APPENDIX C

PLANNING FOR SUCCESS AND ACTING TO PREVENT THE ESTABLISHMENT OF INVASIVE SPECIES.

RAPID RESPONSE

discussion date: June 21, 2012

Eradication of a newly detected population of a known invasive species is often the first goal of a rapid response effort. Focusing detection programs, improving reporting, stockpiling resources, strengthening response networks, conducting tabletop exercises, and having a response plan waiting all help create the ability to detect, find the extent of, and control a target species. Research on eradication has found that a limited distribution of the target and an effective suite of tools are the only significant predictors of successful eradication efforts. Rapid *response is not actually necessary for an eradication effort but does increase the likelihood that the target species will be controlled before it is allowed to spread.*

There are many benefits of responding to new populations of invasive species as soon as possible even if eradication is not the goal for a particular species. What rapid response can do when a species is not a good candidate for an eradication effort is buy time or shift management to minimize harm from the newly established species. For example, response efforts to regionally spreading invasive species such as emerald ash borer can slow the spread of target species allowing communities to spread the costs of mitigating for this pest out over a longer period. When more than 20% of the urban tree canopy may need to be replanted, this can be an important consideration.

TOPICS:

CASE STUDIES: Wisconsin Department of Natural Resources response to yellow floating heart and red swamp crayfish. . . . 2

POLICY AND PLANNING: "Messages from a crowd are difficult to understand" — Tools to assist decision making for aquatic invasive species rapid response. . . . 4

POLICY AND PLANNING: Rapid response efforts in Wisconsin . . . 6

POLICY AND PLANNING: Rapid response to newly established invasive species — National and federal examples. . . . 9

RESOURCES: Wisconsin DNR's suppression sub-grant program. . . . 10

POLICY AND PLANNING: Lessons from epidemiology – Infectious zoonotic disease preparedness. . . . 11

GAPS . . . 13

Case studies: WISCONSIN DEPARTMENT OF NATURAL RESOURCES RESPONSE TO YELLOW FLOATING HEART AND RED SWAMP CRAYFISH.

Heidi Bunk, *Lakes Biologist, Wisconsin Department of Natural Resources*

Red Swamp Crayfish

In August and October 2009 two populations of red swamp crayfish (*Procambarus clarkii*) were discovered. This species of crayfish had previously been recognized as invasive when introduced from its native range in the lower Mississippi Basin to states in the west and along the east coast. This animal is very flexible in the use of habitats and can burrow to avoid drought and cold winters. It can complete up to four reproductive cycles in one season and can outcompete native crayfish.

The initial discovery of the Germantown, Wisconsin population was reported by a citizen on August 25 who called to report that he has been finding large (8") bright red crayfish in and around his sister's condominium association pond at Esquire Estates. He took it upon himself to identify the animals online and determined that they were likely red swamp crayfish. On August 26 Fisheries staff visited the pond and confirmed red swamp crayfish in the shallow water and crawling on the grass near the shoreline of the 5 acre subdivision pond and into storm water culverts draining the pond.

This pond is located within ½ mile of a series of ponds that are seasonally connected to the Menomonee River and less than ¾ mile from the river itself. It was easy to foresee the crayfish moving to the river since they are known to crawl across land during wet weather and during fall migrations. A search of the surrounding area determined that a shallow storm water pond at the local Police Department was connected to the Esquire Estates pond. Trapping for the crayfish determined that they had likely walked between the two sites. In October 2009, another population was reported about 60 miles south of the Germantown population within ¾ mile of the Lake Michigan shoreline at Sam Poerio Park, City of Kenosha. There was no obvious connection between the populations.

A suite of control efforts including barrier fencing, trapping, chlorine treatment and Pyronyl 303 (insecticide) treatment were identified and employed. Pyronyl 303 is botanically derived from chrysanthemum and is acutely toxic but doesn't persist and may cause fewer long term environmental effects than other available toxicants. Many of the same staff were responsible for work at both locations and built up the expertise needed to carry out control. The control team worked with colleagues at UW Madison who developed crayfish control methods and were able to hire one of their students for the control effort increasing feedback on the development of tools.

Intensive monitoring started in 2010 clearly showed that a gap in funding allowed the population to rebound after a combination of tools including use of chlorine and drawdowns had been successful at reducing the population. The statistics from Germantown were helpful in determining that the nearby police pond should be filled as it was operating as an alternative refuge for the animals. Extensive precautions were taken to ensure that crayfish didn't survive the filling of the pond.

