Indicators for Narragansett Bay Region
Invasive Species
WORKSHOP SUMMARY
Wednesday, December 15, 2010

Meeting the goals for this workshop:

1. **Develop consensus around communicating invasive species to the public on Earth Day 2011**. *We agreed in concept with the matrix developed and presented by David Gregg. We recognized that the public may need a simplified message with examples of invasive species. Our message will be most powerful if we can include economic data on the costs imposed by invasive species.*
2. **Identify monitoring and research priorities for advancing an indicator of invasive species in the Narragansett Bay watershed.** *The group endorsed reconvening the Invasive Species Council, particularly for freshwater and terrestrial species. Marine aquatic species are coordinated under CRMC's Aquatic Invasive Species Council. We recognized that our monitoring for invasives is limited. Volunteer surveillance can be helpful but some species do not lend themselves to volunteer monitoring. We identified potential funding for invasive monitoring/management through the RI Bays, Rivers and Watersheds Coordination Team (CT) habitat restoration coordinator. We identified the need for economic data on the impacts of invasive species. Coordination with MA is needed to cover the entire watershed.*

SUMMARY OF PRESENTATIONS AND DISCUSSION

Invasive species indicators used in other states/countries (Lesley Lambert)

National Estuary Programs throughout the country (there are 28) are required to evaluate the status and trends of their watersheds. A few include invasive species primarily as a descriptive component of the assessment. Programs in Europe (Natura2000) and New Zealand provide comprehensive documentation of the areas threatened by invasive species. Copies of these reports will be posted on the indicator web site.

What is our definition of invasive species? (Hope Leeson)

Species that become invasive have the ability to survive a multi-step process of arrival, establishment and dispersal into natural communities. Components of the definition to consider include:

- Native to other continents, or other parts of North America, but which are not indigenous to RI.
- Has the biological potential for rapid and widespread colonization of habitats where it can out-compete native species.
- Has the biological potential for dispersing over spatial gaps, away from the site of introduction.
- A species that causes harm and impact. Some cause environmental harm – phragmites outcompetes other species, including rare species, and has hybridized with our native Phragmites. Some cause economic harm (overgrown stone wall producing economic

harm to those who re-built the wall – an iconic landscape element). Some cause harm to human health (Japanese barberry linked to deer ticks and Lyme disease).

Case studies of invasive species in Rhode Island

1. Japanese stiltgrass (Hope Leeson). Japanese stiltgrass provides a useful example of a species vector. It is an annual grass that colonizes rich woods, roadsides, and powerline rights-of-way. It is native to eastern Asia and was first recorded in the US in 1919. It was found in CT in 1984 and was first documented in RI in 2005. The grass seeds are barbed and adhere to fur, so they are carried by deer and other mammals. The seeds are also found in mud and can be carried by tire treads and boots. Over time, it is possible to observe and track stiltgrass spreading from the original point where seed was deposited, along paths followed by mowers, skidders, bikes, hikers and small mammals. Stiltgrass was found this year in pristine riverine and alluvial woodland.

This species is somewhat hard to identify, so not likely to be a species that can be identified by the public. It is being managed at some sites through RINHS's Forest Health Works Project. Seeds stay in the seed bank for at least 7 years. The best time to manage is by mowing in early to mid-September because it prevents the plant from spreading its seeds.

2. Kudzu (Hope Leeson). Kudzu is a good example of a species that will likely be coming to RI due to climate change. Kudzu is native to China, where the roots are foodstuff, and was introduced in Philadelphia as an ornamental in 1876. It was introduced to southeastern US in the 1930s as fodder and to prevent erosion. It is a vine in the pea family and is widespread in the southeastern US states. Kudzu grows rapidly, as much as a foot a day and is causing real economic damage to forestry businesses. Studies in Switzerland have documented reductions in native plant and arthropod species due to the invasion of Kudzu. Kudzu is winter hardy in zones 5 – 10, drought tolerant and can thrive in a wide range of pH (3 – 8). Kudzu reproduces by seed up to zone 7 (RI is just outside of Zone 7 according to the USDA Plant hardiness map 2009). An increase of 5 – 10 degrees will put RI into Zone 7. Kudzu was in New Haven 1978 and Greenwich CT in 2006. In Massachusetts, it was documented in Barnstable in 1987 and in Marblehead in 2006. Although the New England populations are producing seed, it does not appear at this time, that they are reproducing by seed.

