government relative to invasive species will need to be science-based, transparent and sensitive to complementary roles. And it will be important that we collaborate closely with our North American neighbors, especially Canada, if we hope to have any meaningful success toward invasive species exclusion and management priorities. In the interest of time, I will encourage you to read the report in full, specifically the information needs and management recommendations.

The nursery industry is also well aware of the increasing concern over some intentional introductions that simply have done too well, becoming noxious in some instances. Some of these intentional but now harmful introductions occurred decades, even centuries ago. Some were brought in by government to serve specific purposes, some by commercial interests and some by interested amateurs and plant enthusiasts. Some have naturalized and become part of North America's flora, now recognized only by a few experts as so-called "aliens." A few have established and now severely disrupt or change the functioning of ecosystems.

Information Needs and Concerns. Regarding information issues, I wish to comment on the growing dialogue among the nursery industry and the related academic community regarding potential controls on intentional species introductions. Most, but not all, introductions in the commercial horticultural trade involve improved varieties of species that have been introduced many times in the past, generally with considerable benefit and without serious problems. Yet, there is growing agreement that some type of pre-introduction

screening – whether voluntary or regulatory – should occur for those new plant taxa being brought into North America for the first time.

A focus on screening truly new taxa proposed for introduction begs the question, "What is already here?" This is perhaps the most fundamental and unmet information need we face in the area of intentional plant introductions.

There are predictive models in various stages of development that show promise toward helping us exclude some of the potential worst actors. Are they perfect? No. Do they have a long way to go? Clearly. Meanwhile, the models should be communicated, tested and improved. The many pathways other than plant introduction by professionals also should be recognized. If the United States were to adopt a highly rigorous "guilty until proven innocent" standard, it would likely leave us with a false sense of security. New species will still find their way here, but the pathways will be more diffuse and difficult to target. It would accomplish little to target the trade only when entry pathways are more complex.

While discussing information and information management, the topic of lists must be raised. People love to create lists. We make lists every day – our to-do list, the grocery list, etc. Clearly, lists can empower – so long as the list creator and the list user fully understand the criteria and rigor that were applied and the intended use of the list. The same is true, of course, for databases. Unfortunately, in the arena of invasive plants, and especially managing existing problems, open discussions on list criteria and intended use often are given short shrift. So we are seeing a proliferation of lists leading to polarization and resulting political intervention in the invasive species management debate. One could say we are drowning in information and starving for wisdom.

There are bright spots – the states or localities that have encouraged outreach and education first, and reached some consensus on priorities and intended outcomes are the ones moving forward. From the nursery industry's standpoint, we have heard from two today – Florida and Colorado. Massachusetts is a third state where a robust dialogue is taking place. There are plenty of negative examples too.

From where we stand, the use of lists is a good vantage from which to understand the broader challenges and sensitivities associated with information collection, manipulation, sharing and use. Major lessons and observations so far include:

- There is a great need for education and outreach – both among the industry and to the consumer. Within the industry, we have found that common ground exists when an informed conversation about priorities and options occurs.
- Policymakers and resource managers would be wise to understand the industry dynamic relative to marketplace pressures and decision timelines. This is especially true where production phase-outs and shifts to alternatives are being encouraged.
- We have much to learn regarding how to respond in a coherent and science-based way, given the regional, indeed local, nature of the issue.
- There are tremendous unfulfilled research needs. The nursery industry is trying to address some of those research needs, and we have hope that certain useful plants viewed as invasive can be bred to address invasiveness concerns.
- More than ever before, invasive species priority-setting will require collaboration – international, federal, state and local; government, academia, industry and other interest groups must be involved.
- Decisions must be transparent, made with a sound science foundation, consider benefits and be practical about intended outcomes.

In closing, ANLA is pleased to be a part of this roundtable today and a player in the invasive species dialogue. We believe that this dialogue will help to frame and encourage appropriate responses to the invasive species issue that are compatible with the sustainable growth and health of the nursery industry for years to come.

American Seed Trade Association

Dean Urmston
Executive Vice President

The American Seed Trade Association (ASTA) has long recognized the need to identify, monitor and, when necessary, control or eradicate plant species that significantly adversely affect the environment, production agriculture, conservation efforts or otherwise cause harm to the economy, environment or human health. ASTA is concerned, however, that state or federal agencies may take or may already have taken ill-considered or otherwise inappropriate measures, including development of lists to control so-called invasive species. Such measures could significantly harm the distribution and use of many beneficial crops that have long been used in production agriculture.

It is the position of ASTA that the harm the species is likely to cause must far outweigh the economic and related losses that would be incurred by the seed industry and the public in general should an existing agricultural crop, turf, conservation or ornamental be considered “invasive” under the Executive Order No. 13112 (EO).

ASTA also understands that several states have in existence local plant councils or committees that are engaging a limited constituency in the discussion of invasive/alien plants. These state “listing” procedures appear both procedurally and substantively deficient. First, the listing process continues in most instances without input from all interested parties, including state seed control officials, ASTA and state and regional seed industry associations, Land-grant University Extension personnel, state plant material specialists, turf specialists or representatives from production agriculture. Second, the manner in which the state and local councils and committees are designating species indicates that they are failing to apply coherent, scientifically based criteria and may be ignoring the substantive law. In fact, in many instances, they seem to be simply amalgamating various lists, developed on the basis of widely varying criteria

ASTA is committed to cooperating with the National Invasive Species Council (NISC) and all interested state and federal government agencies through the provision of technical support, economic data and other means in addressing the legitimate challenges posed by invasive species. That process must include the application of

appropriate standards and take into account the full economic impact of a species' identification as "invasive." Failure to undertake this critical cost/benefit analysis will threaten the future availability of commercially useful species for farms, lawns, athletic fields and conservation areas.

ASTA supports efforts to protect our nation and its agricultural industry from harmful, invasive species and will cooperate with the NISC and interested state agencies in the development of management plans and other tools to protect against unreasonable adverse harm to the economy, environment, or human health. ASTA will oppose and challenge, however, any efforts to list as "invasive" – or otherwise jeopardize the legitimate use and viability of – species beneficial to agricultural crops, turf, conservation or ornamental purposes.

Capitolink, LLC

Thomas R. Hebert
Partner

Capitolink is a small government affairs consulting firm in Washington, D.C., and I am one of three people on the staff. I worked in the public sector from the late 1980s until two years ago, and throughout that time, I focused on agriculture, natural resource conservation and environmental issues. Two years ago, I left the federal government and joined the private sector. I am involved in this discussion today because of work I do with a company called SePro Corporation, which has interests in aquatic invasive plant management, in herbicide work, in developing biological control agents and in management of aquatic systems in general, using geographic information systems and related services.

