



Department of
Environmental
Conservation

Agriculture
and Markets

NEW YORK STATE INVASIVE SPECIES COMPREHENSIVE MANAGEMENT PLAN

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New York State Invasive Species Comprehensive Management Plan

PREPARED FOR:

New York State Invasive Species Council

PREPARED BY:



| Executive Summary

New York State (NYS) is a diverse mosaic of natural, agricultural, and urban ecosystems which provide essential services to the residents of NYS, the surrounding region, and the global community. Large marine and freshwater systems offer an abundance of natural resources while providing opportunities for commercial fishing and recreational activities. New York's agricultural sector encompasses nearly 7 million acres of farmland and ranks in the top 10 nationally in 30 agricultural commodities such as apples, maple syrup, grapes, and dairy products, and the state's 19 million acres of forests support a \$22 billion forest economy. New York is also home to the 6.1 million-acre Adirondack Park which features an abundance of freshwater and intact forest systems and serves as one of the world's preeminent models of public-private land conservation. However, NYS's ecological, economic, and public well-being continue to be threatened by the proliferation of invasive species.



New York State's status as a hub for global commerce, its geographic setting, and patchwork of privately owned land have created significant challenges to managing invasive species. Intercontinental trade through the St. Lawrence Seaway and New York Harbor make New York home to some of the busiest air and sea ports on the planet and create a diverse suite of introduction pathways which consistently pose novel threats to the resources of NYS.

For decades, NYS officials and resource managers have provided a critical line of defense to prevent or slow the proliferation of invasive species that can harm public health, ecosystem integrity, agricultural productivity, and commerce. These efforts have positioned NYS as a leader in invasive species management. Since the 2005 Invasive Species Task Force Report, NYS has made outstanding progress toward creating and implementing a broad invasive species management program including significant accomplishments such as the formation of the Invasive Species Council and Invasive Species Advisory Committee; NYS Invasive Species Research Institute; the invasive species database

iMapInvasives; the NYS Department of Environmental Conservation Bureau of Invasive Species and Ecosystem Health; and the creation of the eight Partnerships for Regional Invasive Species Management (PRISM), which together encompass the entirety of NYS. Despite these accomplishments and significant effort, invasive species continue to pose significant risks to NYS's ecosystems, economy, and human health.

To address these risks, New York has developed this Invasive Species Comprehensive Management Plan (ISCMP), as directed in Title 17 of Environmental Conservation Law Article 9, to encompass all current and future invasive species taxa and the suite of

ecosystem types (e.g., terrestrial, freshwater, and marine) found across the State. The ISCMP was designed to highlight the great work that NYS has already done by promoting existing programs and methods that have been successful, while identifying structures and processes to help guide invasive species management into the future.

The ISCMP is framed around eight focal initiatives:

- Continue to build partnerships and capacity
- Commit to a centralized framework for sharing invasive species information
- Set priorities for invasive species management and advance preparedness
- Engage and inform the public
- Advance prevention and early detection
- Improve the response to invasive species
- Recover ecosystem resilience
- Evaluate success

Each initiative includes recommended actions to guide the management activities of State agencies, and to align the priorities of regional and local natural resource managers to State-level actions. Ultimately, the goal of the ISCMP is to help minimize the introduction, establishment, and proliferation of invasive species thereby limiting potential negative impacts. By including a focus on ecosystem resilience, this comprehensive management plan recognizes the important role that ecosystems themselves play in the dynamics of invasive species. While resilient ecosystems may be more resistant to invasive species, they also will likely maintain a greater capacity to recover from their impacts. This Plan positions NYS to continue its role as a leader in the management of invasive species and protect our natural resources for future generations of New Yorkers.

Invasive species manual control, photo courtesy of Adirondack Park Invasive Plant Program



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Sand sedge removal, photo courtesy of New York Natural Heritage Program

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| List of Acronyms

ALB	Asian Longhorned Beetle
APHIS	Animal and Plant Health Inspection Service
AVID	Assessing Vegetation Impacts from Deer
BISEH	Bureau of Invasive Species and Ecosystem Health
BMP	Best Management Practice
CAPS	Cooperative Agricultural Pest Survey
CCE	Cornell Cooperative Extension
CSLAP	Citizens Statewide Lake Assessment Program
DER	Division of Environmental Remediation
EAB	Emerald Ash Borer
EBM	Ecosystem-Based Management
ECL	Environmental Conservation Law
ECO	Environmental Conservation Officers
EPF	Environmental Protection Fund
ESRI	Environmental Systems Research Institute
GEIS	Generic Environmental Impact Statement
HWA	Hemlock Woolly Adelgid
ICS	Incident Command System
IPMDAT	Invasive Plant Management Decision Analysis Tool
IS	Invasive Species
ISAW	Invasive Species Awareness Week
ISCMP	Invasive Species Comprehensive Management Plan
LWRP	Local Waterfront Revitalization Program
MSA	Master Service Agreements
NAISN	North American Invasive Species Network
NRCS	Natural Resources Conservation Service
NYISRI	New York Invasive Species Research Institute
NYNHP	New York Natural Heritage Program
NYS	New York State
NYS OPRHP	NYS Office of Parks, Recreation, and Historic Preservation
NYSAES	New York State Agricultural Experiment Station
NYSDAM	NYS Department of Agriculture and Markets
NYSDEC	NYS Department of Environmental Conservation
NYSDOE	NYS Department of Education
NYSDOH	NYS Department of Health
NYSDOS	NYS Department of State
NYSDOT	NYS Department of Transportation
DER-10	NYSDEC Division of Environmental Remediation
NYSG	New York Sea Grant
NYSIPM	NYS Integrated Pest Management Program
PPQ	Plant Protection and Quarantine