3. Forest Health Works Project and Japanes barberry (James Barnes). The Forest Health Works Project, an RIDEM/RINHS collaboration funded with federal stimulus money provides insight into the staff and resources needed to create a comprehensive invasive species program. The program focuses on forest invasives and to date has identified about 20 species of interest.

Japanese barberry was introduced in 1800s as an ornamental plant. It's vectors are seeds (spread by mammals and birds) and vegetative expansion of a population. Japanese barberry spreads from disturbed sites, and is used by humans in residential plantings. Barberry is very shade tolerant and grows in moist, fertile soils so it is invading prime forest habitats. While it grows, it changes the soil chemistry, promoting conditions that are favorable to barberry. The

Forest Health Works Project has examined about 7 % of the state for forest invasives (53,000 acres). Within this, they have found 219 acres of barberry. The program is also working on eradication. Barberry is very responsive to treatment, and relatively easy to eradicate. Our neighboring states are working to prevent the introduction and spread of Japanese barberry – Massachusetts has banned its importation and propagation and Connecticut has put in place a voluntary phase out of 25 varieties. RI has no rules in place to date, for the regulation of terrestrial invasive plant species.

4. **Emerald Ash Borer (Lisa Tewksbury, URI Bio Control Lab).** This example shows what can happen when a state agency is on top of an invasive species. The work on the Emerald Ash Borer has been funded through the Cooperative Agricultural Pest Survey (CAPS) . RIDEM has led the early detection effort in the state. The Emerald ash borer only attacks ash trees, but once it attacks the tree, it kills it. The larvae feeding inside the tree generally cause tree death in 1 – 3 years. The insect is small, and it leaves a small D-shaped emergence hole. To date, sites in NY are the closest to RI. CAPS has been monitoring for several years using purple prism traps baited with Manuka oil. For 3 years the forest service and DEM has been using bio-surveillance using a particular wasp that feeds on the ash borer and related species. DEM has been doing firewood vector analysis for Asian Longhorn Beetle and Emerald Ash Borer. DEM is outreaching to towns urging inventory of historically, aesthetically, and other ash street trees and planning in advance for their removal and replacement. Biological controls are under study and capacity exists within RI to be involved in any biocontrol that is decided on.

5. **Aquatic invasive species (AIS) RIDEM-OWR (Evan Ross).** DEM has organized data it collected together with data from partners (URI WW and RINHS) and created the first map of the distribution of AIS in RI's fresh waters. The studies have focused on invasive aquatic plants present in the floating or submergent plant communities but has also surveyed for invasive animals when feasible. Since 2007, DEM and partners have gathered data on 107 freshwater lakes. AIS have been found at 66 % of the sites.

Variable milfoil and fanwort. These plants provide an example of species that are widespread and difficult to manage. The two are similar species – both were introduced from aquariums, and both spread by fragmentation. These aquatic plants are transported on trailers and motors from one waterbody to the next. Once introduced, they quickly create thick mono-species strands which restrict flow, clog pipes, limit recreation, and affect property values. The weed beds also affect biological diversity, and lower dissolved oxygen levels when they decay. Variable milfoil is in 47 % of the lakes surveyed, Fanwort is in 38%. The two generally are seen in the same waterbodies, and are spread throughout the state. The plants are also found in rivers. Finding the plants in rivers complicates management. An upstream population will continue to infect downstream waterbodies unless it is also removed. In all cases, management is challenging because mechanical removal does not work since it is a fragmenting species. Herbicides can work, but they are expensive and they don't eradicate the plants.

Water chestnut: The water chestnut is a prolific plant with large barbed seeds. It is found in five waterbodies in RI: Belleville Pond, N.K., a private pond in Foster, Chapman Pond, Westerly,

and Central Pond and Turner Reservoir in E. Providence. The largest infestation is in Chapman Pond where a sector of the pond is matted with water chestnut. The most difficult infestation to manage will probably be in E. Providence, where water chestnut is mixed with other plants and the infestation extends into Massachusetts. The plant affects water temperature and chemistry but it is simpler to manage than milfoil and fanwort. Water chestnut is an annual and only reproduces by seed and it likes to set in soft, mucky substrates. It can be effectively controlled by hand pulling. Volunteer harvesting in Belleville has been quite successful.