- An estimated $336,558 has been spent so far on eradication, monitoring and containment efforts (does not include LTE costs in the first half of 2012)
- An estimated total of $547,022 will be spent by July 31, 2013 since the projects were initiated

continued

Further south, the pond in Sam Poerio Park, Kenosha was a beloved local fishing pond so filling in the pond was unlikely to receive support from the community. Trapping was conducted in 2010 and trapping yielded just under 300 individuals prior to treatment with Pyronyl 303 in crayfish burrows and chlorine in the water. Following the treatments there were lots of dead crayfish on the shorelines and trapping after the treatment captured 50 individuals. To suppress the population, small mouth bass were stocked. Follow up survey and drawdown showed that crayfish in burrows were surviving the treatment and that small crayfish were present in the pond at the time of retreatment. Ultimately, the pond was filled in partnership with the City of Kenosha and staff from the Department of Public Works.

Ongoing work includes planning for Esquire Estates, the original site where the red swamp crayfish were reported, registration for the use of Pyronyl, meeting with industry and others to encourage tool development to control crayfish. The crayfish were likely used during the school year and released when teachers and students chose not to kill them after classes were over.

Yellow Floating Heart

The invasive aquatic plant yellow floating heart (*Nymphoides peltata*) was discovered by a chemical operator. This plant is listed under Wisconsin's Invasive Species Rule as a prohibited plant for its ability to cover shallow, slow moving water systems completely and shade out other aquatic plants. It is difficult to remove as this plant has seeds that survive up to 5 years, can grow from leaf or stem fragments, and produces a robust underground rhizome that sprouts when damaged. As the plants were growing in two small landscaped ponds the source was intentional introduction. The resident who introduced the plants saw them growing in another area where he dug up and brought back a clump to plant in these ponds not realizing that they were invasive.

The two ponds are located in an apartment complex and are 500 and 900 yards away from Delevan Lake. The chemical operator contracted to treat the ponds reported the plants as he treated the ponds in 2007 but it returned in 2008 and after it had been treated again four times it was realized that this plant could be problematic. This was followed by manual removal of remaining plant fragments by DNR staff in 2008. Monitoring in 2009 found that this effort was unsuccessful and that yellow floating heart was still abundant in both ponds. A $20,000 response grant from the DNR Aquatic Invasive Species program was awarded and with a match from the Town of Delavan the ponds were excavated, relined and refilled. Monitoring identified that several fragments of yellow floating heart survived and were manually removed in 2010.

- Dredging two ponds and installing two liners: $39,875
- Grading slopes, reestablishing vegetation, remove rocks: $14,275
- Total Cost : $54,150 (no staf time included)

The success of this project can be attributed to the report that came before the plants had spread to Delevan Lake, setting the goal of eradication early and planning out the operations prior to starting work, and accessing the resources needed to remove and contain the plants.

continued

POLICY AND PLANNING: "MESSAGES FROM A CROWD ARE DIFFICULT TO UNDERSTAND" — TOOLS TO ASSIST DECISION MAKING FOR AQUATIC INVASIVE SPECIES RAPID RESPONSE.

Michael Hoff, *U.S. Fish and Wildlife Service (USFWS), Minnesota*

An example of a very rapid response to an aquatic invasive species comes from an Australian open marine harbor. This response was enacted when a boat carrying black-striped mussels was discovered in the harbor. This species was a known concern and the area was treated within 4 days and all boats that left the harbor were chased down and inspected and treated. This type of response is difficult to enact in areas with overlapping jurisdictions and competing interests.

Rapid response as supported by the USFWS is undertaken with a plan for eradication. Attempted eradication is recommended before a newly introduced species becomes distributed beyond a range where efforts are effective, efficient, and environmentally sound. Rapid assessment is undertaken once a species is discovered to identify what options are available for action. This assessment is carried out in the field to determine the abundance and distribution of a newly detected species. Rapid risk assessment is the process of predicting the ecological risk posed by previously unknown organisms. The predicted risk from the assessment process is evaluated by a team or decision maker who makes a call based on the risk, resources and likelihood of a desired outcome.