PRISMs	Partnerships for Regional Invasive Species Management
QAPP	Quality Assurance Project Plan
REDC	Regional Economic Development Council
RISCC	Northeast Regional Invasive Species and Climate Change
SUNY ESF	State University of New York College of Environmental Science and Forestry
SWCD	Soil and Water Conservation District
UAV	Unmanned Aerial Vehicle
USDA	United States Department of Agriculture
WAVE	Water Assessments by Volunteer Evaluators
WHIP	Wildlife Habitat Incentive Program
WISPA	Watercraft Inspection Steward Program Application
WRP	Wetland Reserve Program

| Definitions

Biocontrol	The deliberate introduction of host-specific natural enemies of a target species to limit its abundance and spread.
Ecosystem-based Management	An integrated approach to management that considers the entire ecosystem, including humans, to achieve improved environmental conditions and sustained ecosystem services that support human needs and social goals. Ecosystem-based management differs from current approaches that usually focus on a single species, sector, activity or concern; it considers the cumulative impacts of different sectors, including human, social and economic activities (McLeod KL, et al., 2005).
Ecosystem Resilience	The ability for ecosystems to resist disturbance and/or recover from it.
Ecosystem Services	The benefits that humans obtain from ecosystems. Ecosystem services may include those that provide food and water; regulate climate, disease, and water quality; provide recreational, aesthetic, or cultural benefits; or provide essential supporting services such as photosynthesis and nutrient cycling.
eDNA (Environmental DNA)	An indirect DNA-based species detection method whereby DNA is extracted from various media (soil, water, air) and sequenced to determine presence/absence.

**Generic
Environmental
Impact Statement**

A type of environmental impact statement that is typically used to consider broad-based actions or related groups of actions that agencies may approve, fund, or directly undertake. A generic EIS differs from a site or project specific EIS by being more general or conceptual in nature. The broader focus of a generic EIS may aid the lead agency in identifying and broadly analyzing the cumulative impacts of a group of actions, or a combination of impacts from a single action.

**Horizon
Scanning**

A process for identifying and assessing risks posed by non-native species that may be introduced and become established.

**Invasive
Species**

A species that is nonnative to the ecosystem under consideration, and whose introduction causes or is likely to cause economic or environmental harm or harm to human health. For the purposes of 6 NYCRR Part 575, the harm must significantly outweigh any benefits.

**Prohibited
Species**

A species that poses a clear risk to New York's economy, ecological well-being and/or human health and is listed as prohibited under 6 NYCRR Part 575.3.

**Regulated
Species**

A species that has the potential to cause significant harm to New York's economy, ecological well-being and/or human health and could be effectively contained through regulatory programs and is listed as regulated under 6 NYCRR Part 575.4.

Water chestnut pull, photo courtesy of NYS Office of Parks, Recreation, and Historic Preservation



| Introduction

BACKGROUND AND COMPREHENSIVE PLAN ORGANIZATION

New York State (NYS) is home to an outstanding diversity of ecosystems, ranging from the ocean, estuaries, and freshwater lakes and rivers to alpine peaks, forests, agricultural lands, and human settlements. These natural and working landscapes provide vital ecosystem services to the State and surrounding regions. However, invasive species (IS), combined with the effects of other stressors such as climate change, development, and localized imbalances of wildlife populations, threaten to disrupt the resilience of New York's ecosystems. In response, multiple NYS agencies and partners have collectively developed a nationally recognized IS management program that is positioned to continue being a leader in invasive species prevention and management.

New York is a major port of entry for a wide range of taxa from other lands and waterways, and for decades, NYS officials and resource managers have provided a critical line of defense to prevent the establishment and proliferation of invasive species that can harm public health, ecosystem integrity, agricultural productivity, and market access, as well as commerce. Despite these ongoing management efforts, global trade, climate change, and the spread of IS across state boundaries continue to elevate the risk of harm to all New Yorkers from invasive species. Overcoming the threats posed by invasive species requires the combined and synchronized actions of many parties, including private citizens, elected officials, and resource management agencies.

The New York State Invasive Species Task Force report was developed in 2005 to articulate IS challenges and provide management recommendations. That effort resulted in the following 12 recommendations, many of which have seen significant accomplishments to date (described in relevant sections of this document):

- Establish a permanent leadership structure to coordinate invasive species efforts
- Allocate appropriate resources for invasive species effort
- Establish a comprehensive education and outreach effort
- Integrate databases and information clearinghouses
- Convene a regular invasive species conference
- Formalize NYS policy and practices on invasive species
- Establish a center for invasive species research
- Coordinate and streamline regulatory processes
- Encourage nonregulatory approaches to prevention
- Influence Federal actions to support invasive species prevention, eradication and control
- Recognize and fund demonstration projects
- Prepare and implement a comprehensive invasive species management plan, which is the charge of this document

This Invasive Species Comprehensive Management Plan (ISCMP) is intended to guide New York's agencies and partners engaged in IS prevention, early detection, rapid response, and ecosystem restoration toward an effective and coordinated response.

Scope

The ISCMP encompasses all taxa and habitats. This scope includes terrestrial invasive species that affect forested landscapes and agricultural ecosystems as well as aquatic invasive species that can disrupt freshwater, estuarine, and marine ecosystems.

Audience and Purpose

This plan has been developed for use by a variety of stakeholders to set directives, develop work plans, and guide an overarching approach for IS management into the future. This plan lays out initiatives at a scale that will enable managers and decision-makers to formulate corresponding actions, as appropriate. This plan also includes processes and metrics to measure progress and respond to new information

Timeframe

The ISCMP does not have an associated timeline; it is anticipated that certain sections and content of this plan will be updated as our understanding of IS management advances, new approaches of detection are developed, the regulatory environment affecting global commerce

changes, and emerging priorities and/or threats are realized.

