Eastern Invasives Management Network
Upper and Middle Delaware River Watershed

Threat Abatement Priorities

List your current priorities for taking action against invasive plant threats at your conservation area. Your priorities may be grouped by species (or groups of species) and/or by locations within your conservation area. Your priorities may include preventing the establishment of a new invader as well as stopping the spread of species that are already established. Indicate how your priorities are tied to your conservation targets and, where appropriate, to the key ecological factors upon which they depend.

Our priority invasive plant species include:

1. Top Priority: Japanese knotweed (*Polygonum cuspidatum*), purple loosestrife (*Lythrum salicaria, L. virgatum*)
2. Second Priority: autumn olive (*Elaeagnus umbellata*), tree of heaven (*Ailanthus altissima*), common reed (*Phragmites australis*), water chestnut (*Trapa natans*)
3. Third Priority: Japanese and Bush honeysuckles (*Lonicera japonica*, *Lonicera* spp.), Japanese barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*), garlic mustard (*Alliaria petiolata*), reed canary grass (*Phalaris arundinacea*), and Japanese stiltgrass (*Microstegium vimineum*).

Our "watch list" for early warning/rapid response includes: mile-a-minute weed (*Polygonum perfoliatum*), Eurasian water milfoil (*Myriophyllum spicatum)*, hydrilla (*Hydrilla verticillata*), and giant hogweed (*Heracleum mantegazzianum*).

Priority locations for invasive plant management include:

For The Nature Conservancy: Mt. Bethel Fens, Cherry Valley, Butternut Island, Long Eddy. Once the groundtruthing of ecoregional plans for the Upper Delaware is completed, it is likely that TNC will include watershed-based and river corridor sites.)

For National Park Service: the river corridor and riparian areas plus hemlock ravines (the hemlock woolly adelgid, *Adelges tsugae*, is the greatest threat to the hemlock ravines; invasive plants would be the secondary invader once the adelgid kills the hemlocks)

The National Park Service prioritizes its management based on threats to rare, threatened and endangered species. These targets generally overlap TNC's targets in the conservation area. The targets are dependent on the priority locations indicated above and are directly threatened by the priority species listed.

For both NPS and TNC-PA, the priority locations are either wetlands, streams/rivers,islands or riparian areas. For the most part, our principal invasive plant threats are those species that are aquatic or favor riparian habitats and/or edges (and therefore are often found in or near riparian zones). With respect to autumn olive, it is also a major pest in abandoned agricultural fields in NPS. The invasive plant species are ranked based on their level of threat to these sensitive areas.

Our "watch list" includes species that are either present in small numbers in some isolated locations, but not on our priority sites, or are expected to come into our areas.

Have your priorities changed since we last met in December, 2001? If so, point out how and indicate why they have changed.

There has been only slight change in these priorities since our December meeting. The hemlock ravines have increased as a priority site partly because the recent drought has further weakened the hemlocks and allowed for increased damage by the woolly adelgid, killing off trees at a greater rate and increasing opportunities for tree of heaven to invade the ravines. The other slight change has been that NPS has noticed an increase in the need to manage Japanese knotweed along roadsides.

Have you lowered the priority of any invasive plant species or infested location because careful consideration indicated that they actually pose relatively low threats to your conservation targets? If so, describe. If not, select a species or infested location and make an argument for lowering its priority (Play devil's advocate. One point of prioritization is to determine which species and infestations need not be controlled).

We have not yet actually decided to lower the priority of either reed canary grass or Japanese stiltgrass, but both are arguably good candidates for this approach. Reed canary grass has heavily invaded sensitive ice-scour habitats along the river corridor and at Butternut Island. However, it is very difficult to control without harming native grasses, and unlike Japanese knotweed, it does not alter the physical structure of the habitat. There is already a tendency to attempt to control it only in areas without native grasses or where a new invasion is moving into a pristine area. The same is also true for Japanese stiltgrass, which is so widespread and has so many pathways it can use for invasion that control is extremely difficult. One could also repeat these arguments for lowering the priority of Japanese knotweed, which coats the edges of the Delaware River and its tributaries. However, for several of our priority sites, it is possible to keep it to a manageable level. Plus, because roadsides are more readily treatable with herbicides, it is also possible to keep these areas relatively clean of knotweed.