As part of my work with SePro, I am involved with a group called the Invasive Weeds Awareness Coalition (IWAC) which some of you, I am sure, know about. IWAC is an informal group of non-governmental organizations that work here in town on invasive or noxious weed issues, private sector folks such as SePro and others involved in these activities. Some of the relevant federal agencies will drop in and visit with us, and we keep each other informed of activities and identifying proper

areas where we can support the activities of the federal agencies. Last year, it became apparent to IWAC that several events and opportunities were going to present themselves in February 2000 in Washington, D.C., to draw attention to the needs of invasive weeds management. We decided to try to facilitate all these opportunities and called it National Invasive Weeds Awareness Week (NIWAW). In our view and relative to our objectives, NIWAW went well, although improvements are most definitely possible.

As we prepared for NIWAW and for all of the people who were coming to town to meet with Congressional staff to discuss these issues, we all started to think about the messages we would be using with Congress. My own area of focus was on aquatic invasive plants. One of my goals was to be able to put before Congress a solid, factual and credible case for why more funding is needed to manage them. IWAC as a whole wanted that kind of message for all invasive weed species to be available to educate Congress.

When educating Congress, your job is to develop as clear a picture of the problem and needs as possible. And then you try to demonstrate that if monies are made available, there is a good and effective plan of action for dealing with the problem and meeting the needs. The need for a clearer, more definitive picture in many ways boils down to an issue of databases, one of the major subjects for today's roundtable.

As a practitioner trying to educate members of Congress, my view is that there are excellent databases with a lot of great information, but as education tools, they fall short of what we really need. This is not a criticism. People have worked hard to pull together the considerable amounts of data that are available, and the results are impressive and useful. I just think we need more.

That being said, in that context and relative to aquatic invasive plants, in preparation for NIWAW, I worked with a few people, and we were able to assemble a respectable and effective package of information that would matter to members of Congress. We used the U.S. Geological Survey's (USGS) Non-indigenous Aquatic Species Database, APHIS's National Agricultural Pest Information System, Natural Resource Conservation Service's

Plants Database and Biota of North America Program. We supplemented those with maps and descriptive information from a few key states from around the country, provided by aquatic invasive plant program managers in those states. The assembled package was a respectable presentation about the nature and extent of aquatic invasive plant problems in the country.

When working with Congress you often can find that it is not enough to provide a picture of the problem, the needs and a good plan of action. You also will need respectable political constituencies who are willing to go to bat for you. And you find that to a certain extent, deficiencies in one area (i.e., incomplete depiction of problem and need) can be made up with strength in the second area (i.e., motivated and respected political constituencies), and vice versa. I have found over the years that you can make up for lack of good analytical work with good political constituencies – and the inverse is true.

There are limits to how far this substitution can go, and there is no beating having both of these elements in top form – great information and great political support. But the point is that your information does not have to be perfect to be effective in Congress or other centers of decision-making. The world is imperfect and filled with uncertainty, and decision-makers are used to making decisions with imperfect and uncertain information.

In the case of aquatic invasive plants and NIWAW, we have had pretty good luck in getting people's attention on the aquatic invasive plant side. People are willing to talk to us, in part because we had a respectable presentation about the nature and extent of the problem, and we had a respectable set of political constituents there at the same time. We have made a little bit of progress in this area as a result.

But we can do better, and I believe a key to success will be better database tools. We need better and more accessible information on where the infestations are occurring, what their consequences are, both ecologically and economically, and why they should matter to somebody in Congress. We have to be able to demonstrate why it matters to the people that vote for members of Congress. All politics are local.

My second point is the following. I was at USDA for several years and acted as its representative on the Federal Geographic Data Committee for that time. One of the things that I learned in that process is that when it comes to the federal agencies that play an active and direct role in the management of land, it is extremely difficult for them to make their data and data systems inter-operable. These agencies have so much at stake in the data that they generate and pull together. Each of their missions differ, and the political constituencies that support their funding are different. As a result, it can be very hard or impossible to have these agencies generate a seamless, inter-operable data system.

The clear exceptions to this problem are the agencies that are dedicated to doing data work. USGS and others provide examples. But for their data sets to be as valuable as possible, they need to have access to all the valuable information that all these other action agencies are pulling together. My observation is that there will never be enough incentives for the action agencies to do it on their own and to come together. It is tough enough within agencies to do it on their own, let alone cross agency lines. That being said, the efforts on inter-operability are fantastic, and we need some real gains.

My point is that I believe you have to find a way to pull the private sector into this data management issue. You have to find people who believe that they can make money from inter-operable databases to help the public sector do this work and help build the bridge between the action agencies who are pulling data together, and the private sector folks. So, I ask those of you who are working on these matters to be aware of that as we do our work.

Western Governors' Association

Paul E. Gertler

Natural Resources Consultant

The Western Governors' Association (WGA) is a non-partisan association of 18 western states and three Pacific flag islands. WGA became involved in the invasive species issue as a result of a resolution passed in June 1998 that called for the association to try to develop strategies to deal with inva-

sive species. A working group with diverse representation was established to recommend a focus where the Western Governors' invasive species program could be most productive. Ultimately, the working group recommended that the Western Governors focus on building capacity within the western states at all levels – federal, state, local and private.

As we move toward building capacity, a number of different issues come to mind that may be valuable for us to consider. Most are directly related to data collection, access and use. However, I'll start with two concerns that are not data-related. First is the need to take a holistic approach that we not divide into different groups with different areas of interest or specialization. Although there may be value when discussing scientific, technical and strategic issues to focus those discussions on specific areas of expertise (i.e., terrestrial and aquatic), it is critical for the invasive species community to stand together when pursuing political and financial support. I think it is essential to maintain a consolidated front on the massive issue of invasive species when dealing with policymakers and appropriators.

Second is the value of steering our efforts to the middle. Right now, because we are steering to the middle, we have a broad consensus among a diverse set of interests on important priorities in dealing with invasive species. There are some outlying issues, some of which are legitimate invasive species issues, but are so divisive that they could seriously impede our ability to make significant progress. This does not mean that they should not be dealt with later. As we build trust and as we build successes, we can start dealing with some of the more difficult issues. But we must now take advantage of the existing broad consensus on the wide middle of this issue.

Now, I'd like to touch on six issues related to data. First, I think there is an urgent need to assess and document efforts currently being conducted by the numerous governmental and non-governmental entities. We need to know who is doing what with which resources, what money is available and what is being spent so that we can go to policymakers, decision-makers and appropriators and responsibly identify what is being done, what is not being done, where the gaps are and what are the highest priorities.

Second, we must be mindful of the credibility of the data that we use, especially when we are talking to the public or seeking support from those who are not necessarily intimately aware of everything we are doing. Is it possible that some of us are batting around figures that may not stand up to scientific scrutiny? Our continued credibility requires us to be cautious and prudent about the way that we use information.