Relationship to Other NYS Plans

This plan is not intended to supersede existing NYS IS management plans or provide a cookbook for addressing species-specific IS challenges. Rather, because there is an ongoing need to remove barriers and establish a forward-looking framework for coordinated actions, this ISCMP aims to strengthen the framework within which IS actions are implemented (**Figure 1**). The intent is to build on the framework set forth by the 2005 Invasive Species Task Force and 2011 NYS Invasive Species Management Strategy.



The ISCMP will help researchers focus on developing studies and outreach directions that are germane to accomplishing goals of the management plan.

— UNIVERSITY RESEARCHER

GOALS AND INITIATIVES OF THIS COMPREHENSIVE MANAGEMENT PLAN

The overarching goal of this ISCMP is to minimize the introduction, establishment, proliferation, and negative impacts caused by invasive species. This goal will be addressed through eight major initiatives:

1	Continue to build partnerships and capacity, while supporting effective ongoing programs	5	Advance prevention and early detection
2	Commit to a centralized framework for information management	6	Improve the response to new invasions
3	Set priorities for IS management, and advance preparedness	7	Recover ecosystem resilience and services
4	Engage and inform the public about IS	8	Evaluate and report progress, adapt to evolving circumstances

Each section of this plan describes the need for the initiative and the plan's overarching approach for addressing the need, followed by recommended actions. A report card template, which may be used to track the progress of each recommendation, is presented as [Attachment 1](#). While many of the recommended actions suggest a lead agency to oversee their implementation, the decision of allocating responsibility rests with the IS Council and others in State government. For some of the recommended actions, this ISCMP also cites other agencies that might play a key role in implementation based on their expertise or ability to advance actions.



Figure 1.
Conceptual Diagram
Showing the Intended
Alignment of New
York State and
Partner Planning
Documents as they
Relate to the ISCMP

1. Continue to Build Partnerships and Capacity

1A. NEED

Given the breadth of expertise, technology, and staffing required to address IS problems effectively – and the finite funding available for IS management – a major challenge is to create and maintain robust networks that reduce the fragmentation of our IS response, help stakeholders find and share information, prevent duplication of effort, fill gaps in our collective knowledge base, and promote the use of tools and best practices for prevention and management. In New York, responsibility for IS prevention, detection, management, research, and outreach is shared by a network of organizations working in partnership (**Figure 2**).

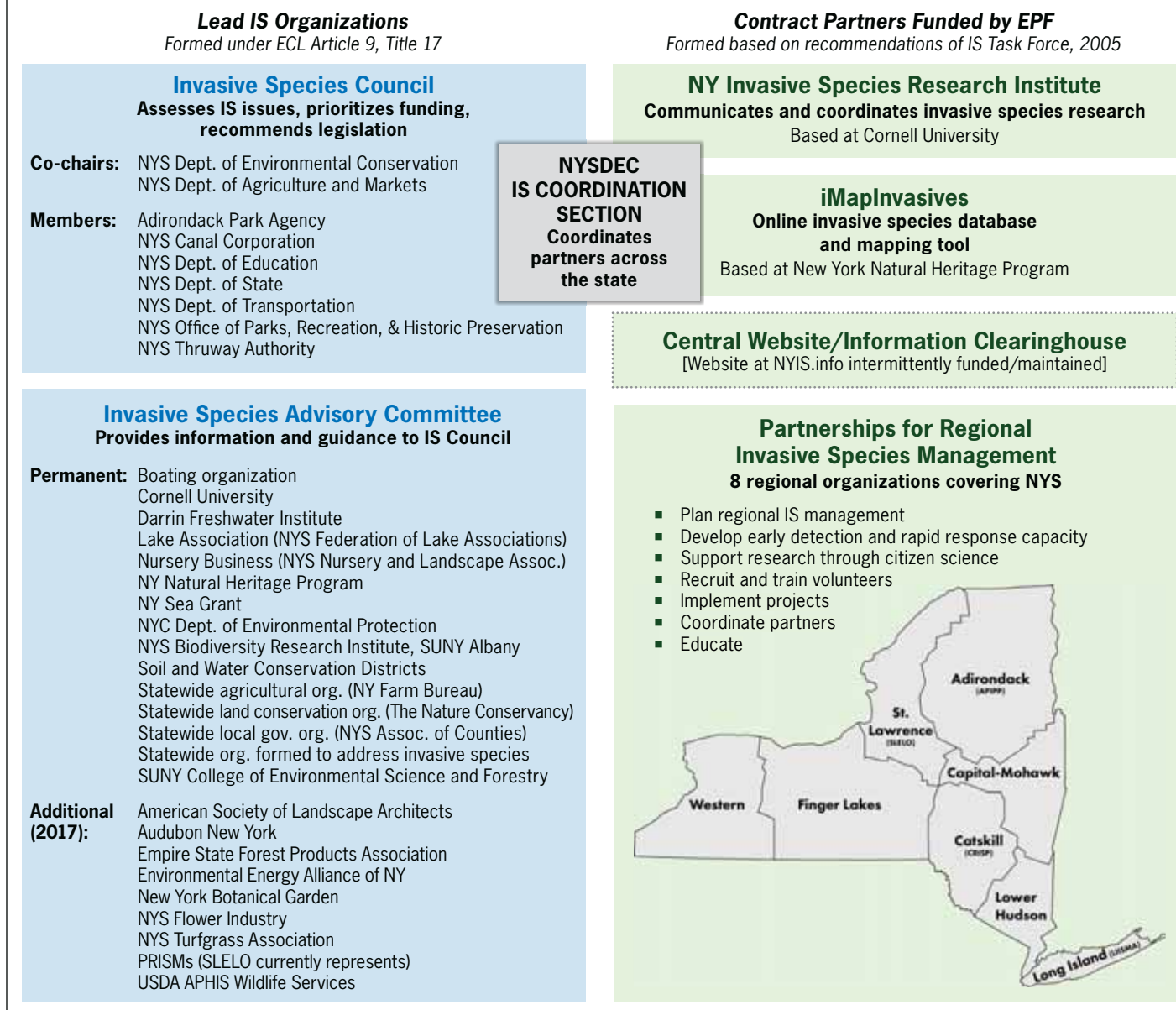
The State's current IS leadership and partnership structure includes the Invasive Species Council, IS Advisory Committee, Partnerships for Regional Invasive Species Management, New York Invasive Species Research Institute, and iMapInvasives initiative (all described more fully on the following pages). The New York State Department of Environmental Conservation (NYSDEC) IS Coordination Section is a hub for collaboration and coordination among partners within the network. While this overall structure has served the State well as the foundation of its nationally recognized IS program, collaboration among such a wide range of partners on a topic as pervasive as invasive species management is challenging. State agencies and partner organizations must strive for ongoing