Threat Abatement Strategies

Describe the strategies that you have developed thus far for abating high priority invasive plant species threats. Include any strategies designed to prevent new invasions or to quickly detect and control new species or populations that become established. Pay particular attention to how you plan to work with partners, describing any innovations you have used and any important challenges you have surmounted or still face in finding or engaging partners.

In our answer to this question, we include the many partner-led efforts throughout the watershed that have an effect on the priority invasive plant species and locations:

1. The National Park Service has been working to educate staff and partners in the area on identifying and prioritizing invasive plants. This is leading up to the arrival of a SWAT team for the region. This team will set priorities and develop inventory, management, and monitoring goals and implement those goals for 10 parks in the area, including both DWGNRA and UPS&RR. The SWAT Team will also help to advise other parks and partners about weed management.

NPS-DWGNRA has been using (and demonstrating to partners) an innovative machine for cutting fields heavily invaded by autumn olive.

NPS-UDS&RR has been regularly removing a small localized population of water chestnut, and conducting one of the knotweed pilot projects described below.

2. The Nature Conservancy has been working to control Phragmites and purple loosestrife as part of an extensive management and monitoring plan for Mt. Bethel Preserve (see excerpt below for more details). There are plans to incorporate grazing for control of purple loosestrife at Mt. Bethel. Smaller, new invasions at the Cherry Valley Preserve have also been cut and treated this season. The inventory work being done by the Weed Warrior team (see next item) will be used to develop a weed management plan for Cherry Valley Preserve.
3. DRIPP (Delaware River Invasive Plant Partnership) has trained and established two Weed Warrior teams to inventory weeds for the DRIPP inventory database for the watershed. The first two teams are supervised by TNC Northeast PA staff and TNC-New Jersey Skylands Staff. Both teams are inventorying weeds on TNC preserves. The TNC-NEPA team is also assisting a local state park (Hickory Run State Park) with inventorying weeds for the development of a park weed management plan. It is hoped that this process of inventorying with volunteers for the development of weed management plans will then be replicated at other state parks in the watershed. The Weed Warrior team concept is being refined so that it can be shared as a tool for other partners and/or local communities to use for invasive plant management.
4. DRIPP is also coordinating two local, educational Knotweed Pilot Projects which are testing different methods of knotweed control. These projects engage local citizens in two ways: local landowners are given information about the project and the problems posed by invasive species; and some citizens volunteer to help with the work. Hopefully these sites will eventually be used to conduct field demonstrations for partners and local communities.
5. PA-DOT, a DRIPP partner, has been working to control many of the priority species along roadsides throughout the watershed. They are working with another DRIPP partner, Penn State University, to develop innovative control techniques.
6. *Galerucella* beetles have been released at many purple loosestrife sites throughout the conservation area by numerous partners including The Nature Conservancy and National Park Service. It appears that the most successful sites have been those where large numbers of beetles were released in the initial effort.
7. DRIPP has developed a Powerpoint presentation to use with garden clubs and private landowners in local communities to educate them about invasive plants commonly found in gardens, native (and non-native, non-invasive) alternatives, and ways they can get involved in the prevention and management of invasive plants.
8. DRIPP is also working to develop an early warning/rapid response system for the watershed. Interested partners have begun to establish a system for notification and verification of new potential invaders and a system for notifying interested land managers. DRIPP has set a 2003 goal of continued investigation of the feasibility of a watershed-wide EW/RR system and will explore becoming a pilot program for testing the national system proposed by FICMNEW.
9. DRIPP is working to develop a watershed-wide management plan that will set priorities for the region. In 2003, DRIPP will hold its first Annual Action Agenda Summit where key partners set annual goals that align with the priorities outlined in the management plan. It is hoped that

this agenda event will draw in more key partners and bring greater awareness to what is being done and what needs to be done across the region.

10. In response to many land managers' requests for advice and resources, DRIPP will hold a Management Plan Review workshop (similar in structure to these EIN workshops) for key land managers to work closely with an expert panel and other participants to develop their own weed management plans. DRIPP will also be developing a weed management plan resource tip sheet, and an Expertise Referral List of DRIPP partners with experience and expertise in specific subjects. Lastly, we will be hosting several field demonstration days for partners throughout the watershed to highlight innovative techniques and management planning and implementation, and we will identify needs and sources for new research and demonstrations.