Third is the issue of the availability of data and how to make it accessible and useful. A corollary to this issue is the need to consider quality assurance and quality control (QA/QC) of these data. People who use these data need to understand the QA/QC that apply to different data sets.

Fourth is the need to be cautious about developing centralized databases. Perhaps, it might be more efficient to take a different approach. There are always going to be databases that have many different uses. It might be more effective and efficient to focus on developing specific standards and criteria by which data are gathered and put into databases rather than trying to create large centralized databases that tend to be expensive to create and maintain, take a long time to develop and are often outdated as soon as they are completed.

Fifth is the need to strike a balance between the resources expended on data collection, management, access and use with the need to take on-the-ground action. Total funding for invasive species work is limited and likely to remain so. With this in mind, we must find a balance between addressing data needs and taking on-the-ground action.

Finally, there is the need to ensure that the level of data gathered and stored in databases is commensurate with the use they will be put to. For example, when dealing with national issues, the level of information will be general and broad. In contrast, the information will need to be more detailed and specific when dealing with local issues such as noxious weed control on a specific land area.

I believe that if we carefully consider these issues and continue meaningful dialogue about how information is to be used, we will be "steered to the middle," and that together we can muster the resources needed to have a major impact on the invasive species problem.

Pet Industry Joint Advisory Committee

N. Marshall Meyers

Executive Vice President and General Counsel

The Pet Industry Joint Advisory Council (PIJAC), the largest pet industry trade association, has a long history of involvement with invasive species issues, dating more than 30 years. PIJAC's representation is limited only to issues involving live organisms. These involve acquisition, import/export, interstate movement, sale and possession of companion pets, including aquatic organisms. These run from puppies to live rock. Virtually every pet that we own in this country is technically an "alien," some of which are invasive and prohibited, others that have possession restricted where their impact is detrimental to local ecosystems.

The pet industry's concern is traceable to an attempt by the U.S. Fish and Wildlife Service in the early 1970s to adopt regulations banning all imports of non-native species until proven innocent. The pet industry would have been compelled to prove on a species-by-species basis that the importation would not be harmful to the environment, agriculture, other wildlife or humans. Once proving the "negative," importation might be approved. Needless to say, these regulations were not adopted.

Over the course of a year, PIJAC monitors more than 10,000 proposed laws and regulations that affect the \$23 billion pet industry. Sixty-one percent of U.S. households own and care for thousands of different species. Pets are an integral part of American society. So, we must keep that in perspective in determining how we are going to have an overarching regulatory system to try to deal with the invasive species issue. It is a complex and sometimes highly emotional issue.

The pet industry historically has been dependent on non-native species and recognizes its responsibility to avoid introducing harmful invasive species. Over the years, the industry has worked with state governments in regulating, and sometimes prohibiting, the importation, sale and/or possession of certain species that have been

demonstrated to be harmful invasives. The industry is opposed to wholesale, nationwide bans absent clear demonstration that a species is, in fact, harmful on a nationwide basis. On the other hand, the pet industry has supported a myriad of listings, restrictions and regulatory mechanisms to minimize adverse impacts.

With that brief background, I will address several concerns regarding this highly complex issue.

First, and of major concern – decision-making based on inadequate or incorrect science or simply for political expediency. Simplicity – ban until proven innocent – really does not work. You cannot sell it to the public; you cannot sell it to industry.

Second concern – reliance on research conducted for other purposes, but now being interpreted to infer invasiveness.

Third concern – lack of basic criteria or research protocol(s) for ascertaining invasiveness. What attributes indicate or predict invasiveness? What criteria or standards should be employed to measure impacts or aid in determining whether a specific invasive alien is harmful and therefore should be prohibited, controlled or eradicated?

Fourth concern – quality of data. Significant data gaps exist, particularly with respect to the biology of many species, the vulnerability of receptive habitats, etc.

Fifth concern – databases. Reliance upon databases, absent thorough investigation and analysis, will lead to ill-conceived listings and bad decision-making. While databases have their place, they can be easily misused by shortcutting the process. Simplistic or user-friendly databases on the Internet are not necessarily a virtue. They can lead to misinformation, disinformation or misinterpretations. We must avoid the apt characterization a few moments ago of "garbage in and gospel out." Something needs to be done to ensure credibility of the data being utilized by the risk assessment assessors, decision-makers and policymakers.

I am intrigued when I review on-line Internet surveys where one can enter sites with little to no verification. Specimens of a species reportedly

spotted and identified in a single pond are recorded as “introduced,” possibly “established,” and the entire state is marked “red” on a national database map. Databases replete with references to articles or reports generated for other purposes than invasiveness are relied upon to justify a listing as an invasive. Scientific scrutiny and scientific-based decision-making is made of sterner stuff. Work needs to be done to establish standards to qualify information in databases and to provide warning about the data gaps or other inadequacies in the databases. QA/QC needs to be an integral part of the emerging database industry – we need some form of codes or flags to indicate the relevancy of the plethora of data in these databases.

Sixth concern – lack of standardized terminology. A cursory review of the history of federal and state regulation of invasive species depicts conflicting and sometimes contradictory terminology. What is meant by the term “introduced?” Is it restricted to imports into the United States, interstate commerce, translocations outside the natural range or placement into an ecosystem? Does the term “invasive” automatically mean harmful, or are some invasives acceptable if the impact is minimal or possibly beneficial? Are terms of art applicable equally to fauna and flora? We believe that we need to standardize terminology and create a glossary of terms.

Seventh concern – credibility of risk assessments. The credibility of the risk assessment process is dependent upon (1) standardized processes, (2) relevant and reliable data, including qualified anecdotal information, (3) clear explanation of uncertainties – what is not known, (4) stakeholder involvement at all stages, (5) assessors and regulators being independent, (6) flexibility and (7) transparency. The Aquatic Nuisance Species Task Force’s *Generic Non-indigenous Aquatic Organisms Risk Analysis Review Process*, (October 21, 1996) is being used by a number of states for aquatic and non-aquatic species. This process provides a template for conducting comprehensive and comprehensible assessments.

Eighth concern – “precautionary principle.” This term of art has multiple meanings and applications, depending upon the arena in which it is being utilized. Reliance upon the philosophy of

“when in doubt, keep it out” is not realistic in a global community in which trade is an integral part of our activities. Thus, my precautionary principle is avoid – prevent going down a path that the public cannot buy into and industry cannot accept. All we will achieve is unresolvable confrontation and we will not deal with the real issues of trying to figure out how to control those invasive species causing real harm.