improvements to meet stakeholder needs, share expertise and programmatic strengths, use resources efficiently, and connect in ways that will enhance our ability to overcome the risks posed by IS.

Progress to Date

- The **IS Council** was established in 2007 through New York's Environmental Conservation Law (ECL) Title 17, Section 9, fulfilling a criterion of the Environmental Law Institute's "Gold Standard" for a model state program. Nine State agencies are represented on the Invasive Species Council, which is chaired by NYSDEC and the NYS Department of Agriculture and Markets (NYSDAM). The Council fosters collaboration and coordination among State agencies, the IS Advisory Committee, and stakeholders across the State to minimize the harm caused by invasive species to New York's environment, economy, and human health. It meets at least four times per year, including one joint meeting with the Advisory Committee.
- The **IS Advisory Committee**, established in 2007 under ECL §9-1707, includes up to 25 representatives from a range of stakeholder groups including nongovernmental organizations, trade/business groups, and educational institutions. This committee meets four times per year and provides guidance to the IS Council.

Figure 2. Collaborative Network for Invasive Species Management in New York State



- The **NYS Environmental Protection Fund (EPF)** has supported IS programs and grants since 2006, as an outgrowth of the IS Task Force’s recommendation to allocate appropriate resources for invasive species efforts. EPF allocations for IS programs and grants has increased dramatically since 2006, reaching \$13.3 million in 2018.

- The **Partnerships for Regional Invasive Species Management (PRISMs)** play a central role in New York’s approach to IS management by building expertise within their respective regions of the State and providing regionally adapted, on-the-ground actions regarding IS outreach, prevention, management,

and monitoring, as well as identifying regional priorities for allocation of agency resources. Eight PRISMs provide complete coverage of New York, with a focus on facilitating cooperation between public and private interests. The IS Task Force recognized the value of such regional entities based on the success of Weed Management Areas (a precursor to PRISMs). The same legislation that called for establishment of the IS Council and Advisory Committee also called for funding of the PRISMs.

- The **New York Invasive Species Research Institute (NYISRI)**, based at Cornell University, has fostered the sharing of knowledge among IS researchers and practitioners in the State since 2008. Established in response to an IS Task Force recommendation, NYISRI communicates and coordinates invasive species research through its website, publications, presentations, events, professional network, and online database of experts, as well as through the work of its advisory board.

The NY Invasive Species Research Institute has helped reduce barriers to effective coordination with other organizations.

— UNIVERSITY RESEARCHER



- **iMapInvasives** is an online invasive species database and mapping tool managed by the New York Natural Heritage Program (NYNHP), a partnership between NYSDEC and the State University of New York College of Environmental Science and Forestry (SUNY ESF). The initiative began in 2007 after the IS Task Force recommended integration of databases, and the platform was launched in 2010. This resource compiles and conveys information on invasive species observations, surveys, and treatments and can provide email alerts, reports, and dashboards.
- NYSDEC's **Invasive Species Coordination Section** develops, administers, and coordinates State-funded IS programs. The Section's staff members are housed within NYSDEC's Bureau of Invasive Species and Ecosystem Health (BISEH).
- Members of New York's collaborative IS network participate in **national, international, and multistate organizations** formed to address invasive species (**Table 1**). For example, NYISRI was a co-organizer of the 2017 and 2018 Northeast Regional Invasive Species and Climate Change (RISCC) Management Symposium, IS Coordination Section staff participate in regional aquatic nuisance species groups, and a member of the IS Advisory Committee represents New York on the National IS Council Advisory Committee.
- **New York State's Office of Parks, Recreation and Historic Preservation (NYS OPRHP)** Invasive Species Management Team (ISMT) develops,

administers, and coordinates IS management efforts within NYS Parks and Historic Sites. The ISMT operates a strike team program to conduct manual removal of invasive species impacting rare, threatened, and endangered species and unique communities; a forest health program which conducts forest pest surveys and organizes treatments; and a statewide boat launch steward program which provides watercraft inspections and public education. Additionally, since 2008 NYS OPRHP has hired 6 natural resource stewardship biologists, 5 stewardship specialists, and multiple other long-term positions. The duties of these new staff positions include developing and implementing invasive species management projects at State Parks and Historic Sites.

