APPENDIX A

PROTECTING WISCONSIN FROM NEW INVASIVE SPECIES

PREVENTION

discussion date: March 13, 2012

Preventing the introduction of alien invasive species is the most cost-effective, environmentally benign and preferred option, and is a high priority. After all, "an ounce of prevention is worth a pound of cure." *Examples of effective prevention of invasive species are more difficult to document than instances where prevention efforts fail and damaging species become established. It's impossible to know every instance that treating ballast water, cleaning equipment, or fumigating wood products prevented spread or new introductions. However, taking these and other steps to reduce the risk posed by moving commodities and vehicles matters. The likelihood that a new species will become established goes up with the number of times it is introduced. So, reducing the likelihood of a species being introduced can reduce the risk of its establishment.*

The greatest prevention benefit can come from identifying and closing the pathways and vectors that allow introduction of multiple species. Examples of pathways include firewood that can contain forest pests and pathogens, live plants that may either harbor pests or become pests themselves, and ballast water that can contain multiple harmful species. Managing these pathways can have broad impacts as the US Environmental Protection Agency identified ballast water as the likely pathway for about 30% of the invasive species in the Great Lakes that include ecosystem changing species like spiny water flea, round goby, and zebra and quagga mussels. Ballast water management is also an example of good pathway management as the Wisconsin Department of Natural Resources ballast water program reports that no new aquatic invasive species are known in the Great Lakes since the 2006 ballast water exchange requirement. More can be done to shore up this record but this is encouraging.

The major impediment to implementing effective prevention efforts is that currently profits are enjoyed at the international level while costs are borne at the local level (Figure 1). This disconnect between the impacts on citizens on the receiving end and the extra costs to shippers and product suppliers should be resolved by having prevention measures incorporated as part of the cost of doing business. Preventing new invasive species from reaching our continent requires increased national and international effort. Wisconsin can do little in isolation, but we can push for greater protection of our resources at the national level.

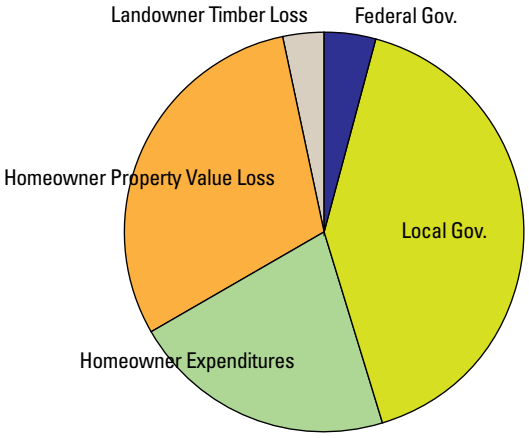

Figure 1. Costs of invasive forest pests are borne mostly at local level (Redrawn from Aukema et al. 2011).

TOPICS:

POLICY PLANNING: Wisconsin prevention efforts before and after the border by the U.S. Department of Agriculture (USDA)

JoAnn Cruse, *USDA Animal & Plant Health Inspection Service (USDA APHIS)*

The obvious entry points to the United States are the big ports. A major problem is that less than 1% of shipments at ports of entry are actually inspected, even when inspection is used in the broadest sense, such as in a paper review (see box below for example). There were USDA inspectors at 327 land sea and air border ports. Most of these are now enforced by Customs and Border Protection—Department of Homeland Security specialists who receive training but not to the same level that USDA Plant Protection and Quarantine specialists required. Another group, Smuggling Interdiction and Trade Compliance staff work with post import markets to reduce risk. USDA has the official set of taxonomists who identify pests *not known* to occur (NKOs) which can trigger action to halt their import. The number of finds of these pests is tallied after identification at the ports. This is the second line of defense while the first line of defense is offshore certification.

Port Operations FY 11 Statistics for Long Beach, CA – Total containers 4.2 million

- 11,176 regulated containers were inspected (agriculture)
- 13,981 miscellaneous containers were inspected
- 30,143 regulated commodities were document review only
- 24,394 miscellaneous shipments were document review only
- 782 Emergency Action Notifications were issued.
- 1,470 cargo tally pest submitted
- 616 cargo reportable pest submitted

Current goal: paper review or inspection for a minimum of 0.5% of shipments.

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Beginning overseas, before materials are even packaged for shipment, inspection staff identify risks and work with our trade partners to reduce risk. Foreign Plant Inspection Stations have specialists who work to identify pests and diseases that may pose a risk if they travel to North America. Pre-clearance and pre-departure programs inspect commodities abroad to reduce the likelihood that products will arrive. If it is discovered that there is a pest in a commodity that arrives, it is rejected and often sent to a secondary market. This process can facilitate trade and reduce risk. Post Entry Quarantine can also be employed. There are several ways that data about new pests are found including the Offshore Pest Information System and the less detailed Exotic Pest Identification Collection and Analysis.