Ninth and final concern – regulatory mechanisms. Databases must be pragmatic, affordable, effective and implementable. And we cannot do it, in my opinion, only at the federal level. Most of the control and regulation is at the state level. The states cannot be ignored or excluded. One must look at what has happened in Florida, Arizona, California, Wisconsin and Colorado over the last couple years – they work with stakeholders; they conduct risk assessments applicable to their ecosystems; they prepare and implement a variety of management plans. Partnering with the states is essential; preemption will result in inappropriate and bad regulation.

So what are a few of the opportunities? From the standpoint of the pet industry, we need to enhance public awareness mainly through education. We can pass all the laws and rules we want, but possession of a lot of these critters will go underground if we are not careful. Industry educational efforts on how to handle unwanted pets and fish needs to be expanded. PIJAC’s disease education initiative, such as a collaborative poster with the Centers for Disease Control and Prevention on reptile-associated *Salmonella*, needs to be expanded. PIJAC is currently exploring ways to encourage owners of unwanted aliens to surrender those animals to PIJAC-member stores rather than release them into the environment. We need to work with other stakeholders on how such initiatives can be implemented.

What are some of the needs? Recognition of the economic importance of the pet industry in general and the important role alien species play in our society. Most importantly, we must recognize that the 50 states, as others have indicated today, are at the ground level where regulation is most effective. Collaboration and dialogue should not be minimized.

In closing, PIJAC remains committed to seeking more effective ways to minimize adverse impacts from species in our trade. We support collaborative efforts that involve all relevant stakeholders and processes that include methods for ascertaining the economic and other benefits resulting from ownership of live animals and plants.

Great Lakes Commission

Kathe Glassner-Shwayder

Environmental Policy Analyst/Project Manager

As a representative of the Great Lakes Commission and the Great Lakes Panel on Aquatic Nuisance Species, I will be sharing a brief assessment of aquatic nuisance species (ANS) prevention and control issues evolving in the Great Lakes region.

As we look at needs and opportunities in regard to prevention and control in the Great Lakes, we need to take a glimpse at the hydrology and socio-economic characteristics of systems where ANS problems are emerging. The following facts and figures about the Great Lakes Basin are presented to help put the magnitude of the prevention and control challenge into perspective.

Close to 100,000 square miles of fresh surface water are found in the Great Lakes system; that is 90% of the U.S. supply and one-fifth of the world's supply. Twenty-five million of the Basin's 40 million residents rely on the lakes for their drinking water. And the economic significance of this resource is staggering. Manufacturing, tourism, recreation, sport fishing and maritime transportation are all multi-billion dollar industries. The Great Lakes system is, in many ways, "Grand Central Station" for ANS as the system links global transportation routes with the interior of the United States. Thus, prevention and control is an imperative – not only for our ecological and economic well-being – but for many other freshwater systems potentially impacted by Great Lakes infestations.

We in the Great Lakes Basin have documented the arrival of approximately 145 aquatic nuisance species since the early 1800s. Over a third have been introduced in just the last three to four decades, with maritime transportation as a lead-

ing vector. About 10% of those species – such as the sea lamprey, zebra mussel, ruffe, round goby, purple loosestrife and watermilfoil – have proven to be problematic. The ecological and economic impacts of such species are increasingly well documented; we find they're proving to be substantial and, in some cases, staggering.

Enactment of the federal Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990 was due largely to the unintentional introduction of the zebra mussel in the Great Lakes and the subsequent economic and ecological impacts. The 1996 National Invasive Species Act reauthorized the original legislation and expanded its national scope.

The Great Lakes Panel on Aquatic Nuisance Species was convened in late 1991 with the following primary responsibilities for the Great Lakes region:

- To identify priorities for the Great Lakes with respect to ANS
- To make recommendations to the Aquatic Nuisance Species Task Force regarding programs to carry out a zebra mussel demonstration program
- To assist the Task Force in coordinating ANS program activities in the Great Lakes
- To provide advice to public and private individuals
- To submit annually a report to the Task Force describing activities within the Great Lakes related to ANS research, prevention and control.

The wide range of membership of the Panel has been established to ensure that its policy positions provide a balanced and regional perspective on ANS issues in the Great Lakes region. Through its diverse membership, the Panel is able to provide a healthy forum for discussion, consensus-building, coordination and action among relevant Great Lakes user groups from public and private sectors both in the United States and Canada.

The inter-jurisdictional, regional approach to prevention and control is strongly promoted by the operation of the Great Lakes Panel, which is staffed by the Great Lakes Commission, an interstate compact agency. In brief, the objective is to

instill a sense of ownership by participating agencies, build upon and showcase their successes, operate by consensus, provide a coordination/catalyst/convenor function and serve as a single regional voice to elected leaders and other policy-makers.

The Panel is led by elected officers and meets regularly to establish priorities, cultivate partnerships and explore an array of funding opportunities to address our priorities. The following list of selected Panel initiatives illustrates where this regional entity has focused efforts in the past decade regarding ANS prevention and control:

- Model comprehensive state management plan on ANS prevention and control
- Model guidance on legislation, regulation and policy for ANS prevention and control in the Great Lakes region
- Aquatic invaders television special
- Ballast water management symposium
- ANS action plan
- Legislative and appropriations priorities
- Biological invasions brochure
- ANS update newsletter
- Information/education strategy
- Information/education inventory
- Research inventory

In conclusion, I would like to leave you with the following questions that encapsulate priorities regarding unmet needs and opportunities that emerged from a recent workshop of Panel membership and other stakeholders:

- What action can be taken to more effectively prevent future ANS introduction and dispersal?
- How can ANS management programs be designed to effectively control established populations?
- How can detection and monitoring programs be strengthened to facilitate a more proactive approach to ANS prevention and control?
- How can information/education programs and associated stakeholders function to raise the profile on ANS issues with the goal of promoting action on prevention and control?
- What measures can be taken to strengthen multi-jurisdictional coordination critical to preventing ANS introduction and dispersal on an ecosystem level?

The Nature Conservancy and Association for Biodiversity Information

John Randall

Wildlife Invasive Species Program, The Nature Conservancy

Nancy Benton

Botanical Research Associate, Association for Biodiversity Information

The Nature Conservancy. An invasion is underway that is undermining our nation's economy and endangering our most precious natural treasures. The intruders are alien species – non-native plants and animals introduced into this country either intentionally or by accident. Attention to the problem of alien, or exotic, species often centers on their costs to agriculture, ranching, forestry and industry. The price they exact from the nation's forests, grasslands and waterways, however, is at least as great. Unfortunately, many alien species are proliferating unfettered, causing severe environmental or economic damage.