- In 2008, NYS OPRHP developed its **Friends of Recreation, Conservation, and Environmental Stewardship (FORCES)** program with the intention of boosting and growing volunteerism within NYS Parks. The program creates opportunities for a wide range of mutually beneficial partnerships that enhance State Parks while providing students with real world experiences and opportunities to further their academic programs, and develop personal connections to NYS Parks. Many of these opportunities focus on invasive species management and restoration.
- The **IS Coordinator** position at NYSDAM was reinstated and staffed in August 2018 creating more robust capacity to fully represent agricultural interests and contributions to the State's IS effort.

Table 1. National and Multistate Invasive Species Organizations

NATIONAL AND NORTH AMERICAN	MULTISTATE
Aquatic Nuisance Species Task Force National Aquatic Nuisance Species Task Force National Institute of Invasive Species Science (NISS) National Invasive Species Advisory Committee National Invasive Species Council (NISC) National Invasive Species Information Center (NISIC) National Invasive Species Working Group (ISWG) National Plant Board National Plant Conservation Alliance's Alien Plant Working Group North American Invasive Species Management Association North American Invasive Species Network US Forest Service Forest Health Cooperative USDA Interagency Research Forum on Invasive Species USDA New Pest Advisory Group	Delaware River Invasive Plant Partnership (DRIPP) Great Lakes Commission Great Lakes Panel on Aquatic Nuisance Species Great Lakes Restoration Initiative (GLRI) Haudenosaunee Environmental Task Force (HETF) Invasive Plant Atlas of New England (IPANE) Long Island Sound Study (LISS) Mid-Atlantic Aquatic Nuisance Species Panel Mid-Atlantic Exotic Pest Plant Council (MA-EPPC) New York-New Jersey Trail Conference Northeast Aquatic Nuisance Species Panel (NEANS) Northeast Aquatic Plant Management Society (APMS) Northeast Forest Pest Council Northeast Regional Invasive Species and Climate Change Network Northeastern Integrated Pest Management Center Palisades Interstate Park Commission

1B. APPROACH

New York's IS leadership should build on existing successful partnerships and processes while seeking opportunities to engage more fully with NYS and regional stakeholder organizations. Given the breadth of organizations involved, State IS leaders should continue to clarify roles among the network of partners and consider ways to more fully involve agencies and programs that could bring key insights or resources to the collaboration.

Agriculture and natural resource agencies and representatives on the IS Advisory Committee should forge stronger connections so that they are more fully attuned to each other's priorities and can tap into each other's strengths regarding IS management and stakeholder outreach. State agencies should seek opportunities to ensure that IS considerations are reflected in their respective programs and grant awards, and that the partner agencies have adequate staffing to respond to the IS challenges. The statewide IS network should be continuously reviewed to ensure that it draws on diverse expertise and consolidates the delivery of information that will help stakeholders manage IS. Members of the IS network should continue and expand engagement with national and multistate organizations to share and gather information about IS threats, research, and policy beyond New York.

Opportunities to consolidate and simplify NYS contracts to partner organizations should be evaluated to improve efficiency and reduce administrative labor effort. Similarly, all organizations collaborating in IS management in New York

(and regionally) should be looking for ways to partner when pursuing extramural funding to project, to the extent possible, the full strength of New York's invasive species organization and avoid undermining each other's efforts in the shared goal of IS management.



We need to strengthen relationships among IS Advisory Committee partners, including communication and coordination regarding lessons learned.

— LANDSCAPE ARCHITECT

1C. RECOMMENDED ACTIONS

Maintain the existing IS Council/IS Advisory Committee model with PRISMs, NYISRI and iMapInvasives as critical elements to a decentralized program.

- Promote the collaborative nature of the IS network and partnerships within the State, and acknowledge shared interests of collaborators.
- Define respective roles, needs, and contributions of partner organizations, and provide this information prominently on a centralized website (Section 2) so

it can be easily shared among those who collaborate within the IS Council, IS Advisory Committee, and organizations that may be more loosely connected to the network.

- The IS Coordination Section should evaluate the opportunity to reduce contracting uncertainty and increase flexibility by establishing unit cost, long-term (e.g., 5-year) master contracts with annual task orders.

Incorporate agriculture programs more fully within the IS leadership framework.

- Add representatives from the NYS Integrated Pest Management (NYSIPM) Program, Cornell Cooperative Extension's (CCE) Master Gardeners Program, and/or Diagnostic Laboratories to the existing IS leadership structure (e.g., IS Advisory Committee or Horizon Scanning Committee [Section 3]), and provide them with a concrete role and objectives. For example, these roles could include sharing priorities identified by the U.S. Department of Agriculture's (USDA) New Pest Advisory Group, and the Cooperative Agricultural Pest Survey (CAPS) and summarizing CAPS information, which may be inaccessible to non-USDA affiliated agencies but could be shared in aggregated form to enhance preparedness and supplement iMapInvasives.
- Acknowledge the need for, and incentivize, ongoing support of the valuable programs listed above in the context of statewide IS management and identify opportunities for cost sharing when these groups materially contribute to the goals of the IS Council.

Engage climate change experts in invasive species collaborations.

- Address IS within the context of a changing climate by involving State-based climate change experts in IS Council meetings, especially as their work is being carried out through programs within State agencies (e.g., NYSDEC Office of Climate Change, NYSDOS, NYSDAM).
- Consider including a climate change representative on the IS Advisory Committee or Horizon Scanning Committee (Section 3).
- Synthesize current knowledge on invasive species and climate change interactions, and pursue initiatives to translate this knowledge into action (e.g., incorporate into regulations and management plans).

