Monitoring the Pulse of Invasive Plants in the Adirondack Park: A Coordinated Approach to Regional Invasive Plant Management

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Abstract
A global ecological crisis, invasive species threaten the unique array of environments that sustain exemplary plant and animal communities in the Adirondack Park. In an effort to maintain the Park’s significant biodiversity, the Adirondack Park Invasive Plant Program relies on area-wide partnerships and invasive plant distribution information to direct regional invasive plant survey, control, and outreach efforts. Program partners strive to develop integrative plant management strategies based on ecological relationships and collective problem-solving to prevent the continued introduction and spread of invasive plant species in this exceptional yet vulnerable area.

The Adirondack landscape is one of great mountains, extensive waterways, intact wetlands, and unbroken forests. It is globally recognized for its significant natural communities, admired for its beauty and serenity, and offers unparalleled opportunities for exploration and enjoyment. This distinctive setting, however, is not immune from the damaging effects of non-native, invasive species.

In fact, invasive species are second only to habitat loss as a leading cause of the loss of biodiversity in the Adirondacks and nationwide. Invasives make headlines across the globe for affecting agriculture, clogging waterways, altering fire regimes, disrupting fisheries, and causing human ailments. Invasive species are not a new challenge but a growing one.

Unlike many parts of the Northeast, the Adirondacks contain many large intact ecosystems and high-quality natural communities. However, certain conditions make it vulnerable to invasive species, including the presence of ecologically “sensitive” species, vast remote areas that are difficult to monitor, management regulations that may limit control options, and continued importation of non-native species from outside the region.

The growing risk to the Adirondacks’ natural areas is signaled by recent movements of invasive plants into the Park’s interior.

Even with these challenges, there are still opportunities to preserve or restore the Park’s vast areas and to reduce the costly ecological and economic impacts caused by invasive plants. The same geographical features that make much of the Adirondacks inaccessible, or accessible only by foot or paddle, keep those areas at low risk for invasion. The limited transportation infrastructure and human development also curb the proliferation of invasive plant species throughout the Park. Robust and diversely populated native systems remain in position to prevent invasive species establishment. Thus a unique opportunity exists to protect this natural landscape by using a cooperative, comprehensive, regional program for invasive species prevention and control.

Although often used interchangeably, “invasive,” “non-native,” “exotic,” “alien,” and “nuisance” species are all terms that have unique connotations and important distinctions. Native or indigenous is a species present in its historic range as determined at the time of European settlement. Non-native, synonymous with exotic or alien, is a species located outside its historic range and introduced accidentally or intentionally by humans. Invasive refers to any species that reproduces rapidly, establishes a large population, and displaces native flora and fauna. And finally, nuisance, or weed, is any species that interferes with human activities. While dandelions are a nuisance, and native plants can become locally aggressive or invasive, the non-native, invasive species pose the greatest threat to natural communities and the resources on which we depend.

Non-native flora, fauna, fungi, bacteria and viruses are commonly introduced to our air, land, and water resources; however, many of them exist in the United States without causing measurable negative impact on the surrounding environment. New York has the highest percentage of non-native species among the mainland states; of the 3,195 plant species, 1,117 (35%) are non-native.

The myriad non-native species found across the state should not lessen our attention to existing or potentially invasive ones. Between 20 and 50 non-natives in New York are invasive. Species such as zebra mussel, purple loosestrife, Asian longhorn beetle, and Eurasian watermilfoil invade New York’s and other states’ landscapes, alter ecological processes, and introduce a range of management challenges.

Nature Out of Place
Although they are invasive here, non-native species typically pose no problems in their native habitats. A variety of environmental conditions and physiological traits augment the rapid spread of species when introduced outside of their native environment.
Without native predators and parasites, non-native invasives reproduce and spread unchecked.

The reproductive capacity of invasive plants increases the likelihood of survival and expansion through frequent and abundant seed production and vegetative spread. Early and aggressive growth of invaders may reduce resources available for nearby native vegetation; and alteration of soil composition or releasing phytotoxins may inhibit native plant growth. Morphology, such as canopy forming leaves, thick stems or thorny branches contributes to the success of non-native, invasive plant species by reducing the light available for other plants and altering the quality of forage for wildlife.