Once a species is detected in the U.S., a New Pest Advisory Group meets to determine if an action is required. If so, interstate quarantine is the next recommended step. This group makes a recommendation based on the perceived seriousness of the pest. In most cases, the new finds were not recognized pests in their home or originating country.

POLICY PLANNING: Department of Agriculture, Trade, and Consumer Protection

Brian Kuhn

Wisconsin's Department of Agriculture, Trade, and Consumer Protection (DATCP) picks up where USDA APHIS leaves off at the state's borders. There is some overlap but also extensive coordination to prevent duplicating services. Both USDA APHIS and the Forest Service provide funds to survey and manage specific pests. The Interstate Pest Control Compact functions like an insurance policy to help address pests beyond the scope of state budgets.

Both external and internal quarantines are used to prevent the intrastate movement of pests. The intent of regulations is to slow the spread of human mediated movement of pests. An example of an external quarantine is regulation of all raw walnut wood coming into Wisconsin to prevent the spread of thousand cankers disease. The agency works with industry to prevent introductions of diseases that could damage state resources. Internal quarantines are used to try to reduce the spread of priority pests such as emerald ash borer, gypsy moth, and pine shoot beetle. Tools for reducing risk for intrastate transport include compliance agreements with providers, risk reduction procedures for biomass shippers, and heat treating for firewood. Outreach is a critical part of prevention and work to educate constituents and the public. For example, Wisconsin campers, foresters, and landowners are all engaged in preventing the spread of emerald ash borer.

CASE STUDIES: Threats of invasive insects and pathogens to forests

Ken Raffa, *University of Wisconsin, Madison*

A variety of economic and political factors have increased the rate of imports, and a combination of biological and operational factors have made solid wood packing material a particularly important pathway for moving tree pests and diseases. The risk has been increasing as fewer government employees are available to inspect more material that originates from a wider array of places and is being disseminated within containerized cargo to more places before being opened.

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In addition to single invasive species like emerald ash borer, insect-pathogen complexes cause severe economic and environmental losses. Examples of pest insect-pathogen complexes include Dutch elm disease, thousand canker disease, pine wood wasp, laurel wilt disease, and beech bark disease. In some cases, introduced species establish relationships with previously innocuous native species to cause uncontrollable losses. Some invasive pests come from different areas of the US or North America that were separated by a barrier. Examples include pitch canker, thousand canker disease, and potentially mountain pine beetle and its associated microorganisms.

Very few of our most damaging exotic insects and pathogens are pests in their native range. Some were even unknown until they were introduced to a new, highly susceptible habitat. Their more aggressive behavior and dramatic, ecosystem-wide impacts may be due to access to naive hosts and escaping from natural enemies. For example, Dutch elm disease evolved in Asia where it is not an important pest, and invaded Europe and then North America where there is no natural resistance in native elms. Likewise, there is no known resistance or tolerance among North American ash trees to emerald ash borer, even though this insect is not a pest in its native Asia, where it is associated with very stressed or dead trees.

International trade policies governing phytosanitary measures require the use of 'science-based risk assessments' to identify which organisms are likely to become pests if transported within a specific commodity from a specific source. History shows that this policy is scientifically unfounded; often insects and pathogens that are of no consequence in their native range, precisely because they were held in check by predators and host tree defenses in that region, become problems once transported. Similar problems arise with inter-state movement of commodities.

Once an insect or pathogen is established all of our options are costly and only marginally effective. Therefore, controlling pathways is the best defense. Examples of prevention successes have included instances where penalties for noncompliance were borne by shippers and where a combination of regulation, citizen engagement and inter-agency collaboration facilitated rapid response. Key considerations on the future success of prevention efforts for forest pests include:

- The historical record shows that inconsequential insects and pathogens often cause major problems once introduced into a new region. So it is not possible to identify those resident insects and microbes in a region that would establish and become damaging if transported into a new region. This means that efforts should be focused on pathways.
- Undisturbed and disturbed habitats appear equally susceptible to exotic insects and pathogens.
- Wood products and live plants are particularly important pathways.
- A variety of pre-shipment treatments, such as heat, antibiotics, radiation, increased visual inspection, and substitute packing products are known to reduce risk. However, these incur costs at the point of origin, as opposed to invasive species that incur costs at the local level, and current policies do not guarantee their use.

RESEARCH: Aquatic invasive species in Wisconsin

Jeff Vander Zaden, *University of Wisconsin, Madison*

The aquatic invasive species focus in Wisconsin has been on 15,000 inland lakes and thousands of kilometers of streams that all tend to be isolated and can be viewed as islands of water in a sea of land. Species tend not to move easily unless transported across a fragmented waterscape and this has important implications in addressing the spread of these species.