Increase State agency engagement, and leverage strengths of existing agency programs.

- State agencies on the IS Council should be actively represented at Council meetings and routinely prompted to reflect on their role in the collaborative network. Each agency is encouraged to hire or designate one full time staff specifically focused on addressing IS issues and serving as a representative to the IS Council. Each IS Council member should share information about their agency's interests and responsibilities regarding IS to clarify potential roles regarding regulatory issues, land management, funding channels, and target audiences for outreach and training.

- Each IS Council member should review existing planning or permit development programs and identify opportunities to incorporate IS considerations. For example, NYS Department of State (NYSDOS) could encourage Local Waterfront Revitalization Program (LWRP) applicants to include IS considerations in their economic development projects, and could add an IS component to its proposal scoring criteria. Similarly, NYSDEC could make IS considerations a required component of Unit Management Plans, and the NYS Department of Transportation (NYSDOT) could include IS considerations within the NYS Scenic Byways Program.
- Explore ways to involve State agencies that are not currently members of the IS Council but may have important contributions and interests in IS-related issues. For example, the NYS Department of Health (NYSDOH) might provide insights on the human health impacts of some IS; and the NYS Office of General Services (OGS) is tasked with managing state lands under water. The OGS can also offer expertise in term contract management.
- The knowledge and expertise housed at the NYSDEC Division of Marine Resources, and New York Sea Grant (NYSG) should be more thoroughly leveraged to raise awareness and address IS issues in New York's ocean ecosystem. This may be accomplished by supporting greater collaboration among marine programs and the Lower Hudson and Long Island PRISMs. Consideration should also be given to the inclusion of a marine expert on the IS Advisory Committee or Horizon Scanning Committee (Section 3) to ensure that the marine perspective is adequately represented.



PRISM coordinators, photo courtesy of Capital / Mohawk Partnership for Regional Invasive Species Management

Strategically expand stakeholder groups represented within the IS leadership structure.

- *Elected officials.* This could be accomplished by directing PRISM leads to engage with and inform State and local legislators in their region as well as evaluate opportunities to assist with challenges posed by IS. In addition, BISEH representatives could meet annually with the Governor's office to share annual priorities and horizon scanning outcomes as determined by a Horizon Scanning Committee (Section 3C).
- *Private landowners.* The IS Council should consider adding a private landowner representative (e.g., NY Forest Owners Association) to the IS Advisory Committee. See Section 4 for additional recommendations on providing outreach to and engaging with private landowners.
- *AmeriCorps and other service organizations.* Leaders from these organizations may be able to facilitate new opportunities for implementing projects and engaging individuals.
- *Pet trade, aquarium owners, and water gardeners.* These groups have the potential to influence the spread of invasive species in New York but may lack awareness of the ways that their decisions could contribute to the problem (Lauber, Connelly, and Stedman 2015b).
- *Professional organizations.* The IS Council should identify relevant professional organizations for consultation on technical aspects of

IS management or other discipline as it relates to IS management. Representatives from these organizations may provide presentations to the IS Council and IS Advisory Committee on technical applications and emerging management alternatives.

Connect with national IS organizations and neighboring states to leverage knowledge and resources.

- Ensure that members of New York's IS leadership work with Federal and international partners to promote policies designed to prevent the introduction of IS at a national level (e.g., ballast water policy), and that State initiatives are compatible with and help advance the goals of Federal and international programs.
- Continue to lead and collaborate regionally with researchers, policy makers, and resource managers in neighboring states to develop and share knowledge about the impacts of climate change on invasive species and ecosystem resilience.
- Empower key staff members/organizations within the State's IS network to actively engage in or lead multistate collaborations. For example, encourage NYISRI to continue as a designated "hub" for the North American Invasive Species Network (NAISN); and foster NYSDEC staff's ability to travel and readily participate in multistate IS panels and work groups.
- Engage neighboring states that use iMapInvasives to allow data access, coordinate on issues such as confirming



Stakeholder workshop, photo courtesy of OBG

records and mapping along state boundaries, and establish multi-state email alerts. iMapInvasives staff should also work with NatureServe, PRISMs, neighboring states, and Canadian provinces to advance data sharing capabilities by leveraging existing technology.

Work together when pursuing extramural funding.

- Encourage PRISMs to seek opportunities to partner in pursuing extramural funding opportunities and implementing

cross-regional programs. Similarly encourage IS Council members to partner in pursuing extramural funding opportunities. This strategy will help minimize multiple organizations competing for the same extramural IS funding. For example, NYISRI recently partnered with the NYSDOT to pursue biocontrol funding. Collaborative partnerships such as this reinforce the strength of New York's comprehensive IS program. Establishing research and management priorities at the state level (Section 3) is recommended to facilitate the coordinated pursuit of funding.

2. Commit to a Centralized Framework for Sharing Invasive Species Information

2A. NEED

New York has adopted a management framework that includes both centralized and regional organizations and partnerships. These parties, and the public, need to be kept informed of new threats, effective management actions, and who's doing what, when, where, and how. Existing websites such as the New York Invasive Species Clearinghouse (nyis.info), PRISM websites, the NYSDEC Nuisance and Invasive Species web page, and sites maintained by other IS partners provide extensive information, however, audiences seeking IS expertise perceive a scattered array of online resources and a high potential for conflicting or outdated information. Meanwhile, programs maintaining these sites risk duplication of effort.

The New York Invasive Species Clearinghouse site was developed to serve in a central role, but support for this site (funding and staff to manage it) has fluctuated in recent years. There is also a need for centralized, statewide information to support collective decision-making at the state scale. The current iMapInvasives mapping resource provides outstanding opportunities for geographic analysis of IS challenges and empowering citizen science; however, its current platform limits usage.

