Commentary

A Response to the ESA Position Paper on Biological Invasions

As an ecologist and pest risk analyst, I read with great interest the recent position paper of the Ecological Society of America, "Biological Invasions: Recommendations for U.S. Policy and Management" (Lodge et al. 2006). I work in the Center for Plant Health Science and Technology (CPHST) ‹http://cphst.aphis.usda.gov/›, which provides scientific support for the Plant Protection and Quarantine (PPQ) program of the Animal and Plant Health Inspection Service (APHIS) in the USDA. My intent with this letter is to correct what I believe are two errors in the position paper about CPHST/PPQ and how we produce pest risk assessments (PRAs), and to share information about ongoing projects that already address some of the recommendations in the position paper. I hope this fosters the idea that groups like PPQ and the ESA are primarily allies, rather than adversaries, in safeguarding the United States from the threats posed by exotic invasive species. (I apologize in advance for the profligate acronyms: I work in government.)

The first error I would like to correct is the statement, "No USDA or USFWS employee has a job dedicated to evaluating the risk associated with importations of [specific] organisms" (Lodge et al. 2006:23). In CPHST, that is the primary task of the scientific team for Quarantine 37 (Q-37 or plants for propagation) assessments in the Plant Epidemiology and Risk Analysis Laboratory (PERAL). Other PERAL scientists are sometimes tasked with assessments on specific organisms, usually because of special importance (e.g., *Caulerpa* spp., *Phytophthora ramorum*) or new interceptions (e.g., pinecones in potpourri from India). Besides organismal assessments, the 40 PERAL scientists assess the risks associated with pathways and imports of commodities, publish new pest alerts and do rapid evaluations, and support domestic response and management programs. Plant PRAs by PERAL are used by decision makers in government and in the Federal rulemaking process.

Secondly, for PERAL, it is not true that PRAs "…rely exclusively upon qualitative, expert opinion", or that "…protocols rarely meet any of the essential criteria for rigorous risk assessments…" where the listed criteria were peer review, transparency, repeatability, specified uncertainties, and quantitative output (Lodge et al. 2006:26). Every PRA published by PERAL has been peer-reviewed within both CPHST and PPQ. Often, PRAs are reviewed in other relevant APHIS programs, and externally reviewed by stakeholders, non-Federal scientists, and scientists in other Federal agencies. Both our qualitative and quantitative PRAs are transparent: rationales for methods, risk ratings, and results are detailed and referenced; documents are available for review by the public; and contacts and authors are clearly identified. Our PRAs explicitly consider environmental as well as economic consequences of introduction of exotic plant pests. Quantitative PRAs are done if the objectives warrant it and if enough relevant data exists, which is no different from ecological modeling in general. In quantitative PRAs propagule pressure (Recommendation No. 2) is explicitly considered, and the uncertainties for inputs and outputs are always specified (e.g., Griffin 1997, Sequeira et al. 2002, 2004, Caton and Spears 2005, Caton et al. 2006*a*, *b*). Besides being good scientific practice, we must follow the criteria above because of possible legal challenges to our PRAs. Finally, PERAL recently completed ISO (International Organization for Standardization) 9001 certification for commodity-based PRAs and evaluations of new pests. This was done to enhance quality assurance and continual process improvement.

I will address one additional problem because it is in my area of expertise, and because I think it points to the complexity of biological invasions and biosecurity efforts. On p. 18, Lodge et al. (2006) make the unreferenced statement that, "Commerce in living organisms usually introduces species at a lower rate than transportation related pathways." That may only

be true for some taxa, such as the aquatic animals they discuss. In contrast, two-thirds of introduced plant species in Australia were escapes from horticulture, with that proportion expected to increase over time (Groves et al. 2005). For the continental United States, estimates are that more than half of all naturalized exotic plants were brought for gardening (Randall and Marinelli 1996, Mack and Erneberg 2002). A less general statement was probably warranted there, but my main point is that pathway risk levels seem likely to depend on such factors as taxa, commodity, geographic origin, and conveyance. Therefore, in agreement with Lodge et al. (2006) (Recommendation No. 1), better understanding of the relative risks presented by different pathways is a priority goal of our organization.