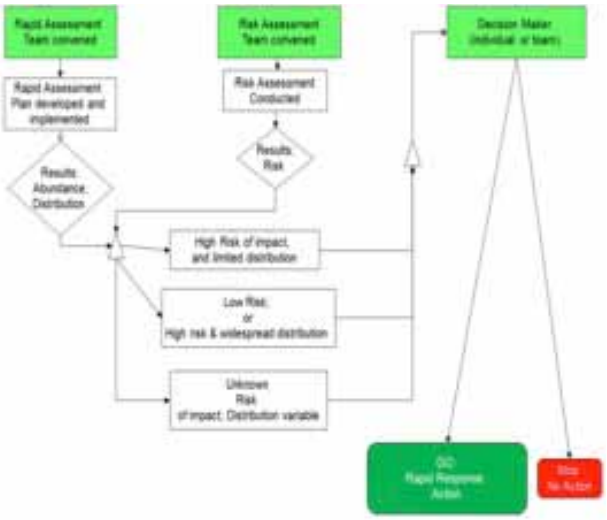
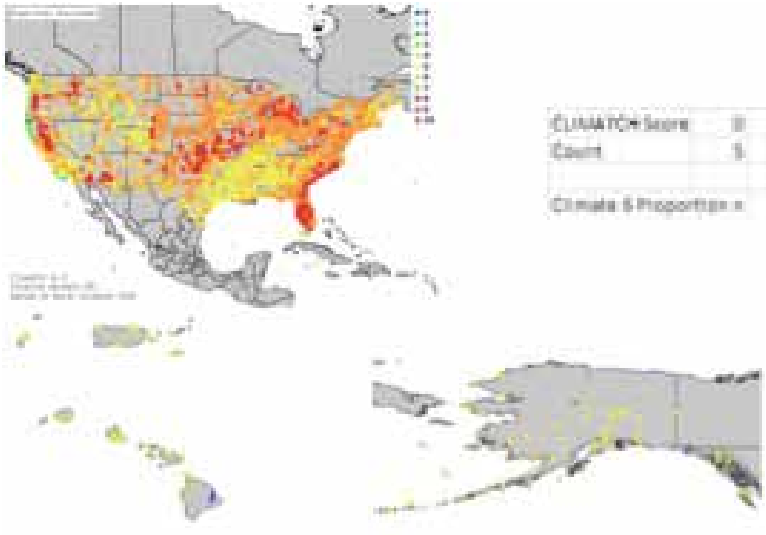


Figure 1. Draft decision tree for aquatic invasive species risk assessment and decisions.

The Great Lakes Restoration Initiative 2010-2014 Action Plan identified the goal: develop a comprehensive program for detection and tracking newly identified invasive species in the Great Lakes. The USFWS surveillance plan is species based and probabilistic taking into account past history of introductions and invasion. Sampling will focus on select locations and use both traditional and eDNA methods. States have been provided with model rapid response plans and regional rapid response plans developed by the Mississippi River Basin Panel on Aquatic Nuisance Species and others. Funding is available for states to develop, test, and implement aquatic invasive species response plans that are specific to their agencies and partnerships. To test the response capacity to potential finds within the region the USFWS will hold 22 mock exercises by 2014. Preparing for success is important through fostering existing pathways for communication and building experience working together through training in Incident Command System.

continued

In addition to the support provided to states to develop plans, the USFWS has taken concrete steps, including the stockpiling of rotenone ($1.5m) for response to new finds of invasive fishes. Sampling with both traditional methods and eDNA is being conducted and the results are shared across jurisdictions. Planned sampling through the USFWS early detection program can be modified to support local rapid response efforts by shifting monitoring efforts to provide additional surveys for local finds. Other tools that the USFWS is working to provide include risk assessments to guide the level of the planned response.



- History of Invasivesness: . . . . . **HIGH**
- Climate Match: . . . . . **HIGH**
- Overall Risk Assessment Category: . . . . . **HIGH**
  - Certainty of Assessment: . . . . . **HIGH**

Figure 2. Risk Assessment elements from the Stone Moroko (*Pseudorasbora parva*)**.**

There have been valuable lessons learned from the Eurasian ruffe invasion. Ruffe were probably in the Great Lakes for at least 3 years prior to identification highlighting the need for early detection capacity. Qualitative risk assessment was problematic as agencies expressed different opinions on the on the level of economic and ecological harm. The lesson was that a common language for risk assessment would have helped establish a similar understanding of the low level of risk. For more discussion see the discussion by Horns et al, 2000, "Seasonal changes in ruffe abundance in two lake superior tributaries: implications for control."