Other examples

- **Phragmites**: An interesting example of genetics and invasive species. Like bittersweet, Phragmites has a native species that is difficult to distinguish from the invasive. There is some level of hybridization between the native and the invasive which also makes this more difficult. This raises an interesting question -- at what level would you consider a bio-control that will affect the native species? It also exemplifies how much scientific investment is needed before we really understand what is happening with an invasive species.

- **Invasive tunicates in marine environments**: Rapid assessments have been done – Save the Bay, NBEP, CRMC, MIT Seagrant, and others participated in tworapid assessments in Narragansett Bay. Marine surveillance has issues that surveillance in other habitats does not: there is low capacity in RI (and globally) to identify all the organisms found, we do not know the nativity of many species found in marine habitats, and there are limited effective management tools available for marine invasions. Nonetheless, there are best practices and policy recommendations for marine invasive preparedness that could be implemented if we were working systematically.

- **Snakehead Fish**: An East Asian fish which is a cold hardy, versatile predator. It is tolerant of a wide range of habitats. Snakehead releases have been documented in MA, but it is not reproducing in the wild there to our knowledge. It is reproducing in the wild in the Potomac. Vector in North America is primarily through the live food trade for Asian communities. In RI, we have a very underdeveloped understanding of the live food trade. Learning about and monitoring the live food trade would be a first step, perhaps followed by policy or regulatory steps, depending on what is found to be in local commerce.

- **Asian Longhorn Beetle**: This is a generalist feeder that attacks hardwood trees. Unchecked it has the potential to do no less than change the landscape of New England. There is an infestation in Worcester and track-forward surveying techniques found larva in Rhode Island, in firewood that was transported from Worcester..RI has been as well prepared as can be expected, and has used creative thinking and management. This effort was led by DEM Forestry and DEM Ag using USDA funds that were channeled to the RI Tree Council which has good capacity for outreach and public education. Both public education and systematic surveys targeted at high risk areas were employed. This example is instructive because though the results were good, it was one time funding and the effort has not been sustained. It is also a good example because the direct and indirect cost and quality of life damage from this species in the Worcester area is very high, in the hundreds of millions of dollars.

- **Brown Marmorated Stinkbug:** This insect is a plant feeder and is a serious pest on vegetables and fruit, as well as nuisance to home owners. It was accidentally introduced into eastern Pennsylvania from East Asia in the mid-1990's. It is now wide spread in the northeastern US. Despite the fact that it is conspicuous and good outreach materials exist, its presence in RI, though likely, is not yet officially confirmed. This is an example of how a systematic survey effort, or even just better information handling, would improve our area's responsiveness. Confirmation of its presence, location, and numbers would help agriculturalists to plan.

Review the invasive species indicator matrix described in Appendix B (David Gregg)
What should a metric on invasive species look like? There are various options including:
-- Report quanitative measurements or counts, perhaps mapping or counting sentinal sites, samples, or survey tracks. This is potentially scientifically supportable, but would be expensive to implement at a large enough scale. We don't currently have data or funds to support wide scale mapping. Sample sites or sentinal sites might not change fast enough to show significant change from one cycle to another. The question presents the difficulty of what you count? Certain invasives? Which? All invasive species? That raises definitional issues. This approach also begs the question of management issues and how they are reflected in the indicator.
-- Report a metric based on qualitative assessments of threats, presence/absence, and management responses that allows for an assessment of utility to managers/decision makers.

D. Gregg decided to create a draft indicator that would fulfill the second option – a metric at a larger scale, but one that would allow us to assess whether awareness, prepardness, and management were making the overall "status" of invasive species better or worse.

To avoid prolonged discussion over definitions of invasive species or attempts at making comprehensive invasive species lists, this metric envisions using a fixed set of some 20 or 30 invasive species. Using lists developed in RI and elsewhere, select species with particularly large impact potential or important management challenges.