The Nature Conservancy (TNC) is particularly concerned about invasive species because they are a major threat to its mission of protecting the organisms that make up the diversity of life on Earth by protecting the lands and waters they need to survive. TNC is one of the largest non-profit conservation organizations in the world and is active in North America, South America and the Pacific Basin. At present, TNC owns and manages more than 1,300 preserves scattered across the United States. TNC carries out invasive species control programs on its preserves and works to promote the prevention and control of invaders that threaten biological diversity on its property and elsewhere. When TNC stewards from around the nation were surveyed in 1992, 1995 and 1998, 48 states reported invasive plant problems and about 60% ranked invasive plants among their top-ten conservation concerns in each survey. Over 12% ranked invasive plants as the greatest conservation challenge they face. And higher percentages would have been obtained if questions about invasive animals had been included in the survey. Federal and state land-managing and conservation agencies also report severe problems with invasive species. When U.S. National Park superintend-

ents were surveyed, 61% of the 246 respondents indicated that non-native plants were a moderate or major problem. The area of U.S. Bureau of Land Management lands infested with weeds increased from an estimated 2.5 million acres in 1985 to roughly 6 million acres in 1991 and an estimated 8.5 million acres in 1994. These estimates indicate a 14% annual increase in area infested. Animal invaders (vertebrate and invertebrate) are similarly widespread and, in some cases, cause more severe damage.

Role of TNC in Invasive Plant Control. Weed control programs are now in place on TNC preserves across the United States, employing techniques ranging from manual removal, mechanical methods, prescribed fire, judicious use of herbicides, the release of biological control agents and encouragement of native competitors. The most successful endeavors follow an adaptive management strategy in which plans based on the goals of the preserve are developed, weeds that interfere with those goals are identified and prioritized, and control measures are selected and implemented where appropriate. Emphasis is placed on preventing new weeds from becoming established and on early detection and elimination of incipient infestations. Managers must focus on the vegetation or community to take place of the weeds and periodically re-evaluate whether their programs are moving them toward this objective.

TNC works with public and private partners who share concerns about invasive species, including federal, state and local land management agencies and agriculture departments, ranchers, farmers, nursery growers and other agricultural interests and other conservation organizations.

TNC also works with private industries and organizations to prevent the entry of new weeds and to control existing problems. For example, we are working with nursery industry representatives to develop protocols to screen newly introduced species for potential to become invasive. If adopted, potential invaders that are identified by the protocol would not be introduced or distributed. We are also working with U.S. and Canadian arboreta and botanical gardens to develop similar

protocols for these institutions. Such protocols will not stop all new pests from entering but every pest species we prevent will avoid tremendous additional biodiversity losses and save large sums of money and time in the future.

The Need for Invasive Species Databases.

Documenting current invasions and preventing new invasions are vital to the protection of biological diversity. Data on non-native invasive species present in the United States are incomplete, and data that are available are scattered in a variety of published and unpublished accounts and databases. This makes it difficult or impossible for land managers to identify, much less properly manage invasive species on their lands. In addition, the lack of data makes it more difficult to prevent invasions by new species into areas in which they have not yet been introduced because access to information on their previous invasive ability is mostly unavailable. Studies have shown that the best predictor of whether a new species will become invasive is whether it has invaded elsewhere. We see development of a network of invasive species databases as crucial to our ability to manage existing invasions, to halt or slow their spread and to prevent new invasions. Prevention, early detection, containment and eradication will be most possible if other nations also develop invasive species databases, and so we seek ways to make this happen, too. Only a network of invasive species databases from many nations will contain the information needed to make such predictions and hence prohibit entry of species with high potential to invade. It is our hope that these databases also will contain information on how to control pest species, since this may be crucial to efforts to quickly eradicate or contain them if they are first discovered in a new area. Eradication and containment are most possible and cost-effective for species that have just been detected and whose populations are still small.

Other groups concerned with biodiversity protection also see construction and maintenance of invasive species databases as crucial. For example, the IUCN (World Conservation Union, formerly International Union for the Conservation of Nature and Natural Resources) Invasive Species Specialist

Group's first priority is developing a network of invasive species databases.

Association for Biodiversity Information. Since 1980, TNC, in partnership with the Natural Heritage Network, has maintained data on classification, distribution and status of thousands of non-native species – as well as many thousands of native species – in its central scientific databases. The Association for Biodiversity Information (ABI) is a new nonprofit organization that was formed in July 1999 when TNC and the Heritage Network jointly established an independent institution to achieve their mutual goal of advancing the application of biodiversity information to conservation. ABI's mission is to manage and distribute authoritative information about the world's plants, animals and ecological communities. Working in partnership with 85 independent Natural Heritage programs and Conservation Data Centres that gather scientific information on species and communities, ABI has aggregated into a single data set key biological data for more than 50,000 plants, animals and ecological communities of the United States and Canada.

Heritage and ABI staff adhere to rigorous data collection, management and quality control standards that allow data to be compared and combined across the network of databases. The Heritage network is best known for its work in maintaining locational information on rare species and in ranking native species based on their conservation priority.

Just like we need to rank native species to prioritize conservation efforts, we believe there is a critical need to review non-native species to determine which are priorities for early detection and management, as well as to determine which species land managers do not need to worry much about. For the past few years, the Conservancy and ABI have worked together to create an invasiveness priority assessment system to classify non-native species into various categories of invasiveness. We are currently seeking ways to fund and expand this effort and incorporate these rankings of invasiveness into the Heritage databases.

American Land Alliance

Faith T. Campbell
Invasive Species Program

American Lands Alliance is a 501(c)(3) environmental organization focused on protecting and restoring forests, grasslands and aquatic and other ecosystems. We accomplish our mission by strengthening grassroots conservation networks, helping to provide advocacy services and improve communication and coordination among these groups and other societal institutions. I have represented American Lands on invasive species issues since 1997; previously, I represented other environmental organizations on invasive species policy issues.

Our goal is to stimulate more effective programs to curtail introductions and minimize the damage caused by invasive alien species, with a focus on “plant pests” and invasive plants. We see increasing public awareness, support and pressure as crucial to needed improvements. For this reason, we welcome today's information about the growing network of publicly accessible data on bio-invasion. And we endorse the call that these and other databases be both accessible and complete. Political considerations must not be allowed to determine which species are contained in such databases.

We would like to highlight several additional concerns about invasive species information. First, while several non-governmental sources can provide valuable information about established species – and are doing so for at least some groups of invaders – only the government can provide data on what species are coming in on which pathways. And this information is crucial to developing priorities for pathway-closing programs (whether voluntary or regulatory) and in assessing the effectiveness of these programs. As a previous speaker indicated, current “interception” data maintained by APHIS fall far short of the needed standard. It is vitally important to obtain statistically valid sampling data that cover all pathways in proportion to the true “size” of the pathway, and that include all species found there.