When faced with the decision to not to take action or to take action by implementing integrated pest management to control the abundance and distribution of Eurasian Ruffe there were arguments that all control methods lacked specificity and would cause widespread harm. Residents from the Great Lakes where the Eurasian ruffe was not established wanted "rapid, aggressive action to control ruffe" while those living adjacent to the waters colonized by the ruff wanted no chemical treatments. Additional background work to improve the public's understanding of the chemicals that were being proposed may have reduced the level of opposition. There was no clear window in which the species was more vulnerable as is the case with the control of lamprey.

continued

The projected impacts from the ruffe were not uniform across the Great Lakes and so control would have uneven costs and uncertainty about the benefits to the water users across the system. More importantly, a narrow assessment of the impacts at the invasion site did not justify a response while a larger view of the national or international resource impacts would have pointed towards the advantages of acting.

About twenty years later, the resources required for a rapid response remain largely the same. Contingency funding is needed to put resources quickly where they are needed. There is no pool of funds and carryover authority is highly limited. Any requests require a budget cycle to complete. The requirements for any Federal funds include environmental compliance and permitting which may be able to be pre-staged if the species and type of response can be predicted. The lack of a clear decision maker or unified command system blocked action in the case of the Eurasian ruffe but could be overcome with advance agreements as to the roles and responsibilities of the partners and the decision framework.

The toolbox for specific and effective tools remains largely empty. Research is needed to develop effective, efficient, and ecologically sound approaches to eradicating aquatic invasive species that pose a high risk of establishment in the Great Lakes. U.S. Geological Survey (USGS) researchers and others are working to find control treatments but these still largely rely on toxicants. The use of some of the tools available for control is likely going to be constrained by public opinion about the utility and desirability of chemical control.

By far, the greatest return will be from the efforts to block the ongoing introduction of invasive species by working to filter invasive species out of the largest pathways into the Great Lakes. Of the key pathways:

- ballast water treatments and protocols are underway;
- inter-basin connections have been identified and some have been mitigated; and
- organisms in trade have been identified in aquaculture, aquarium trade, water gardens, bait shops, sport fish stocking, and live food, and work remains to be done.

Ideally there are actions to change ecosystem management to change the ecological resistance to future invasions, but until evidence is found that this is effective, the development of better response tools and pathway management will be where the USFWS will focus.

We need systems that are able to help us prioritize what should be targeted for rapid response. A promising collaboration with the University of Minnesota is working with pathways, species, and locations that together create a predicted and site specific risk for a given invasive species. The balance of actions, outreach, containment, and research will vary based on where a species is in the invasion process. The tools will be used to help identify where the greatest good can be done with limited resources. Species risk assessments, and pathway risk assessments are a part of this effort. The combination of pathway and species risk assessments can help prioritize where detection and response efforts are ultimately focused. Specifically, one of the tools being used is a Bayesian network to help combine a set of multiple risk assessments.

POLICY AND PLANNING: RAPID RESPONSE EFFORTS IN WISCONSIN

Bob Wakeman, *Wisconsin Department of Natural Resources*

Some aquatic invasive species like purple loosestrife have been managed over the long term with biocontrol and partnerships with groups to help distribute the weevils that control purple loosestrife. Some species like rusty crayfish have triggered response early on, but this response subsides as the species becomes more "integrated" into the ecosystems. Private ponds have recently resulted in the introduction with Vietnamese water celery, hydrilla, red swamp crayfish, and invasive species that have the potential to spread to Wisconsin's lakes and are likely to provide new introductions that will have to be evaluated for a response.

continued

Currently there is no rapid response plan for Wisconsin. There is a 1995 aquatic invasive species plan that was written by DNR fish management staff but this was not finalized. A rapid response plan is being developed for Wisconsin due to support from the U.S. Fish and Wildlife Service (USFWS) and funding for an ongoing program which provides capacity to plan and staff a response. The downside of a species by species planning approach is that there are almost an unlimited number of species that these plans could address. Wisconsin's goal will be to write a general plan that provides a framework for how to stage a response.

The Rapid Response Process for the AIS Partnership:

- ✓ Early Detection and Reporting
- ✓ Verification
- ✓ Notification
- ✓ Rapid Assessment
- ✓ Planning
- ✓ Rapid Response

The challenges for early detection and reporting are many and include addressing small ponds, either private water garden ponds or storm water ponds where species are planted and can escape to neighboring waterbodies. The importation of large numbers of live animals through bait sales and stocking is another pathway that is outside the typical monitoring area for most natural area managers. While Wisconsin has both paid staff and an army of volunteers through partnerships with Citizen Lake Monitoring Network and Project RED with the River Alliance, there are gaps in coverage especially for urban ponds, harbors, and businesses that import and distribute live animals.