David presented some advantages to this metric –

- The matrix would give decision makers a sense of the importance of management response to invasives because is showcases preparedness. Economic impact (realized or potential) could be incorporated into the metric through the selection of the co-efficient.
- The ongoing discussion that would be required to create and maintain the list of species, co-efficients, and index values and to carry out each evaluation would promote dialogue among stakeholders that would have many benefits, and would be a good thing to task a revived RI Invasive Species Council with.

Discussion
The indicator project's target audience is state and local decision makers. There was general consensus within the workgroup that the matrix was a good framework for presenting the complicated information on invasives to this audience.

Communicating the information might require another step, perhaps a red/yellow/green light to indicate whether the index is good or bad. Concerns were also raised about the coefficient needed in the matrix. It could take a lot of time and discussion to develop. It is important at all times to consider how the dialog around the index is moving the dialog around invasive species forward. It could be difficult to build the matrix and reach consensus – we should certainly build off work that has been done in the past by the Invasive Species Council and others.

The group raised the following things to consider in

- Marine/terrestrial and freshwater environments should be considered separately. The freshwater analysis may be the easiest because the unit (lake, river) of analysis is clear.
- Could the matrix be used to develop an index for each watershed? For each town?
- Consider grouping species into a) species we know are here and b) species we are keeping an eye out for
- Species list should be developed in cooperation with DEM and others so it captures ongoing work
- Think about the components of invasive species described in Hope's presentation and consider them when selecting species for the list.
- But remember that not every species needs to be on the list.

<u>Moving forward</u>

- Consider reconvening the Invasive Species Council. It has a record of excellent work that we should build off of but there are capacity issues and some disagreement about how to structure the council. It would be important to have the full buy-in of all key stakeholders. Also it is important to recognize that marine invasive species management receives some funding and coordinated through CRMC.
- Funding is an ongoing need. The Stewardship Collaborative has provided limited funding to RINHS to support work on invasives.
- The Bays, Rivers and Watersheds Coordination Team (CT) is planning to establish a position for coordinating habitat restoration. Habitat restoration and managing invasives are tightly linked.

What do we want to communicate on Earth Day 2011?

Recognize that in communicating on Earth Day we are reaching a broader audience than our target decision makers.

- Include strong examples (case studies) with economic information if possible
- Recognize that this is an opportunity to educate people about these species.
- Include a positive message – here is what you can do! Talk about vectors, perhaps specific to the community (eg. Nurseries within the community)
- Include personal stories

- Keep a clear message – identifying what needs to be done. It would be best to include a go-to person or agency.

What are some research needs?

- Data on the economic impacts of invasives. Collecting good data and bringing it together will take some work.
- Do we have data on the chemicals used to treat invasives? What are the cumulative impacts of these chemicals? Could we put together a time series of applications? The RINHS began looking at this issue and found that there is some data, especially for aquatic systems. It is difficult to determine if the applications are to remove invasive plants or native plants that are too prolific.

APPENDIX A

Workshop Participants – December 15, 2010

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APPENDIX B

Rhode Island Invasive Species Index

Invasive Species Indicator—Strawman 1

by David W. Gregg, 12/3/2010

We propose an invasive species index that focuses on preparedness and response (management). It could be useful alone for stimulating and guiding agencies, non-profits, and others or used in conjunction with other indices that focus more directly measures of invasive species' environmental or economic impact or potential impact.

What follows is description of the index and the process for developing and using it, followed by a made-up example of the index applied to two time periods and a work-flow diagram.

To avoid the difficulties inherent in making a comprehensive list of invasive species, this index relies on a list of **index species** chosen by an **invasive species index committee** based on a pre-determined set of **index listing criteria**. This would be similar to how the Dow Jones Industrial index is a useful indicator of stock market trends even though it represents only a small sample of all the stocks on the market. Like the Dow Jones, the invasive index species list would be reviewed periodically and species could be added or removed with due consideration of the effects of such changes on the comparability of the index value over time.

Each index species would be given an **impact coefficient** based on biological, environmental, economic, and other criteria. The criteria and the coefficient for each species would be developed and periodically reviewed by the invasive species index committee.