Now I will address the recommendations made by Lodge et al. (2006), but not necessarily because I disagreed with them. Rather, I felt that in some cases they mistakenly gave the impression that Federal pest risk scientists and managers are merely sitting around waiting for help to appear.

Describing "proposed lead organizations" for their first three recommendations, Lodge et al. (2006) wrote each time that "Universities continue to develop…" new tools for analyses and biotechnology. This implied to me a vision in which "government funds, universities research, and then government adopts." I think that view is unfortunate, and, at least for PPQ and CPHST, inaccurate. Scientists in PPQ work cooperatively with university scientists on many research and analysis projects, often from conceptualization through technology transfer. A selected list of recently completed or ongoing projects in CPHST that are highly cooperative includes the following:

- Agricultural Internet Monitoring System (AIMS) to identify and interdict U.S.-based online pathways for exotic invasive species [with the Center for Integrated Pest Management (CIPM) at North Carolina State University (NCSU)]

- Annual prioritization of species for the Cooperative Agricultural Pest Survey [with many state agencies, universities, and private organizations]

- Applying remote sensing technology for detection of exotic invasive plant pests [e.g., emerald ash borer, with Michigan State University; Asian long-horned beetle, with Clark University]

- Computer diagnostics for quarantine mites (exotic Acarines) [with Colorado State University and the University of Alberta]

- Creation of a global weed prioritization model for potential invasiveness in the United States [with the Weed Science Society of America]

- Modeling United States metropolitan areas as hubs of human-mediated pathways of invasive species [with Michigan State University and the U.S. Forest Service]

- NCSU/APHIS Plant Pest Forecast (NAPPFAST; ‹www.nappfast.org› system for climate- and weather-based risk mapping [with CIPM-NCSU]

- Pathway prioritization project (Lodge et al. (2006: Fig. 2)) [public and Federal scientists coordinated by the National Invasive Species Council]

- Predicting the atmospheric transport of soybean rust from South America into the United States [with NCSU and Penn State University]

Regardless of who conceived of these projects, all groups have benefited. We value those collaborations, but often develop tools and technologies ourselves. Examples include enhanced lures for early detection of pests, and improved diagnostic tests for detection and identification of pests. I urge ESA members to view PPQ more as a possible partner in biological invasions research and development than just as a potential source of funding. In particular, PPQ scientists and managers may often have the best, most current

information about what pest threats may be emerging, what important statutory changes are forthcoming, what topic areas most need research, what operational issues may need to be addressed, and what challenges likely loom ahead.

One of my colleagues has half-jokingly said that the public only knows what the government is doing about two years after the fact. I am pleased to mention the following selected, ongoing PPQ projects about which Lodge et al. (2006) may have been unaware, that address the two prevention-related recommendations in the position paper:

Recommendation (1): Reduce species in pathways.

- AIMS, for reducing introductions of regulated plant pests and animal products
- Commodity origin by trace elements analysis, to quickly identify mislabeled/smuggled cargo of high risk
- Development of odor-based detection and monitoring systems for exotic pests
- Offshore Pest Identification System (OPIS), to monitor potential emerging pest species and outbreaks
- Proposed revisions to the Quarantine-37 (plants for propagation) regulations, including a new designation for plant species of "Not Authorized Pending Risk Assessment"

Recommendation (2): Institute risk screening.

- Cooperatively developed lists of plant pest species of particular concern (e.g., mites with Acaralogical Society of America, nematodes with Society of Nematologists, insects with the Entomological Society of America)
- Global weed prioritization model, to identify high risk plant species for assessments and possible listing as Federal noxious weeds [trait-based species screening]
- NAPPFAST risk mapping for *Phytophthora ramorum*, *Maconellicoccus hirsutus* (pink hibiscus mealy bug), and other pest species. CPHST has compiled insect developmental requirements for over 500 insect species. [environmental matching]

In particular, in this era of internet commerce the development of AIMS was so revolutionary and important that plant and animal protection agencies in several other countries have requested cooperative access to AIMS or help in developing their own similar systems.

I think the position paper could have benefited from including a PPQ scientist as a co-author or reviewer. Besides correcting some errors and highlighting examples of progress being made, one of us could have pointed out that one of the biggest challenges now facing PPQ is the recent transfer of agricultural inspectors at ports into the Department of Homeland Security. Whereas the primary objective of the inspectors used to be preventing introductions of quarantine materials and associated pests, they now also have to work to prevent terrorism. How this change will affect Federal biosecurity efforts in the long term remains to be seen, but it is clearly a significant development.