Verification is another challenge as it takes a fleet of experts to cover all species of interest. There was a situation locally where a red swamp crayfish was intercepted in Waupaca, Wisconsin and it turned out to be a native white river crayfish. Trained DNR staff that can verify and identify finds quickly along with a network of national and regional experts for less frequently encountered species are both needed. A recent workshop held by University of Wisconsin La Crosse professors increased the pool of trained identifiers for snails and provided collections for research. Encouraging opportunities like the La Crosse example will reduce gaps in our network of identifiers.

A notification protocol has been developed for the DNR's Aquatic Invasive Species Team and partners. The flowchart depends on the extent of the anticipated interest in what species are found and that depends on whether or not it is a new find in the state, a regulated species, or is in a critical waterbody. For multi-jurisdictional waters which includes most of the Great Lakes this is an ongoing challenge. The rapid assessment element is crucial and includes delimiting the population and evaluating the risk that the species could pose to ecosystems in the area. The assessment includes the biology, current established range and the local resources that are at risk. For smaller local events like the discovery of yellow floating heart in a stormwater pond, local staff can assess the risk, extent of the population, and feasibility of control. The USFWS is in process of developing tools that would quickly determine if a newly discovered species poses a threat to natural resources for species that have not yet been encountered locally.

Planning starts with an inventory of resources: people, money, equipment, legal authority, and enforcement personnel. A successful model to bring together these components from multiple agencies, levels of government, and jurisdictions is to use the Incident Command System (ICS) to coordinate response activities. The ICS was used during the Asian carp response in the Chicago Area Waterway System when hundreds of individuals from numerous states and federal agencies responded to the call for assistance. Bringing together all of the agencies to plan for a response where jurisdictions overlap is a challenge. Once there is a finding, the process of making the decision to attempt a rapid response and mobilize resources should follow from the communication and planning that have been done in advance. The response can swamp the local staff and capacity to respond. The ability to mobilize additional staff, funding and equipment over the likely timespan of the response is challenging and will remain a barrier to success as long as the financial burden falls on the existing operating budget. The establishment of an emergency fund would improve the ability of the DNR to plan for responses.

continued

When the goal of a control effort is eradication, extensive investment in monitoring and evaluation is necessary for determining if the operation was a success. Because of the time intensive nature of follow up, partnerships are needed to ensure adequate coverage of the sampling and monitoring. For any control effort or rapid response effort, monitoring should be part of the planned response to ensure that the management goals have been successful and even if they are not, to better prepare for future efforts. Finally, restoration is an area that has not been fully implemented in aquatic systems. The red swamp crayfish and yellow floating heart examples that Heidi Bunk described concluded with an effort to stock bass, but most of the systems that have been the target of past efforts are very small and highly urban so have not been a target for conservation work.

Would we do better on rusty crayfish today? This is not likely, as there are still big gaps in our ability to respond and we are limited by having very few toxicants and almost no species specific tools. At this point, research on a parasite is being forwarded to help establish large scale control. If there are still limited tools to respond then eradication can't actually be the goal. The goals of rapid response can be containment, population reduction to reduce spread, or eradication.

The DNR Aquatic Invasive Species Team is building a rapid response framework that is targeted for completion by February 2013 with an initial draft out by September 30, 2012. The framework can viewed as an opportunity to build a DNR wide rapid response plan and identify common needs and resources that could be shared across programs. To prepare for future discoveries a full time rapid response team coordinator, funding, and table top exercises are all planned for development.

Table 1. The status of Wisconsin's Aquatic Invasive Species rapid response resources and known gaps.