Initially and for each **index period** (perhaps three to five years) the index committee would rate the preparedness and responsiveness of agencies, non-profits, communities, and the general public to the each index species on an integer scale. **Rating criteria** for each position on the scale would have to be established in advance of the first iteration by the index committee. A sample scale is provided in the example below.

To develop the index, each species' rate is multiplied by its impact coefficient and all are summed. The sum of ratings, adjusted by coefficients, for all the index species at each review interval is the **Invasive Species Index**.

It would require a bit of work by the index committee to establish the index listing criteria, list of index species, impact coefficients, and rating scale but once this was done, the committee would meet only periodically. The initial work might make a good target for grant funding. Furthermore, the work of creating and maintaining this index would be tremendously valuable because it would require regular review of the invasive species situation outside and within Rhode Island and regular communication among stakeholders.

Example Invasive Species Index Application:

TIME 1	impact coefficent		Preparedness and Response Rating					
index species		not present, not likely	species not known in RI but in neighbor, or known vector present in RI; detection plan in operation in RI	known from restricted sites in RI; w/ mngment response	known in neigbor or vector present, no detection plan in RI	known to be widespread in RI; w/ mngment response	known from restricted sites in RI; NOT under management	known to be widespread in RI, NOT under management
Rating value		0	1	2	3	4	5	6
mitten crab	0.9				2.7			
water chestnut	0.7		0.7					
barberry	0.4							2.4
emerald ash borer	0.6		0.6					
kudzu	0.6		0.6					
fire ant	0.2	0.0						
zebra mussel	0.4			0.8				
asiatic clam	0.2						1.0	
INDEX								8.8

TIME 2	impact coefficent		Preparedness and Response Rating					
index species		not present, not likely	species not known in RI but in neighbor, or known vector present in RI; detection plan in operation in RI	known from restricted sites in RI; w/ mngment response	known in neigbor or vector present, no detection plan in RI	known to be widespread in RI; w/ mngment response	known from restricted sites in RI; NOT under management	known to be widespread in RI, NOT under management
Rating value			1	2	3	4	5	6
mitten crab	0.9			1.8				
water chestnut	0.7						3.5	
barberry	0.4					1.6		
emerald ash borer	0.6				1.8			
kudzu	0.6		0.6					
fire ant	0.2		0.2					
zebra mussel	0.4		0.4					
asiatic clam	0.2							1.2
INDEX								11.1

Notes on example:

Overall, the index went from 8.8 to 11.1, indicating overall increase in "urgency" around the invasive species issue.

Mitten Crab versus Water Chestnut: No organized detection plan was in operation for mitten crab at TIME 1 so it added more to the index than water chestnut. By TIME 2 a chance detection of crab was made. Because a management plan was put into operation right away, the rank didn't jump all the way to 5, thus rewarding rapid response in contrast to water chestnut where no management was put into action at a time when it could have been most effective.

Barberry: At TIME 1, barberry is widespread and there is no coordinated plan to deal with its impacts: its rank of 5 adds 2.4 to the index. At TIME 2, a coordinated plan has been created and is being followed and so although it is still wide spread its contribution to the index drops by one-third to 1.6.

Emerald Ash Borer: At TIME 1 there is a state-funded detection program but by TIME 2 funding for that program has been withdrawn and the program is cancelled.

Kudzu: At both intervals, kudzu has viable populations in Massachusetts while in RI an active monitoring effort fails to detect any.

Fire Ant: Because of global warming, fire ant is able to become established in Conn. during the index interval, though it remains undetected by an active effort in RI.

Zebra Mussel: during the interval, a vigorous control effort eradicated zebra mussel from the one pond it occurred in and it's rank dropped from 2 to 1.

Asiatic Clam: during the interval, further fieldwork confirmed asiatic clam to be more widespread than previously thought, raising its rank from 5 to 6.

Workflow:
Preliminary steps:
Create invasive species index committee (maybe use existing RI Invasive Species Council model to avoid creating new bodies?)
Committee helps identify and secure funding for initial work
Committee agrees on index species criteria
Committee agrees on list of index species
Committee agrees index coefficient criteria
Committee assigns index coefficient to each index species
Committee agrees criteria for index ranks

Each index instance:
Committee reviews index species list and the coefficients assigned to each listed species
Committee assigns an index rank to each index species and generates the final index