Finally, the removal of native terrestrial and aquatic vegetation, such as clearing native vegetation from around a dock, creates a suitable environment for invasive species colonization. Frequently found in disturbed areas, invasive plants thrive in exposed, un-vegetated sites where competition from native plants is minimal.

Non-native species arrive by numerous pathways. Many invasive plants found in the Adirondacks originate from Europe, Asia, Africa, and Australia. Global trade and travel promote the transfer of foreign species, leaving few areas protected from their introduction. Discarding exotic aquarium plants into surrounding waterways introduces new populations. But, direct planting and cultivation of non-native species as ornamentals is the most significant source of non-native introductions. These plants are often appealing for use in landscaping or terrestrial or aquatic gardens because of their showy or fragrant flowers, fast growth, and soil stabilization characteristics.

Once introduced, invasive plants move locally and regionally in a variety of ways. Wind, wildlife, and waterways carry to new locations plant fragments capable of taking root. Watercraft, automobiles, all-terrain vehicles, or construction equipment move plant fragments or seeds attached to trailers or imbedded in tire treads. Transporting dirt for fill that contains plant material also spreads invasive plants. Hiking boots? Another possible seed source. In the core of the Adirondacks, invasive plants gain a foothold along roadways, in yards, at trailheads, and near boat launch sites, then spread into more remote areas.

One could ask if humans are part of the environment, isn’t their introduction of invasive species a natural process of landscape change and evolution that is bound to occur? Although frequently asked and an appropriate question, the changes to our landscapes caused by invasive species occur at an exceedingly rapid rate unequaled by natural rates of native species dispersal. Scientific research documents natural shifts in native species’ ranges induced by environmental change on episodic or geologic time scales; but many ecological systems do not have the capacity to buffer the impacts of accelerated change caused by non-native invasive species.

Before humans arrived in Hawaii, new plant species are believed to have become established at the rate of one every 10,000 years. For the past 200 years, we have been bringing new species to the islands at a rate one million times higher.

Land managers may question whether a threshold exists for the number of individual species acceptable within a
A Coordinated Approach

The Adirondack Park Invasive Plant Program, or APIPP (pronounced A-pip), is a partnership program for regional invasive plant monitoring, management, and education. What started as a pilot project to assess the presence of terrestrial invasive plants in the Adirondack Park evolved into a rigorous comprehensive program for both aquatic and terrestrial invasive plants; a program that initiates dialogue and engages response from numerous organizations and communities; inventories, monitors, and reports the Park-wide distribution of invasive plants; reviews and applies best management practices; and, increases both agency and public awareness about threats and prevention.

The four principal partner organizations that established APIPP are the Adirondack Nature Conservancy (ANC); Adirondack Park Agency (APA); NYS Department of Environmental Conservation (DEC), Regions 5 and 6; and, NYS Department of Transportation (DOT), Regions 1, 2 and 7. Their representatives serve as the steering committee to plan and implement invasive plant initiatives in the Park. This spring, the Invasive Plant Council of New York State (IPC NYS) joined the partnership as the fifth principal partner.

APIPP’s framework relies on diverse partnerships among watershed and resident groups, local government, and community members. These region-wide partnerships are essential to effectively organize efforts across the Park to provide the expertise and assistance for a landscape-level approach to integrated invasive plant management. A six-million-acre park with an assemblage of public and private lands, divided by a grid of political and regulatory boundaries, requires this “grass roots” approach and commitment to invasive species prevention and control.

The regional invasive plant initiative began in 1998 when a core group, led by the ANC, APA, DEC, and DOT, observed increasing populations of terrestrial invasives in the Park and began documenting the extent of their presence. Together with citizen volunteers, the group selected nine species of concern and conducted extensive roadside inventories.

The following year, the group expanded its inventory to include back-country sites to assess whether species were moving beyond the rights-of-way into intact natural areas of the Park. At that time, the explosive pattern of terrestrial invasive plants was largely confined to transportation corridors. Further analysis showed two trends in geographic distribution: the interior of the Park contained few and isolated invasive plant populations; while numerous and expansible populations were concentrated in the northern and eastern peripheries.

To set priorities and focus management efforts, the group selected four target species that posed the greatest threat to natural areas and designated two conservation areas based on their distribution trends: the Core Conservation Area and the Border Conservation Area. Spearheaded by the ANC Invasive Species Field Coordinator, Steven Flint, and DOT Environmental Managers Control, efforts to contain, reduce, or eradicate the target terrestrial invasive plant populations in the Core Area ensued.