Second, information programs – taken together – must have sufficient breadth. I note the absence of forest pest experts from this workshop and my general sense that they are poorly represented in the entire process under the EO. American forests have suffered severe damage as a result of introduced species, and they are at high risk of additional introductions. Leaders of the various projects that seek to implement the EO need to make efforts to include people knowledgeable about and concerned about forest pests, as well as any other “orphan” groups.

Another aspect of “breadth” concerns invasive plants. Hundreds of species of plants shown to be

invasive in natural systems are not included on any federal or state “noxious weed” list – nor are they likely to be in the future. Nevertheless, they are part of the phenomenon being addressed here. These species need to be included in databases and other information sources; they need to be the subject of research; they need to be managed.

Thank you for the opportunity to express one environmental organization’s perspective on invasive species information issues. American Lands looks forward to working with a wide array of stakeholders on solving the many challenges bio-invasion present.

ENVIRONMENTAL AND ECONOMIC COSTS

David Pimentel

Professor of Ecology and Agricultural Science, Cornell University

In the history of the United States, according to our estimates, approximately 50,000 non-indigenous (non-native) species have been introduced into the country. This number includes 25,000 plants, 20 mammals, 97 birds, 53 reptiles and amphibians, 138 fish, 4,500 arthropods, 88 mollusks and 20,000 microbes. Earlier estimates by the Office of Technology Assessment indicated that at least 4,500 species of foreign origin have established free living populations in this country. A more recent estimate by the U.S. Geological Survey indicates that the number now exceeds 7,000.

Introduced species, such as corn, wheat, rice and other crops, cattle, poultry and other livestock, now make up more than 98% of the U.S. food system at a value of approximately \$800 billion per year. Other exotic species have been introduced for landscape restoration, biological pest control, sport, pets and food processing. Some non-indigenous species, however, have caused major economic losses in agriculture, forestry and several other segments of the U.S. economy, in addition to harming the environment. The invading non-indigenous species cause major environmental damage and losses adding up to more than \$137

billion per year. About 42% of the species on the threatened or endangered species lists are at risk primarily because of non-indigenous species.

Estimating the full extent of the environmental damage and the number of species extinctions caused by exotic species is difficult because little is known about the estimated 750,000 species in the United States, half of which have not even been described. Nonetheless, about 400 of the 958 species that are listed as threatened or endangered under the Endangered Species Act are considered to be at risk primarily because of competition with and predation by non-indigenous species. In other regions of the world, as many as 80% of endangered species are threatened due to the pressures of non-native species. Many other species not on the list are also negatively affected by alien species and/or the ecosystem changes they cause.

Estimating the economic impacts associated with non-indigenous species in the United States is also difficult; nevertheless, enough data are available to quantify some of the impacts on agriculture, forestry and public health. We have assessed as much as possible the magnitude of the environ-

mental impacts and economic costs associated with the diverse non-indigenous species that have become established within the United States. Although species translocated within the United States also can have significant impacts, this assessment is limited to non-indigenous species

that did not originate within the United States or its territories. A detailed report upon which this presentation is based is available on the Internet at http://www.news.cornell.edu/releases/Jan99/species_costs.html.

THE INTERNATIONAL TRADE CONTEXT

John K. Greifer

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At a global level, several international institutions feature as their primary purpose the exchange of pest, disease and other quarantine related information among its members. The International Plant Protection Convention (IPPC) (<http://www.fao.org/waicent/FaoInfo/Agricult/AGP/AGPP/PQ/Default.htm>) and Office International des Epizooties (OIE) (<http://www.oie.int/home.htm>) are two prime examples of international institutions that have evolved to meet the need among countries to share information related to pest and disease issues, particularly as it relates to the movement of people and commodities.

The driving issue that has brought quarantine officials together at the IPPC and OIE has been the dual interest in preventing pest spread and doing this in a fashion that does not unnecessarily interfere in commerce between countries. In this regard, these international organizations have maintained and promoted since their inception the concept that regulatory actions that affect other countries have a technical justification and rationale.

About the IPPC and OIE

The IPPC and OIE each have a membership of more than 110 countries. The IPPC was established in 1952 and the OIE dates back to the 1920s. As previously indicated, the IPPC and OIE share the common purpose of promoting international cooperation in the prevention of pest and disease spread. The IPPC is strictly focused on plant pests while the OIE is focused on animal disease risks.

The Agreement on Application of Sanitary and Phytosanitary Measures (SPS Agreement), which went into effect in 1995 as part of the broader package of trade agreements in the Uruguay Round, recognizes the international standards developed under the IPPC and OIE. The SPS Agreement encourages, but does not require, countries to base their phytosanitary measures on standards developed by IPPC (OIE for animal health and Codex Alimentarius for food safety standards). The purpose for these provisions in a trade agreement, like the SPS Agreement, is to promote harmonization of health measures between countries and thereby make the trade system more predictable and stable.

While the IPPC, OIE and Codex standard-setting functions have become more visible as a result of the World Trade Organization Agreement, we know less about these institutions information-sharing functions.

Information-Sharing Aspects

The IPPC contains several provisions regarding specific kinds of information to be exchanged between members, including pest reporting, pest listing, notifications of non-compliance, phytosanitary measures and pest status.

Pest Reporting Members are required to inform each other about the occurrence or outbreak of pests within their territories that may pose a potential threat to other members. A working group met in September 2000 to develop standard

procedures for such reporting. (Member-to-member process).

Pest Listing. Members are required to establish and keep up-to-date lists of regulated pests. The purpose is to keep other members informed of which pests are subject to phytosanitary requirements and to help facilitate phytosanitary certification for exports. A working group met in January 2000 to develop a standard format for such lists. (Members submit to Secretariat, and Secretariat distributes to other members).

Notifications of Non-Compliance. Under the Convention, members are obligated to notify exporting members of incidents of non-compliance of imported shipments (e.g., phytosanitary certification deficiencies and pest interceptions). A working group met in December 1999 to develop a standard approach for these kinds of notifications. (Member-to-member process).

Phytosanitary Measures. The IPPC requires members to share copies of new or amended phytosanitary legislation or regulations to other members who may be affected. This includes providing on request the rationale for these new or amended phytosanitary measures. (Member-to-member responsibility).

Pest Status. The Convention requires members to conduct surveillance and maintain information regarding pests within their territories. This is intended to support pest categorization, pest reporting and the development of appropriate phytosanitary measures. A standard currently exists (ISPM #8 – Determination of Pest Status in an Area) that emphasizes good reporting practices.

The newly revised text of the IPPC (amended in 1997) requires members to establish official contacts. Generally, the chief plant protection officer at the national level is the official contact for IPPC purposes. The intent of establishing a system of official contacts is to facilitate the exchange of information directly between members. These are critical for making it easier to communicate on urgent issues related to export certification, pest issues and other phytosanitary matters.