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Once a species has become locally problematic it is often too late to eradicate it. But we often can identify which species will cause damage by examining similar habitats in the same region. There are a limited number of people involved in the spread of the worst species as boating is the most important vector in moving species once they have become established in the Laurentian Great Lakes. Even those species that are well established can be slowed or contained to where they currently occur. For example, rainbow smelt are bad for walleye recruitment and are currently found in about 26 lakes. In surveys of 5100 Wisconsin lakes, about 180 were identified as potentially vulnerable to smelt invasion. Containment or damage control for these remaining waters can be addressed strategically through Smart Prevention. The questions to filter out the invasive species are: Can they arrive? Can they reproduce? Will they cause harm?

Research on inaccessible or wilderness lakes that are difficult to access showed no evidence of aquatic invasive species. There is no evidence that birds play an important role. An approximation of the relative risk that an aquatic invasive species will be present in a lake is whether or not there is a boat launch. More complex models of boater use and movement may provide more information. Suitability of a lake can be determined for species about which there is adequate information and given across the landscape where the parameters are known for the lakes such as, "round gobies do well in areas with zebra mussels." Predictions show which streams below dams are vulnerable and what areas above dams are suitable should they be moved. Once vulnerable water bodies have been identified they can be prioritized according to values such as whether is there a walleye fishery.

The model works well for highlighting where invasive species are likely to establish, but there are sources of uncertainty: impacts of invasive species can be variable. Most species have a log normal highly skewed distribution. Using data for 12 invasive and 99 native species, there are more than 23,000 estimates of abundance; the evidence shows their general distributions are similar. The question of why invasive species do not always grow to high densities is an interesting one for management. The Smart Prevention tool has been developed for a number of species and can be accessed through the Invasive Species Interactive Mapping System. [http://www.aissmartprevention.wisc.edu]

RESEARCH: Terrestrial invasive plants

Don Waller, *University of Wisconsin, Madison*

Wisconsin has an extensive history of land cover change, and extensive ecological monitoring has documented impacts of change and tracks major drivers of ecological change such as urbanization. Still, there is a high degree of uncertainty about which terrestrial plants will establish, spread and become invasive species. The impacts, though, are clear: tree seedlings and wild flowers are lost. In forested areas the number of tree seedlings declined by greater than 50% and over time; this led to a 16% decrease in tree diversity. The blanket of invasive garlic mustard, buckthorn and honeysuckle has an even greater impact on the understory. About 80% of sites lost herb diversity and local understory diversity declined 26% with the overall number of species per square meter declining by 25%. About 26% of studied sites had exotics in 1950 and 82% have exotics today. There has been an increasing rate of spread in these species. Whole landscapes change within a few decades.

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Forest fragments that are surrounded by development of roads are much more likely to be invaded. Forested sites that have not lost biodiversity are on the Menomonie and Ojibwe Reservations and some of the Apostle Islands. Generally, urban cover within 5km is the best predictor of the presence of exotic species at a site. Urbanization also tends to increase the number of woody invasive species and foster declines in plant diversity. Beta diversity (diversity among sites) is also decreased with urbanization. Common species are becoming more common and widespread, and rare species are becoming more rare and localized. There is good evidence that invasive species negatively affect native species. Landscape effects have become the most important predictor rather than small scale site effects.

Where to take action? Focus monitoring and detection efforts early, then move towards biocontrol for more widespread species. For effective management of widespread and abundant species like garlic mustard there should be more productive links with volunteer programs to reduce wasted time and volunteer frustration. One example is the use of ongoing research efforts to monitor for newly establishing species and input data directly to a common database. There is a need for adaptive monitoring in the same way that we work towards adaptive management. Limited resources can be best used by focusing monitoring, early detection, and eradication on vulnerable areas that have not yet lost a lot of habitat quality. There are partners in non-governmental organizations and scientists who are ready to assist with this work, but encouragement and funding are needed to provide the coordination to expand existing, often volunteer, programs.

Wisconsin has led the nation in many environmental fronts from Muir to DDT, and we should also be taking the lead on invasive species but are not investing enough resources (Figure 2). Managers should put time and effort into the edges of invasions and focus control efforts on species that have the most limited distributions.