Outreach to the Border Conservation Area spawned support from groups such as the Master Gardeners, Boquet and Ausable River Associations, and Plattsburgh University. Numerous representatives from concerned groups across the Park joined together to form the Roadside Invasive Plant Working Group to plan, both immediate and long-term, plant management strategies.

In 2001, ANC, APA, DEC, and DOT signed a Memorandum of Understanding formalizing their commitment to implementing invasive plant initiatives in the Park. This Park-wide inter-agency and community effort received an Environmental Excellence Award from the Federal Highways Administration that same year.
The momentum of the terrestrial project led to a similar initiative for aquatic invasive plants. A variety of aquatic plant research and monitoring efforts were ongoing throughout the Park, but they were isolated and independent. State agencies and local groups realized the need for coordination to collect baseline information to determine the regional distribution of aquatic invasive plants in the Park.

Under an Environmental Protection Agency Grant (submitted in 2001 by the ANC, APA, DEC, Paul Smith's College, and the Franklin County Network of Shoreline Associations), the APA hired a full time coordinator to develop a Park-wide volunteer monitoring program and to promote regional outreach, education, and information exchange.

With 18 months of funding, the aquatic invasive plant project succeeded in establishing an active volunteer and community education program. Seen as an important mechanism to meet both regional and local needs, a 13 member Advisory Panel of professional and community representatives from throughout the region was selected to guide and support the program. With assistance from the Panel, many volunteers, and partner groups, such as Hamilton County Soil and Water Conservation District and the Paul Smith's College Watershed Stewardship Program, the aquatic invasive plant project documented aquatic invasives in the Park. This information demonstrated the urgency to develop a Park-wide approach to aquatic invasive plant management.

Invasive plant expansion in the Park, the investment of staff time and many cooperators, and re-energized community attention called for the continuation of the invasive plant initiative. Limited resources and parallel missions pointed to a need for alignment between terrestrial and aquatic partners. In the spring of 2003, the projects joined together under the organizational name of the Adirondack Park Invasive Plant Program, or APIPP. Funded by the Adirondack Nature Conservancy until September 2004, the program now coordinates both the Aquatic Invasive Plant Project and the Terrestrial Invasive Plant Project. Partners are currently seeking additional funds to sustain the program.

**Japanese Knotweed** (Polygonum cuspidatum), also referred to as Japanese bamboo, is the most prevalent and problematic terrestrial invader in the Core Area of the Park. This herbaceous perennial is abundant in many hamlets and along the major roadways of the central Adirondacks.

**Community Based Conservation**

APIPP seeks and coordinates groups and individuals willing to participate in inventory, control, or outreach efforts to prevent further introduction and spread of invasive plants in the Adirondacks. Because of the miles of roadway, shoreline, and trails to survey, and the rising numbers of plant populations to control, involving the public is essential to help environmental managers collect the necessary information to implement a management program over a large area.

Training and monitoring are the core of APIPP's efforts to inspire citizen-based stewardship to detect and respond to invasive plant infestations. More than 125 participants across the Park have been trained to identify and monitor invasive plants. Through these training sessions APIPP institutes a Park-wide plan for systematic data collection to pinpoint the distribution of aquatic and terrestrial invasive plants.

In two seasons 88 volunteers dedicated over 500 hours to survey 92 waters for aquatic invasive plants. Local resident groups spent over 500 hours assisting the ANC to control terrestrial invasive plants throughout the region. APIPP enters the collected information into a database that helps track invasive populations over time. The remarkable display of support and assistance among Adirondack communities bolsters the program that now has five years of data collection and effective action.

Volunteer monitoring complements an effort by APIPP principal partners to train appropriate staff within their own agencies, such as the DEC Unit Management Planners and DOT construction and maintenance crews. By sharing program needs and informational resources, APIPP aims to widen its coverage while providing useful information to natural resource and land managers.

APIPP also recognizes the importance of increasing public awareness about invasive species issues. The program participates in local events and offers educational presentations to a variety of organizations including lake associations, garden clubs, watershed groups, and schools. Good avenues for information, the presentations can be real eye-openers. Shocked to learn that Japanese knotweed was one of the worst plant invaders in the Park, one chagrined resident admitted that he recently planted a row of knotweed along a stream bank to obscure his view of an adjacent property!