Activity	Currently	Room to improve/evolve
Early Detect & Reporting	Partnership members	Greater reliance on statewide coverage
Verification	Existing access to technical experts	Expand relationships with local experts statewide
Notification	Good notification plan for relatively simple cases	Not prepared for AIS in multijurisdictional waters
Rapid Assessment	Need to beg borrow and steal time from existing staff	Need resources to accomplish this more efficiently
Planning	Falls on Regional staff with some Central Office support	Not prepared for AIS in multijurisdictional waters
Rapid Response	AIS Rapid Response Grants afford minimal financial support Hard to sustain multiyear effort with current resource level	Need dedicated bank roll to fund expensive response activities Need dedicated statewide team to take pressure off regions
Monitoring and Evaluation	Handled locally with regional staff	Need to recognize the time commitment and work plan
Restoration	Not much experience with this so far	Need dedicated bank roll to accomplish this

POLICY AND PLANNING: RAPID RESPONSE TO NEWLY ESTABLISHED INVASIVE SPECIES — NATIONAL AND FEDERAL EXAMPLES.

JoAnn Cruse, *USDA, Animal and Plant Health Inspection Service*

The basic steps in a U.S. Department of Agricultural Animal and Plant Health Inspection Service (APHIS) emergency response are: survey and delimit infestation, containment and treatment, and eradication or control. For pests that may be of quarantine significance elsewhere follow-up to treatment includes re-establishing trade partners once containment is demonstrated. Whether it is a finding of bovine spongiform encephalopathy (BSE also known as mad cow disease) or citrus canker the countries that do not have these diseases want assurance that the U.S. is not spreading these pests and diseases before trade is resumed.

Before a rapid response is needed the USDA may establish Memorandums of Understanding with states and tribes for the highest risk pests. Table top, functional, and full scale exercises are three increasingly involved levels of practice that pull together the staff and groups that would be called on for an actual response. This practice highlights issues that may arise during a response and increases familiarity between the partners and opens up communication. Plans for priority pests are improved after each exercise and are updated annually and each plan is generally species specific to account for behavior and control tools specific to each species or group of species.

A general timeline for a response to a new find would be as follows:

Day 1: A specimen is submitted to state or federal office.

Day 2/3/4: Forwarded for identification to APHIS identifier and possibly Systemic Entomology Lab (SEL)

Day 4: Results sent to State Plant Health Director (SPHD)/ State Plant Regulatory Official (SPRO)/ APHIS Headquarters with determination of pest and if not found in U.S.

Day 5: New Pest Advisory Group (NPAG) in APHIS meets to determine if pest is of significance to U.S. and requires action. If not significant, defer situation to the state.

Week 1 *(concurrent actions)***:**

- Local, state, and federal staff assess the site/situation with known (if any) biological data available. Assess risk and need for safeguards. Consider biological timeframes.
- Determine authorities for action — refer to existing memorandums of understanding and response plans. Consider quarantine options.
- Work together with local officials/business if press release and coordination is needed.
- Determine if Incident Command System (ICS) will be used. If there are federal funds involved then use of ICS is required.
- Identify available survey methods and staffing needed. Consider additional federal staff needed and whether or not National Incident Management Teams (NIMTs) will be mobilized.
- Identify available funding or request funding — by state and federal offices.

Week 2:

- Initial staff report for duty w/ assignments.
- Determine equipment and staffing needs. If not enough locally, request assistance from APHIS (if applicable). Use Resource Ordering and Status System (ROSS) for nationwide support.
- Establish quarantine on known infestation

continued

The problem of swamping local resources with a large scale response is one that APHIS has addressed through pre-formed National Incident Management Teams (NIMTs). There are four of these teams nationally and the staff are in an on-call status on rotation. Each team has 16 members. If activated, the team members are on for 30-45 days at a time. A small version of this team system was activated locally when emerald ash borer was found in La Crosse. The team was called in to help coordinate the communication and approach amongst the states and two APHIS regions. The teams require a delegation of authority with the Unified Command being led by the state plan regulatory official being the lead.

The response can be very expensive and last months or be over very quickly. The federal agencies may be backing off initiating new responses as the number of finds has been increasing over the past decade with increasing trade. One example of quick evaluation leading to the reversal of a response mobilization was soybean rust. This quarantine lasted 2 weeks as it became obvious that there was no way to contain this pathogen.

Other responses are longer term. For Asian longhorn beetle contracts for staff, rent, and communications are $5,000,000 per year for New York and Massachusetts. While removal of trees is more cost effective even with the larger up-front investment, in the long run public perception weighs in and often wins even if the method preferred means that it will take longer to eradicate the population. Some of the staff brought on previously as permanent positions for some responses have had to be reassigned so the agency is moving towards term positions for more flexibility. Generally, states and tribes can apply for funds to continue or develop local rapid response efforts. Planning for the exit strategy should be considered early on.