As an example of strategies being used at one of TNC-PA's priority sites, the following piece has been excerpted from a draft of *The Mt. Bethel Fen Complex Management and Monitoring Plan*, written by Su Fanok, April 2001. None of the Appendix or reference materials cited in this excerpt have been included.

Combating Invasive Species

Four different techniques will be used to reduce the density and vigor of invasive species throughout the complex: grazing, biocontrols, manual and mechanical control techniques and herbiciding. The same grazing plan as mentioned previously will be used to also combat invasive species, with the except that these heavily dominated invasive areas will be hit "hard" (as a result of increased stocking rates) by grazers during the first year. Consequently, goats, known to be the most damaging to vegetation including woody species will be introduced first, followed by sheep who favor grasses and cows whose trampling will assist in breaking-up the rhizomatous roots of *Phragmites australis*. For further information regarding grazing methodology and locations, see Appendix D, Weed Control Methods Handbook and Appendix C, NRCS Prescribed Grazing Plan.

All species will eat both *Lythrum salicaria* and *Phragmites australis*, but goats relish loosestrife and will denude it in one growing season. Sheep prefer grasses but eat *Lythrum salicaria* and *Phragmites australis* occasionally or when grassy forage becomes limited. Cows will help control *Lythrum salicaria* through grazing and trampling, but being a woody forb, it 's not a preferred food. Again, cows prefer grasses (including *Phragmites australis*) and nibble on the loosestrife and shrubs indiscriminately. In several sites in New Jersey, cows trampled and compacted several years' worth of litter, broke up rhizomes, and created a perfect hollow-hummock topography beneficial for one of the fens target species, *Clemmys muhlenbergii* (Tesauro, personal communication 2001).

Although some grazers will forage on *Lythrum salicaria*, to assist in this population's decline, biocontrols will also be dispersed. *L. salicaria* was introduced to North America without its natural enemies and the objective of our program is to restore the self-regulatory potential of this plant-insect interaction by using biological weed control. Four host specific insect species approved by USDA-APHIS have been released in the US. These species are *Hylobius transversovittatus*, a root-mining weevil, *Galerucella calmariensis* and *Galerucella pusilla*, two leaf-eating beetles, and *Nanophyes marmoratus,* a flower-feeding weevil. We will introduce the two species of Galerucella which feed on the leaf, to one site: Houdaille Wildlife Refuge. In the biocontrol program targeting *L. salicaria*, our strategy is to achieve long-term control, not complete eradication, through provision of a simple, yet diverse, collection of natural enemies.

Approximately 30,000 to 40,000 beetles will be collected during June/July from sites in PA where they are well established. For further discussion regarding biocontrol techniques, see Appendix D, Weed Control Methods Handbook.

In other areas requiring management, manual and mechanical control techniques will be used. Physical removal is very labor and time intensive and involves the use of a steel blade weed cutter to cut down the Phragmites shoots. Shoots are raked into piles, to reduce litter biomass, and moved from the fen area to lower priority adjacent areas. Cutting of the shoots takes place twice or three times (resource permitting) a year in June and mid-September. In the case of *Lythrum salicaria*, plants will be pulled and/or stems clipped using pruners, collected, and again removed from the fen area to lower priority adjacent areas. Flowers and seed heads are collected separately and removed from the site. Clipping takes place once a year during flowering and prior to seed set (typically in July or August). By reducing above ground biomass during the growing season, it is hoped that repeated cuttings will eventually, over the course of 5-years or more, reduce plant vigor. For further information regarding manual and mechanical techniques, see Appendix D, Weed Control Methods Handbook.

The final method of reduction involves the use of herbicides. Selective application of the herbicide is accomplished through a variety of techniques including dropper (clip & drip), bloody-glove, and spraying. The clip & drip method involves cutting the plant stem and administering a drop of herbicide down the stem. This method works well on Phragmites. The bloody-glove method involves wearing an absorbent glove, which has been dipped into an herbicide, then wiping the glove along the upper reaches of the plant stem. Herbicide is absorbed directly into the plant via the stem and leaves, however, breaking the stem aids in more rapid absorption. This method works well on purple loosestrife. In less sensitive buffer/corridor areas, broadcast spraying of herbicide may be considered. Herbiciding *Lythrum salicaria L*. is conducted in late July and/or early August; whereas herbiciding *Phragmites australis* is conducted in mid-September.