To prevent the unintentional spread of invasives, APIPP educates and works with local governments to provide informational tools to their residents who can then practice their own backyard conservation. In July 2003, the Village of Saranac Lake invited invasive species experts to conduct an invasive plant workshop for residents to learn identification and management techniques. Showing similar ambition, the Village of Old Forge and Fulton Chain of Lakes Association sponsor an annual “Weed Day” to encourage residents to bring plants in for identification by local biologists. To leverage additional support, local government can also convey to our state
representatives the impacts of invasive species on Adirondack natural and human communities.

Education, early detection, and rapid response are keys to successful control. By having informed agencies and citizens throughout the Park to alert us to new infestations, APIPP participating organizations, and community members will be better equipped to coordinate and respond with appropriate management techniques.

**Best Management Practices**

The best management plan is preventing invasive plants from becoming established in the first place. When they do, however, then what? With uncertainties about control measures, and inherent biases, how do we manage populations to avoid exacerbating existing infestations, and with whom does that responsibility lie? The diverse land classifications and jurisdictional boundaries unique to the Adirondack Park challenge resource managers and residents alike to appropriately and effectively implement control measures.

On the Forest Preserve, the State Land Master Plan (SLMP) dictates that the “protection and preservation of the natural resources of the state lands within the Park is paramount.” Invasive species severely impact natural resources and impart disturbance on natural areas, leaving the Forest Preserve forever changed, not forever wild. When a natural community in the Forest Preserve is threatened by non-native species, the SLMP requires removal of that species and restoration of the area.

Treatments such as the proposed Sonar application in Lake George, lake-wide hand-harvesting in Upper Saranac, and biological control of loosestrife populations represent a variety of mitigation strategies that exemplify the commitment of Adirondack residents to control invasive species and also demonstrate the complexities faced in managing infestations. Though the regulatory environment may create challenging circumstances, differing control strategies call attention to important questions, emphasize the significance of the issues, and demand creative and consensus-based solutions.

Because neither political nor regulatory boundaries confine invasive plant populations, APIPP fosters a landscape- and partnership-based approach to management. This approach requires information exchange and collaboration among a variety of entities to strategize management at a scale beyond any single individual, organization, or agency.

![Eurasian Watermilfoil (Myriophyllum spicatum) continues to spread through Adirondack waters. Recently another alarm sounded in the Park when volunteers detected the exotic milfoil in Sixth and Seventh Lakes of the Fulton Chain, and now it has also been reported in Fifth Lake.](image)

The strategy must also be both integrated and adaptive to combine multiple techniques to increase probability for sustained success and to assimilate new information as it becomes available. A comprehensive plan must involve state agencies and landowners and incorporate prevention and education, control, restoration and monitoring, and outreach to both public and private organizations and communities. Dynamic natural and human environments necessitate a parallel approach to management.

The control methods to manage plant populations vary in suitability and efficacy depending on the situation and character of the infestation. They include hand pulling, digging, cutting or matting plants; applying herbicide to reduce populations; using equipment to mow, suction, dredge, or excavate problem plants; and introducing a host-specific predator, known as biological control, to minimize populations. Drawdown, flooding, and burning are other measures applied to contain infestations by eliminating parent plants and depleting the seed bank to decrease the likelihood of re-colonization.

None of these techniques can be applied without some collateral impact to the environment, nor is one intrinsically superior to another. As a consequence, appropriate methods must be selected based on site-specific constraints, costs, and regulatory requirements.

APIPP prioritizes areas for inventory and control using a variety of criteria. Inventory foci include locations prone to human access and disturbance and those near to recorded infestations. After capturing the regional picture of invasive plants in the Park and assessing their threat, APIPP provides this information to state agencies, stakeholders and residents, and reviews available literature on effective control methods. Control efforts then focus on small infestations, infestations in proximity to sensitive communities or to aquatic conduits for dispersal, and expansive infestations requiring long-term control.

To guide management activities APIPP partners compiled a set of science-based, field-tested best management practices (BMPs). Best management practices integrate the limitations imposed by climate and soils, as well as regulatory and political concerns, into recommendations for action against invasive plants. The BMPs include information about plant identification, management options, equipment sanitation, and disposal of plant material. In some cases the BMPs do not apply and site by site management plans must be developed. To avoid the more complex aspects of the regulatory process, the APA has
produced guidelines for landowners to handharvest nuisance aquatic plants and instituted a general permit for the control of terrestrial invasive plants.