The Secretariat also plays a vital role in helping distribute information to members (e.g., maintaining IPPC web site, distributing hard copy reports, etc.) as well as guiding individual members to useful information sources.

Future Direction

IPPC members have a number of goals with regard to improving its information-sharing activities. These include:

- Promoting increased access and use of electronic communications and the Internet
- Promoting assistance to regional plant protection organizations in the information technology area
- Developing a clearinghouse mechanism for members to deposit completed pest risk analyses, bilateral agreements, current research and other information
- Finalizing standardized procedures for sharing different types of information as called for in the Convention

Final Comments

The IPPC provides a venue for ongoing discussion of emerging pest issues. Members are free to bring issues of possible global interest to the attention of other IPPC members and recommend possible areas of cooperation.

As an example, the U.S., Mexico and Canada raised a question about the need for an international standard on wood-packing material, given our increasing concern with pests associated with dunnage. Building on work we did at the regional level, we then went to the annual session (1999) of the Interim Commission on Phytosanitary Measures (ICPM) and were successful in obtaining ICPM agreement that this was a priority quarantine issue. Furthermore, the commission agreed that a global standard, based on our regional standard, needed to be developed as rapidly as possible. The result was international consensus to begin developing a global wood-packing standard this year.

These institutions operate on the basis of consensus. While the United States has an excellent opportunity to provide leadership in these organi-

zations, due to our rich scientific resources, we need to be mindful that our effectiveness in getting international cooperation on pest and disease issues depends on our actual and perceived behavior as a partner.

Finally, access to current information regarding IPPC and OIE activities and standards is available through several channels. First, the Animal and Plant Health Inspection Service (APHIS) publishes an annual *Federal Register Notice* in June/July that

describes the current activities within these organizations. That notice seeks comments on IPPC and OIE activities, but, more importantly, provides contact names and web site addresses for those interested in more detailed information. Second, APHIS recently created a special web site where it posts draft standards (IPPC) for public comment. Lastly, information is always available directly from the OIE and IPPC through their web sites.

OBSERVATIONS, NEEDS AND SUGGESTED ACTIONS

Observations

The following observations come primarily from presentations and discussions at the roundtable, but were, in some cases, augmented by the editors and steering committee members who were involved with the deliberations of the program advisory committee and the technical database work session. The database session, held immediately after the roundtable, attracted 30 individuals, most of whom also attended the roundtable.

Federal Perspectives. Policy officials from both the U.S. Departments of Agriculture and Interior encouraged stakeholder groups to participate in developing a strategy for the exchange of information and the development of partnerships. Presentations by the federal officials provided strong evidence that invasive species are receiving a lot of attention throughout the federal government. However, a strategy for coordinating federal activities, now involving more than 20 agencies, was not clearly evident from those presentations.

Computerized Databases. Three case studies involving computerized databases provided a diverse perspective of the kinds of databases being developed. One or more of those databases were recognized as useful by state and private stakeholders. However, some stakeholders, particularly those representing commercial interests, were anxious to learn more about how databases were to be used before enthusiastically supporting further development. The diversity in approach

and use of the databases made it clear that there is a need for an overall strategy in defining purpose and use in databases so that stakeholders can clearly understand their value.

Processes for Using Information. Three case studies involving processes for restricting the spread of invasive species provided useful examples of how due process can be used to get broad-based input into both voluntary and regulatory actions. One case study was particularly unique – a process was used to obtain broad-based input into actions designed to voluntarily discourage the marketing of invasive ornamental plants. Stakeholders representing commercial interests urged continued emphasis on due process in designating invasive species as targets for action.

Non-Federal Stakeholder Perspectives. Invasive species initiatives need to be implemented in a balanced way so that practical preventative measures occur only after informed decisions. Some sectors, such as the agriculture, forestry, nursery, seed and pet industries, feel that they may be asked to bear the brunt of the costs for implementing initiatives. Those concerns were reflected in the following quotes from stakeholder presentations:

“the nursery industry strongly supports coherent and effective measures to exclude, detect and eradicate invading plant pests of all types.”
(from p. 33)

“So we are seeing a proliferation of lists leading to polarization and resulting political intervention in the invasive species management debate. One could say we are drowning in information and starving for wisdom.” (from p. 34)

“(the seed industry) supports efforts to protect our nation and its agricultural industry from harmful, invasive species and will cooperate with the (National Invasive Species Council) and interested state agencies” (from p. 36)

“(the seed industry) will oppose and challenge, however, any efforts to list as ‘invasive’ – or otherwise jeopardize the legitimate use and viability of – species beneficial to agricultural crops, or when used for turf, conservation or ornamental purposes.” (from p. 36)

“Simplicity – ban until proven innocent – really does not work. You cannot sell it to the public; you cannot sell it to industry.” (from p. 39)

“Simplistic or user-friendly databases on the Internet are not necessarily a virtue. They can lead to misinformation, disinformation or misinterpretations.” (from p. 39)

“regulatory mechanisms. Databases must be pragmatic, affordable, effective and implementable. And we cannot do it, in my opinion, only at the federal level. Most of the control and regulation is at the state level. The states cannot be ignored or excluded. One must look at what has happened in Florida, Arizona, California, Wisconsin and Colorado over the last couple years – they work with stakeholders...” (from p. 40)

These candid comments in an interactive setting among a diverse group of private stakeholders indicate substantial effort will be required to develop broad-based support to deal with the invasive species problem.

Important guidance also was provided by non-federal stakeholders on the collection of data on invasive species:

“(we) need to strike a balance between the resources expended on data collection, management, access and use with the need to take on-the-ground action.” (from p. 38)

“(we) need to ensure that the level of data gathered and stored in databases is commensurate with the use they will be put to.” (from p. 38)

“People are willing to talk to us, in part because we had a respectable presentation about the nature and extent of the problems – But we can do better, and I believe a key to success will be better database tools.” (from p. 37)

“Data on non-native invasive species present in the United States are incomplete, and data that are available are scattered in a variety of published and unpublished accounts and databases. This makes it difficult or impossible for land managers to identify, much less properly manage invasive species on their lands.” (from p. 43)

“only the government can provide data on what species are coming in on which pathways. And this information is crucial to developing priorities for pathway-closing programs (whether voluntary or regulatory) and in assessing the effectiveness of these programs – current ‘interception’ data – fall far short of the needed standard.” (from p. 44)

“Hundreds of species of plants shown to be invasive in natural systems are not included on any federal or state ‘noxious weed’ list – nor are they likely to be in the future... These species need to be included in databases and other information sources; they need to be the subject of research; they need to be managed.” (from p. 45)

Economic and Environmental Costs. We see a large amount of evidence that invasive species are responsible for widespread, large economic and environmental costs. However, environmental and economic cost estimates often are inadequate for cost-benefit analyses that may be needed to justify expenditure of public or private funds for specific actions. Furthermore, differences in opinions – often derived from narrow experiences – lead to disagreements on what actions, if any, are desirable.