Progress to Date

- Since iMapInvasives was launched in 2010, over 180,000 invasive species observations have been recorded by engaged citizens and professionals in the field. These observations span 312 terrestrial and 26 aquatic plant species, five terrestrial and 50 aquatic animal species, and 12 insect species. iMapInvasives can be used for collecting, conveying, and analyzing IS data as well as issuing email alerts, and, as such, can serve a central role in supporting data-based decision-making at state and local scales. Development of iMapInvasives 3 (iMap3), featuring an Environmental Systems Research Institute (ESRI) platform is expected to be operational in 2019.
- The Watercraft Inspection Steward Program Application (WISPA) was developed through a partnership among NYS OPRHP, iMapInvasives, NYSDEC, NYSG, and PRISMs. WISPA was designed to standardize data collection during aquatic invasive species watercraft inspections statewide. In 2018, 16 organizations utilized WISPA and participation is expected to expand in the future.
- The NYISRI website is attractive and informative, and it provides expert and manager databases that can be used to locate knowledgeable individuals.

- The New York Invasive Species Clearinghouse (nyis.info) was launched in 2007; a limited update to the site is anticipated to be completed in 2019.

2B. APPROACH

The IS Coordination Section and partners should focus resources on developing and maintaining one information clearinghouse that houses or links to expert-vetted, up-to-date content from the collaborative network of partners across the State. This website should provide content developed by and actively solicited from IS partners who are attuned to emerging issues, new resources,

and the most relevant and current IS expertise. Individual partner websites could then focus only on content related to their specific programs (or be phased out if appropriate), and could link to the centralized site for information of interest to wider audiences. A relaunch of the Invasive Species Clearinghouse should be carefully planned among the IS Council, NYISRI, iMapInvasives, and PRISMs to address these matters.

In addition to supporting development of this centralized IS website, the IS Council should continue to endorse the use of iMap3 and harness its potential to gather information from partners, gain insights to improve priority-setting and evaluation, and share rich, real-time information with collaborators.

2C. RECOMMENDED ACTIONS

Reduce overlapping online information by advancing one actively managed IS website.

- The IS Coordination Section should provide support for a centralized website/clearinghouse to be staffed by a web content professional whose role is to solicit and synthesize information by actively engaging with members of the State's collaborative IS network (IS Council, Advisory Committee, PRISMs, etc.). To fulfill its function as an aggregator and synthesizer of IS content, the site should clearly represent a collaborative network of IS partners rather than any single institutional entity.
- The site should be established with an eye toward serving the needs of end-users, with an information



HWA survey, photo courtesy of Adirondack Park Invasive Plant Program

architecture and design that make key information readily accessible. The site should be managed by dedicated staff with expertise in content strategy and an ability to audit, curate, and augment the site with new information from key contributing partners throughout the State.

- Staff managing the site should be considered an integral part of the State's IS network and should attend meetings of the IS Council, Advisory Committee, and other partners to remain abreast of evolving issues. This staff member should also work closely with outreach/marketing professionals (Section 4) to publicize the site and ensure consistent branding, messaging, search engine optimization, and integration with social media.
- IS Council leads should help to populate a directory of managers and technical experts working on IS matters. The directory shall include contact information and a brief description of responsibilities and be made available

on the centralized website. The expert database available on the NYISRI webpage may be a starting point for developing this directory.

Leverage the collective capacity of partner organizations to maintain an active and interesting online presence, and promote interaction when possible.

- Develop a social media content strategy guide that will help partners create and share content in a way that engages new audiences and amplifies important messages, while avoiding competition over messaging or duplication of effort.
- Primary responsibility for coordinating this online presence could be assigned to staff for the centralized website, with the understanding that they work closely with NYISRI, PRISMs, iMapInvasives, and others (e.g., CCE) who currently maintain websites and social media accounts for consumers of IS information. The potential for consolidating competing social media accounts and blogs for partner organizations should be evaluated.
- Invite and encourage public engagement on IS topics through social media (e.g., establish public social media user groups, use crowdsourcing to assist in addressing information gaps). Social media may also be leveraged to increase public participation in IS Advisory Committee and other public meetings. Guidelines for this type of public engagement could be addressed in the social media content strategy guide, with a web content manager in the role of moderating comments and transmitting information.

Effective coordination among organizations managing invasive species requires funding to maintain iMap... as well as websites with accessible, accurate, and timely information.

— LANDSCAPE ARCHITECT



Advance the capabilities of iMapInvasives.

- Continue to support iMapInvasives development, along with needed staffing, to keep up with the technology needs of key State IS partners. For example, the iMap3 redesign will leverage an ESRI framework to support broader usage, particularly with mobile tools.
- iMapInvasives staff should engage with NYSDAM, NYSDEC Division of Marine Resources, CCE, the NYSIPM Program, and Soil and Water Conservation Districts (SWCDs) to evaluate opportunities for data sharing and ongoing software updates that facilitate shared goals. Similarly, iMapInvasives staff shall continue evaluating opportunities to incorporate additional sources of data (e.g., USDA Forest Inventory and Analysis) as well as instances of education and outreach events to help evaluate geographic gaps in such efforts. Enforcement actions may also be recorded to help identify

areas (geographically, commercial sector) that may require targeted education and outreach attention.

- Additional, general improvements to iMapInvasives include:
 - Expansion of the database to include data on invasive marine taxa
 - Increased data integration and data standardization
 - Advanced data contributions: survey, absence, treatment, and status over time
 - Embedded analysis and statistics via synthesis, dashboard-type views, and GIS analysis integrating rare species information, risk of spread, and prioritization evaluations.