RESOURCES: WISCONSIN DNR'S SUPPRESSION SUB-GRANT PROGRAM.

Courtney Ripp, *Wisconsin Department of Natural Resources*

The only dedicated funding source for controlling terrestrial plants is the pass through funding from the U.S. Forest Service. These funds have been used to address weedy species in forested communities that could pose a threat to forest resources. From 2004-2013 the total amount awarded was $200,000. Grant requirements are minimal and include 1:1 funding match of non-federal funds, reporting for acres treated and herbicide used, and a progress report for the control action.

These suppression projects have been a mix of species that are not widely established in Wisconsin and some that are widespread in some parts of the state but still limited in other parts. To date, ninety three projects have been supported and twenty species that have been targeted for control. The extent of naturalized populations of the species targeted is not generally known prior to the control effort taking place. Japanese hedge parsley efforts exemplify how a lack of effective detection led to a series of responses that in hindsight were not justified given the distribution. While lack of information on the distribution makes the success of any individual project impossible to estimate prior to starting control, it has led to 21,000 acres being surveyed for these targets expanding DNR's knowledge of the location of priority species.

The top priorities for funding are species that are prohibited by Wisconsin's Invasive Species Rule (NR 40), new populations of previously identified "early detection species," and the leading edges of known populations. Other priorities include State Natural Areas, high quality lands protected for conservation, or sites that pose a high risk of spreading invasive species. The lowest tier of the funding priorities includes previously funded projects requiring follow up, managed lands, and species that are not regulated. The grant period is open and within the limits of the federal grant period the small grants are relatively open.

continued

The funds expended are enough to cover a very short term project or a limited amount of supplies. The involvement of the partners including not-for-profit land trusts, "friends groups," and cooperative weed management area groups has not been adequate to sustain interest in larger scale projects or build local capacity to conduct survey and control work. Contractors who are otherwise engaged in restoration projects are one of the main groups of recipients. There is room to increase collaboration between land managers at the local level and improve oversight and engagement.

POLICY AND PLANNING: LESSONS FROM EPIDEMIOLOGY — INFECTIOUS ZOONOTIC DISEASE PREPAREDNESS.

Suzanne Gibbons-Burgener, *DVM, PhD,*
Wisconsin Division of Public Health

West Nile Virus (WNV) established in 1999 in New York City and by 2002 there were cases in both animals and humans. This disease likely arrived a bit earlier but it took some time to detect. The response may not have been a rapid response as it took more time to plan than the disease took to establish and spread. The multi-agency response to this outbreak included public health departments and the federal Centers for Disease Control and Prevention (CDC) which was also the source of funding to states.

A broad network for monitoring for the arrival of the disease gave advance notice to health departments and hospitals to prepare and for susceptible livestock to be vaccinated. Federal funding for surveillance allowed for dead corvids to be reported to "dead bird hotline" which was an important early warning. The federal funding has diminished but dead bird surveillance continues at a lower level with support from the U.S. Fish and Wildlife Service. Locally, the Department of Agriculture Trade and Consumer Protection was involved as there were equine cases. Federal staff from U.S. Department of Agriculture – Veterinary Services and local health departments took samples, collected dead birds, and took on other tasks. The health departments have a variety of rules that can cover the local application of pesticides required for mosquito suppression that spread WNV so planning prior to outbreaks included permitting. The University of Wisconsin Veterinary School, Entomology Department, State Lab of Hygiene, and State Diagnostic Lab were all participants in the effort to collect, process, and test samples. The National Wildlife Health foundation was one of the core testing facilities for the nation and the Marshfield Foundation provided research support. Activating this network required planning and resources dedicated towards coordination. The disease had national reporting requirements and through this developed the framework or at least identified the pathways for communication diseases that emerged afterward WNV spread across the continent.

The response to WNV was to promote steps to reduce the risk of transmission through mosquito abatement. There was quite a bit of effort expended providing outreach about sources of information until USGS developed a hub for arboviruses (Arbonet) to consolidate reports across multiple local agencies. Other diseases that have since benefited from the network and mapping tools include Eastern equine encephalitis (EEE).