Also, we saw disagreement about what organisms should be considered invasive. This “definition” problem is illustrated by widely varying estimates of the number of non-native species in the U.S. – ranging between 7,000 and 50,000 – and the lack of a comprehensive categorization of which species

are invasive. Thus, there is often disagreement about which organisms or groups of organisms are most costly to control.

Overarching Issues. Opportunities for enhancing understanding of the invasive species problem were particularly evident in relation to the following issues:

- The term “invasive species” has different meanings to different people. Development of programs around specific organisms, groups of organisms or well-defined ecosystems may be desirable to clarify what is intended.
- The disagreement about what organisms should be considered invasive is creating confusion among those whose support is needed to take action. One approach to ameliorate this confusion is to establish a national peer-reviewed evaluation model that scientifically assesses the degree of invasiveness of a limited number of species. The model could then be applied in prioritizing and allocating funds to the most economically damaging species. The model(s) also could become a part of formal risk assessments.
- The components of an environmental and economic cost estimate of \$137 billion per year are, in many cases, inadequate for use in cost-benefit analyses that may be needed to justify expenditure of public or private funds for specific control policies. Thus, differences in opinions – often derived from narrow experiences – lead to disagreements on what actions, if any, are desirable.
- Although a tremendous amount of information is available on invasive species, we appear to lack an overall strategy to develop invasive species information systems that instill confidence in stakeholders. For example, one stakeholder was quoted as saying, “We are drowning in information and starving for wisdom.”
- Limited evidence surfaced during the roundtable concerning who is responsible for moving the total invasive species issue forward. For a major effort on invasive species to begin, an individual or well-organized coalition must

become the “torch-bearer” who could muster support and move forward in concert with many diverse interests.

General Strategy. There is considerable merit in pursuing a range of different approaches to deal with invasive species on a problem-specific basis through the appropriate integration of local, state, regional and federal interests. However, the total invasive species community should stand together when pursuing political and financial support. Therefore, the community should maintain a holistic view. However, since the invasive species problem is so varied and complex, some focus on specific areas may be necessary to make progress in developing information management systems for practical use. Thus, two strategies are suggested for programmatic activity: (1) information systems for selected problem areas and (2) cross-cutting efforts that will foster a holistic approach.

Presentations at the roundtable – combined with formal and informal discussions associated with the roundtable – suggest that the following focus areas may provide unique opportunities for expanded partnership development and for collecting, sharing and using information: (1) range-land invasive plants on public and private lands, (2) aquatic invasive animals in fresh and marine waters, (3) aquatic plants in fresh water, (4) information technology to support intervention of invasive species at points of origin and/or at ports of entry and (5) biodiversity on private and public lands specifically designated for that purpose.

Cross-cutting thrusts of interest that are worthy of special attention and that will contribute to maintaining a holistic view include: (1) assess attitudes and priorities of private landowners concerning state and federal actions related to invasive species, (2) review policies and responsibilities of federal agencies on public lands used by private interests, (3) develop policy options, including the use of incentives, to deal with resistance to adopting desired practices and (4) investigate innovative funding options.

Needs and Suggested Actions. Needs for improved management information systems for invasive species and additional inputs into the

development of policies and programs, particularly from non-federal stakeholders, were obvious from the presentations and discussions. Some elaboration on those needs and suggested actions follow:

- More useful information systems are needed. Roundtable participants identified systems such as databases and maps for western range land noxious weeds (invasive plants), as areas where facilitated activities, such as technical workshops involving users, had the potential of being particularly productive. Invasive aquatic plants and animals and regulated plant pests were other areas of particular interest in this regard.
- Participants indicated that they need additional efforts to obtain balanced inputs from all stakeholders, with particular emphasis on non-federal stakeholders at the local and state level. They suggested non-federal facilitated activities to assess the knowledge, attitudes and desires of non-federal stakeholders.

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ACRONYMS

ABI	Association for Biodiversity Information	NAPIS	National Agricultural Pest Information System
AFBF	American Farm Bureau Federation	NAS	Non-indigenous Aquatic Species
ANLA	American Nursery and Landscape Association	NCBA	National Cattlemen's Beef Association
ANS	Aquatic Nuisance Species	NCSU	North Carolina State University
APHIS	Animal and Plant Health Inspection Service, USDA	NFWF	National Fish and Wildlife Federation
ARS	Agricultural Research Service, USDA	NISC	National Invasive Species Council
ASTA	American Seed Trade Association	NIWAW	National Invasive Weed Awareness Week
BLM	Bureau of Land Management, DOI	NOAA	National Oceanic and Atmospheric Administration, DOC
CSREES	Cooperative State Research, Education and Extension Service, USDA	NPS	National Park Service, DOI
DOC	Department of Commerce	NRC	National Research Council
DOI	Department of the Interior	NSF	National Science Foundation
EDF	Environmental Defense Fund	OAWP	Office of Agricultural Water Policy, FDACS
EO	Executive Order No. 13112	OIE	Office International des Epizooties
EPA	U.S. Environmental Protection Agency	PIJAC	Pet Industry Joint Advisory Council
ESA	Entomological Society of America	PIN	Port Interception Network
FDACS	Florida Department of Agriculture and Consumer Services	PINOPS	Port Interception Network – Operations
FLEPPC	Florida Exotic Pest Plant Council	QA/QC	Quality Assurance/Quality Control
FNGA	Florida Nursery Growers Association	RFP	Request for Proposal
FS	U.S. Forest Service, USDA	RMF	Riley Memorial Foundation
FWS	U.S. Fish and Wildlife Service, DOI	SEC	Office of the Secretary
GLC	Great Lakes Commission	SDA	State Department of Agriculture
HUC	Hydrologic Unit Code	SERC	Smithsonian Environmental Research Center
ICPM	Interim Commission on Phytosanitary Measures	SI	Smithsonian Institution
IFACS	Institute of Food and Agricultural Sciences, University of Florida	SPS	Application of Sanitary and Phytosanitary Measures
INEEL	Idaho National Engineering and Environmental Laboratory	TBWG	Tampa Bay Wholesale Growers
IPM	Integrated Pest Management	TNC	The Nature Conservancy
IPPC	International Plant Protection Convention	UC	University of California
ISAC	Invasive Species Advisory Committee	USDA	United States Department of Agriculture
IWAC	Invasive Weeds Action Coalition	USGS	United States Geological Survey, DOI
JFSP	Joint Fire Science Program	WAP	Wireless Application Protocol
MOU	Memorandum of Understanding	WGA	Western Governors' Association
		WSSA	Weed Science Society of America
		XML	Extensible Mark-up Language

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