The Top Invaders

Without realizing it, we may frequently observe non-natives in the landscape. To detect new infestations and contain existing ones, we need to know which invasive species threaten natural areas. Inventory efforts documented 25 invasive plant species of concern in the Park. Of those, the identified target species have the capability of significantly impacting natural communities in the Park.

The target terrestrial invaders include Japanese knotweed, purple loosestrife (Lythrum salicaria), common reed grass (Phragmites australis), and garlic mustard (Alliaria petiolata). Japanese knotweed populates disturbed and riparian areas; garlic mustard can move into more shaded areas opening the possibility for colonization of the Park’s backcountry wilderness; while purple loosestrife and common reed are aggressive invaders of open wetlands.

Japanese knotweed, also referred to as Japanese bamboo, is the most prevalent and problematic terrestrial invader in the Core Area of the Park. It is locally abundant in many hamlets including Indian Lake, Blue Mountain Lake, Long Lake, Tupper Lake, Saranac Lake, Cranberry Lake, Warrensburg, and Pottersville. An herbaceous perennial with rigorous vegetative spread, knotweed is poised to spread and blanket riparian corridors. Even in dormancy, knotweed’s reddish canes remain upright through the winter months flagging its march across the landscape.

Widespread in the Border Conservation Area, purple loosestrife has a limited distribution in the Park’s interior appearing mainly in roadside ditches. Recently loosestrife spread throughout the Saranac River floodplain, and its splash of magenta flowering spikes is visible entering the St. Regis Chain, along Route 30 from Tupper Lake to Blue Mountain Lake, and throughout Hamilton County. Still planted as an ornamental, purple loosestrife thrives in marsh communities and has the capability of expanding throughout the Park and beyond effective localized controls.

While populations of common reed, a perennial grass, are small and scattered in the Park, there is minimal distance separating the 12 ft seas of brownish plumes waving on northern and southern stretches of the Northway and Interstate 81. Concern exists that the native race of common reed (Phragmites australis var. berlandieri) is mistaken for the more aggressive Eurasian race; however caution is taken prior to any control effort to ensure that the plant is accurately identified.

And finally among the terrestrials, garlic mustard is a biennial herb that forms monotypic stands in the forest understory. Reports indicate that the plant produces allelo-chemicals toxic to nearby vegetation. Simil ar to purple loosestrife, garlic mustard spreads primarily through abundant seed production, dispersing seeds viable up to five years. Garlic mustard has high local population numbers in the Fulton Chain of Lakes and Elizabethtown, and anecdotal reports indicate high populations also pervade the Lake Champlain valley.

The target aquatic invaders include Eurasian watermilfoil (Myriophyllum spicatum), water chestnut (Trapa natans), curlyleaf pondweed (Potamogeton crispus), and fanwort (Cabomba caroliniana). Aquatic invasive plants reach nuisance levels in a number of Adirondack lakes and ponds. As of 2001, lake monitoring detected 27 lakes with aquatic invasive plants. Two years of additional monitoring by APIPP volunteers detected an increase to 46 lakes. Forty-two of those are reported with Eurasian watermilfoil, which is now confirmed in lakes in every county in the Adirondack Park.

Eurasian watermilfoil is certainly not a new invader to Adirondack waters nor a new challenge to lake managers. What is new, however, is the recent, ample amount of information garnered about its distribution in the Park. Monitoring efforts documented the submerged aquatic plant throughout the Saranac watershed: Copperas Pond, Fish Creek, the Saranac Chain, Kiwassa Lake, Oseetah Lake, Lake Flower, Saranac River, Franklin Falls, and Union Falls Pond. Recently another alarm sounded in the Park when volunteers detected the exotic milfoil in Sixth and Seventh Lakes of the Fulton Chain, and now is has also been reported in Fifth Lake.

Observed only in Lake Champlain in the Park, water chestnut poses great potential to spread and reach nuisance levels in other Adirondack waters. An annual plant colonizing sandy bottoms, water chestnut is easily identified by its floating, toothed leaves and thorny, spiked nutlets. The nearest lake infested with chestnut is located miles from Sacandaga Lake in central Hamilton County, but in 2003, a lake steward stationed at its boat launch removed a water chestnut nutlet lodged in a boat trailer.