Figure 3. The Arbonet map for human cases of West Nile Virus in Wisconsin as of August, 2012.

continued

A lesson has been that inadequate risk communication can lead to under preparedness by local communities. The Easter Equine Encephalitis outbreak was larger than it should have been due to a lack of vaccination for horses. Working out how to share data has known barriers including the Health Insurance Portability and Accountability Act of 1996 Privacy Rule (HIPAA), and the diagnostic labs restricting who shares their data. The encephalitis outbreak led to the establishment of a form that greatly facilitated data collection and sharing based on balancing privacy and actionable information. This has become a lesson learned: a species that has already been the target of a response becomes a template for future responses for species that are less well known.

Knowing your partners ahead of time is key. When monkey pox was introduced to the United States in May 2003 the first indication that something was wrong came from several reports of folks with fevers and pox. There was also a dead prairie dog that was sent to a veterinarian after it died after biting a child in a household where the mother also got sick. After the veterinary diagnostic lab received tissue, the obvious was ruled out including tularemia. The labs had identified a pox virus. Some of the prairie dogs had been acquired at a swap meet at Wausau, Wisconsin and the origin was a distributer from out of state who brought in animals from Texas and Illinois. The distributor also imported Gambian pouched rats and housed them with the other rodents in his collection. The pox virus turned out to be monkey pox and the vectors were the captive rodents. An emergency order was placed by the CDC that forbade the import and possession of high risk African rodents. Locally, the DNR was left asking, "Were wild rodents exposed?" The swap meets were held outside so the follow up included APHIS trapping the area. The National Wildlife Health center provided the testing of the rodents that were recovered. The Wisconsin Veterinary Medical Association communicated with the veterinarians who might have been exposed or have clients with the disease. What really improved the outcome was that they had all previously worked together.

If everyone working in the field identifies with the goal of "One Health," that points to sharing information about human health as well as animal health. Intrastate communication and the University of Wisconsin system have connections to the testing programs at other facilities. The producers around the state are not formally linked in but they are an enormous passive detection resource who closely monitors their animals. Conservation groups can have focal species such as a group testing bears and reporting unusual outbreaks. Intrastate communication is important for having an early warning system for diseases and species that may be imported.

Don't wait for a crisis to exchange your business cards. A successful response to invasive organisms requires investment and participation in advance. Engagement and ongoing participation in advance in common meetings, planning, and trainings can increase awareness, trust, and connections. Having an understanding of the epidemiology and ecology of a species can help with planning but responding is about relationships. The investment reaps returns at a small scale on a daily basis and a huge return during times when there is a crisis situation. Specific issues when confidentiality is a concern include compatible data sharing, common protocols for data collection and entry, virtual private networks, and other tools. When there is an outbreak, people still need time to hold down the fort. Exhaustion from being assigned to a crisis isn't just an issue for the staff; it can lead to gaps in the ongoing programs that are the focus of their work. Having a pre-staged pool of both human and fiscal resources can keep networks ready for rapid response and continue day to day operation.

GAPS

Know your target

Some species that are likely invaders in Wisconsin can be planned for by maintaining good regional and national communication about the spread of known invasive species. Others may be discovered and be relatively unknown. Having a library of risk assessments and a directory of taxonomic experts would potentially reduce the amount of time spent determining if a species is likely to spread and become invasive. Turning those risk assessments into control plans requires access to very high quality data about the location, distribution and abundance of the target species. Building the capacity to develop maps and use that information in combination with risk assessments would allow high priority species that are good candidates for rapid response to be prioritized.

Communication networks and practice

A successful response to invasive organisms requires investment and participation in advance in order to be successful. Those likely to be involved in a response should have opportunities for engagement in the issues as they arise and ongoing participation in advance in common meetings, planning, and trainings. This background work can increase awareness, trust, and connections. It can also create a common language that will reduce miscommunication when a response is underway. Having an understanding of the epidemiology and ecology of a species can help plan, but responding is about relationships. The investment reaps returns at a small scale on a daily basis and a huge return during times when there is a crisis situation.

Ready resources

If the response to a new invasive species is delayed by waiting for the next grant funding cycle or state biennial budget request, the opportunity to contain the population may be lost. Currently, there is no revolving fund for state priority species and the funding available to federal agencies to respond to national priority species has been both reduced and spread over an increasing list of invasive species. This lack of resources is likely to result in more species becoming established even if they are found and identified early.

A standing rapid response team not actively engaged in a response should be building skills by working on control projects and conducting monitoring and survey work. This would also improve our ability to identify staff with adequate training, licenses, and skills to successfully mobilize a response. These teams will likely need to include members from multiple agencies, and working together in advance of a rapid response effort will build experience.

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

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