Our nation faces serious challenges in plant and animal protection, and we appreciate that the ESA position paper will help to raise awareness and improve Federal policies and programs. Simberloff et al. (2005) recently noted that the strongest voice for improving the prevention and management of invasive species problems has always come from scientists, and I believe they meant scientists in its most general sense, i.e., from all types of institutions. I hope this letter demonstrated that PPQ scientists are capable and serious about biosecurity, have been making progress in key areas about which ESA made recommendations, and could be valuable partners for ESA members interested in or researching biological invasions.

Literature cited

Caton, B. P., T. T. Dobbs, and C. F. Brodel. 2006*a*. Arrivals of hitchhiking insect pests on international cargo aircraft at Miami International Airport. Biological Invasions **8**:765–785.

Caton, B. P., A. V. Lemay, H. E. Meissner, and M. K. Hennessey. 2006*b*. Plant pest risk assessment for direct airline flights from Mexico to Fresno-Yosemite International Airport, California. Center for Plant Health Science and Technology, Plant Protection and Quarantine, Animal and Plant Health Inspection Service, U.S. Department of Agriculture, Raleigh, North Carolina, USA.

Caton, B. P., and B. M. Spears. 2005. Pest risk assessment for pine shoot beetle, *Tomicus piniperda* (L.) (Coleoptera: Scolytidae), on quarantine white pine (*Pinus strobus*). Materials at processors in Maine. Center for Plant Health Science and Technology (CPHST), Plant Protection and Quarantine, Animal and Plant Health Inspection Service, U.S. Department of Agriculture, Raleigh, North Carolina, USA.

Griffin, R. L. 1997. An example of cooperative risk assessment: scenario analysis for the risk of pine shoot beetle outbreaks resulting from the movement of pine logs from regulated areas. Pages 87–102 *in* M.A. Kamrin, editor. Environmental risk harmonization: federal and state approaches to environmental hazards in the USA. John Wiley and Sons, New York, New York, USA.

Groves, R. H., R. Boden, and W. M. Lonsdale. 2005. Jumping the garden fence: invasive garden plants in Australia and their environmental and agricultural impacts. CSIRO report prepared for World Wildlife Fund-Australia, Sydney, Australia.

Lodge, D. M., S. L. Williams, H. MacIsaac, K. Hayes, B. Leung, S. Reichard, R. N. Mack, P. B. Moyle, M. Smith, D. A. Andow, and others. 2006. Biological invasions: recommendations for U.S. policy and management [ESA Position Paper]. Public Affairs Office, Ecological Society of America, Washington, D.C., USA.

Mack, R. N., and M. Erneberg. 2002. The United States naturalized flora: largely the product of deliberate introductions. Annals of the Missouri Botanical Garden **89**(2):176–189.

Randall, J. M., and T. Marinelli, editors. 1996. Invasive plants: weeds of the global garden. Handbook No. 149. Brooklyn Botanical Garden, New York, New York, USA.

Sequeira, R. A., M. K. Hennessey, L. C. Millar, T. M. Kalaris, and E. M. Jones. 2004. Importation of avocado fruit (*Persea americana* Mill. var. 'Hass') from Mexico: a risk assessment. Center for Plant Health Science and Technology (CPHST), Plant Protection and Quarantine, Animal and Plant Health Inspection Service, U.S. Department of Agriculture, Raleigh, North Carolina, USA.

Sequeira, R. A., C. E. Miller, and G. Fowler. 2002. Risk mitigation for tephritid fruit flies with special emphasis on risk reduction for commercial imports of clementines (several varieties of Citrus reticulata) from Spain using a Phytosanitary Hazard Analysis and Critical Control Point (PHAACP) system.: Center for Plant Health Science and Technology, and Policy and Program Development; Plant Protection and Quarantine, Animal and Plant Health Inspection Service, U.S. Department of Agriculture, Riverdale, Maryland, USA.

Simberloff, D., I. M. Parker, and P. N. Windle. 2005. Introduced species policy, management, and future research needs. Frontiers in Ecology and the Environment **3**(2):12–20.

Sincerely,

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