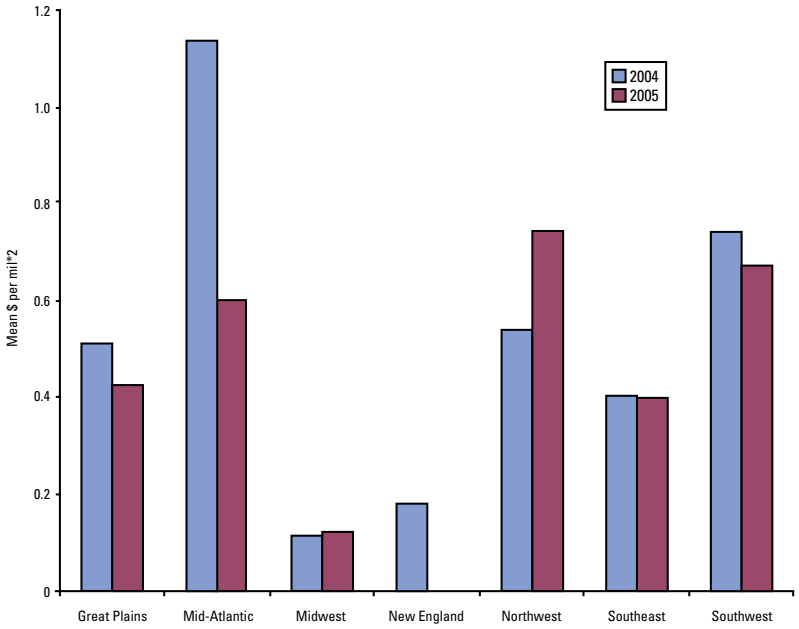

Figure 2. A survey of regional Exotic Pest Plant Councils and equivalents shows the Midwest is particularly underinvesting in terrestrial plant management (Midwest Invasive Plant Network).

POLICY PLANNING: Site level prevention with best management practices

Tom Boos, *Wisconsin Department of Natural Resources*

The purpose of Wisconsin's Invasive Species Rule (NR40) is prevention. Regulating species as either Prohibited or Restricted removes or reduces the primary pathway for many terrestrial plant species which are sold as nursery stock. Buckthorn and honeysuckle are examples of intentionally introduced species that are widespread in some regions of the state but not others. The DNR requires that reasonable precautions be taken to avoid moving such species. Best management practices (BMPs) are a way to clarify how the rule should be applied to management and resource users to prevent the spread of invasive species.

Best management practices describe voluntary actions that may reduce the impact of invasive species. One of the more comprehensive set of BMPs was developed for forest users. Each practice identifies what to consider when planning. Other BMPs are in use are for boaters, roadside managers (mowing timing guidance), loggers, forest recreation users and others. The common themes are planning, education, cleaning, avoidance, minimizing disturbance and using clean materials. Enforcement encourages compliance but the practices are written to be as accessible as possible.

The most resistance to the BMPs was when it was suggested that the language was also going to be used in contracts. There has been concern that the "reasonable precautions" in the BMPs would not provide adequate protection for managers who are making a good faith effort to prevent the spread of invasive species when conducting timber sales, road construction or other activities. The biggest issue has been cost, and there was a high level of concern until the bid prices started to take into account the need to clean equipment and avoid invasive species.

Very high awareness of the BMPs by the target audience is possible. The aquatic invasive species team has been very successful in getting the information out and boat ramp surveys have identified an awareness level for BMPs approaching 95% by boaters after years of investment, evaluation and feedback.

GAPS

Scale

The threats to Wisconsin's economy, environment and quality of life posed by invasive species arise at the global scale and are felt at the local scale. Therefore, an effective response likewise must be multi-scale and multi-component with adequate resources for each step and communication between all agencies. With fewer resources, more emphasis is needed for pre-shipment treatment and pathway management. There is resistance to pre-shipment treatment due to cost or concern about the effects (as for irradiation), and better communication with decision makers and the public about the need for these tools is required. The hand-off from agencies responsible for national programs to prevent invasive species to local agencies trying to keep pests that may be established elsewhere in the country out of their state should be supported with good communication and shared information.

continued

Research

When stopping the movement of all species isn't an option, there needs to be a way to triage risks, pathways and pests by asking, "What are the priority risks, pathways, and species that should be focused on?" More research support is needed to consistently identify the threats that can be addressed. Supporting an increased effort overseas to develop pest alerts would help focus limited inspection efforts to the highest risk item. Managing pathways is effective and work should be done to develop less expensive treatments for wood, plants, ballast water and other important vectors of invasive species. For local managers, work to determine which ecosystems are most vulnerable to invasion would help to guide the application of best management practices and target specific areas for more detection effort.

Communication

Outreach is needed to engage everyone in both taking steps to prevent the movement of invasive species and reporting new sightings. Public adoption of best management practices is needed for all groups of invasive species. Work should include outreach to make clear that a person's actions can make a difference. Examples include buying firewood from a safe source (save trees) and cleaning boats before launching them into a body of water (healthy lakes).

Wisconsin Invasive Species Council: http://invasivespecies.wi.gov
Wisconsin Department of Natural Resources: http://dnr.wi.gov keyword: "invasive"

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