Another submerged aquatic plant, curlyleaf pondweed is distinguished from the numerous native pondweeds found in the Adirondacks by its rigid, lasagna shaped leaves. The only pondweed having small, jagged toothed leaf edges, it reproduces by small fruiting bodies called turions that overwinter in bottom sediments. Curlyleaf pondweed is reported in Lake Champlain, Lake George, Brant Lake, and Mayfield Lake, and volunteers recently detected populations in Franklin Falls and Lake Flower.

Fanwort, a native to the southeastern states but not native to the northeast, is a submerged plant with finely divided, oppositely branched leaves. Plant surveys documented dense infestations of fanwort in the mid 1990s in Saratoga County in Jenny, Hunt, and Efner lakes and more recently in nearby Mill Pond.

The hydrologic connectivity of Adirondack waters presents a critical risk of inter-lake dispersal of aquatic invasives. Monitoring of all waters, especially those adjacent to infected waters, should be incorporated into management plans.
Another constant threat is the continued importation of new invaders, thus the Adirondack Park Invasive Plant Program strives to strengthen and expand the network of partners to detect and respond to early infestations. As public awareness and involvement steadily increase, the coverage and confidence level of detection intensifies.

This past fall, a landowner in Willsboro on Lake Champlain reported an unusual and pervasive plant population. Upon further inspection, the ANC Invasive Species Field Coordinator, Steven Flint, identified the population as black swallow-wort (Vincetoxicum nigrum), an aggressive, fast-growing plant in the ivy family. Widespread in Jefferson County, swallow-wort had not yet been reported in the Park, and significantly this incursion was in proximity to the globally rare Rams-head Ladyslipper (Cypripedium arietinum). Working collaboratively with the landowner, Flint responded immediately with the appropriate control and the site will remain a priority for annual evaluation. Other volunteer efforts reported localized infestations of yellow iris (Iris pseudacorus), established in low-elevation wetlands nationwide, and variable-leaf milfoil (Myriophyllum heterophyllum), an aggressive, submersed species throughout New England.

Correspondence with statewide and regional groups keeps partners current on the movement and management of other invaders like giant hogweed (Heracleum mantegazzianum), European frogbit (Hydrocharis morsus-ranae), and hydriella (Hydrilla verticillata). APIPP is also well-positioned to provide critical invasive plant information to the newly appointed New York State Invasive Species Task Force, co-chaired by the New York State Departments of Environmental Conservation and Agriculture and Markets.16

The Pulse of Invasive Plants

Invasive species put at risk Adirondack lands and waters: our advantage is that infestations are preventable. The Adirondack Park Invasive Plant Program sets a benchmark for what collaboration can achieve. The ANC and partners controlled 114 terrestrial invasive plant sites. Volunteers surveyed 92 lakes and ponds, 73 of which were weed-free. Watershed groups across the region are sharing information about successes and challenges faced. State agencies such as the DEC and DOT are exploring avenues to involve staff in inventory and control efforts. And, APIPP keeps professionals and the public informed of current issues through www.adkinvadives.com, where visitors can view plant distributions maps and detailed images to assist in plant identification.

We can stop the pulse of invasive plants in the Adirondacks and what we have learned about their current distribution will help manage them in the future. We each play an important role in the plan for prevention, whether it be landscaping with native vegetation, taking care to remove vegetation from watercraft before and after entering waterways, or volunteering as an invasive plant monitor. Practicing constant vigilance will prevent the introduction of new species tomorrow and preserve the natural heritage of the Adirondack Park as we experience it today.17, 18

Notes
6. Principal partner representatives include Bill Brown, Dirk Bryant, and Steven Flint, ANC; Ray Curran and Dan Spaal, APA; Mark Craig and Ken Kogut, DEC; and, Rich Ambuske, John Falge, Ed Frantz, and Kyle Williams, DOT.
15. Additional information about these aquatic plants may be found on the web at www.adkinvadives.com/aquatic/plantid/plantid.html, 2003.
17. I would like to thank Ray Curran, Sunita Halasz, and Connie Prickett for their review of the article.
18. I also extend my sincerest thanks to the exceptional team of Principal Partners, to the members of cooperating organizations and those serving on the Terrestrial Invasive Plant Working Group and Aquatic Invasive Plant Advisory Panel, and to the numerous volunteers, for their commitment and contribution to APIPP's evolution.