Continue to advance use of data management resources to understand the status and accomplishments of IS management programs.

- Continue to support WISPA and consider similar applications for other IS initiatives.

Backcountry water monitor volunteer, photo credit Cathy Pedler



3. Set Priorities for Invasive Species Management and Advance Preparedness

3A. NEED

Current priorities for species, habitats, and project sites vary among IS Council members and partners. There is a need to provide a structured process to evaluate IS risks with the goal of identifying the most critical State-level IS priorities (for both species and locations), while maintaining a degree of decentralized priority setting at the regional/local scale, informed by place-based knowledge. At each scale of prioritization (State and regional/local), both public and private land must be considered along with a realistic assessment of vectors including river and canal corridors. Priority setting must also factor in potential climate change effects such as species range shifts, rising sea levels, and habitat suitability changes. In addition, to set well-informed priorities and support decision-making, threats to

New York's environment, economy, and public health from IS need to be assessed and incorporated.

Prevention is a hallmark of an effective IS management plan (see Section 5), and remains a core strategy undertaken by New York's collaborative network of partners. Yet despite best efforts, all invasions will not be averted. Thus, advancements in preparation are needed to limit the extent of negative impacts from new invasions. For example, recent experiences (e.g., hydrilla in the Cayuga Lake Inlet) demonstrated the need for increased preparedness – in this instance, herbicide relabeling and emergency rulemaking were needed to fully implement a response. Prevention and/or preparedness may be best achieved by adopting a forward-thinking approach (e.g., horizon scanning) to identify and plan for potential new invaders before they become established.

Invasives species decision making should be informed by science and seek to engage stakeholders from various perspectives – social, economic, institutional, and ecological.

— NYSDEC GREAT LAKES PROGRAM STAFF



Progress to Date

- Adoption of the Part 575 Prohibited and Regulated Species lists (6 NYCRR Part 575), which prohibits or regulates the possession, transport, importation, sale, purchase, and introduction of select invasive species.
- Partnership with USDA Animal and Plant Health Inspection Service (APHIS)

Plant Protection and Quarantine (PPQ) program, which sets monitoring objectives in collaboration with the NYSDAM CAPS program.

- Completion of non-native animal and plant species invasivity assessments to document potential impacts to New York's native species and natural ecosystems. To date nearly 200 animals and 250 plant species have been assessed, and upcoming assessments are planned for 2018.
- Development of prioritization models within iMapInvasives which are species- and location-based.
- Advancement of an IS prioritization tool development by Cornell University, in partnership with NYISRI and NYNHP, to research and prioritize IS at the manager scale (e.g., regional/local).
- NYS OPRHP is currently creating an Invasive Species Management Plan Template (expected in 2019) to guide development of invasive species management plans and priority setting within individual state parks.

3B. APPROACH

To address prioritization, emphasis should be placed on development and implementation of a State-level priority setting process, which includes assessing risks to the environment, economy, and public health. State-level prioritization of species and locations would facilitate cooperation among IS Council members, and should consider threats to both public and private lands. As part of the priority setting process,



Dwarf shrub bog, photo courtesy of New York Natural Heritage Program

a horizon scanning approach should be developed to evaluate potential IS that may cause the most harm to New York. The horizon scanning process should also consider the interaction of IS and climate change. As an extension of the State-level prioritization, regional/local priorities could be developed that encompass place-based knowledge and expertise. To the extent possible, priority setting should be tied to preparedness measures to avoid or mitigate emergency situations.

Species- and location-based information should be gathered to increase preparedness based on set priorities. Information that may be relevant to elevate New York's level of preparedness for a given IS includes:

- Basic biological parameters (e.g., preferred habitat, fecundity, season of reproduction), potential control measures, strategies for outreach and education, how best to incorporate the species into early

detection monitoring, how best to engage species-specific experts before introduction occurs.

- Further steps to increase preparedness (e.g., regulatory actions such as adding a species to the Prohibited and Regulated Species lists (6 NYCRR Part 575), identifying and removing regulatory barriers to implement a response) should be evaluated and addressed to position New York to deploy rapid response measures (see Section 6).

3C. RECOMMENDED ACTIONS

Establish a collaborative Horizon Scanning Committee focused on prioritization at the State level.

- This committee is intended to set State-level priorities for IS that pose the greatest threat(s) to New York's environment, economy, and public

health, as well as location-based priorities for areas with high conservation or agricultural value. The Horizon Scanning Committee should consider both public land (e.g., natural areas, parks) and private land (e.g., agriculture), as well as freshwater and marine systems in setting priorities.

- Include appropriate IS Council members on the Horizon Scanning Committee to ensure information sharing, diverse perspectives, and collaboration. Potential members include staff representatives from NYSDEC, NYSDAM, NYSDOH, NYSDOT, and NYS OPRHP. In addition, include appropriate representatives of IS Council partners that are best equipped to provide quality input and data. Potential members include staff representatives from NYISRI, the NYSIPM Program, NYNHP, NYSDEC Office of Climate Change, and NYSDEC Division of Marine Resources. Representatives should be prepared to share data and expertise from their respective programs to optimize the state-level prioritization process.
- Develop a horizon scanning procedure to identify and document potential new IS to New York, and conduct environmental, economic, and public health assessments for the identified species to inform prioritization and preparedness. Previous plant and animal ecological and socio-economic invasivity assessments could be used as guidance, and updated to include public health considerations. The horizon scanning procedure should also evaluate potential interactions between IS and climate change by considering the latest climate models and species characteristics. Regular



Pale Swallowwort in the SLELO Region, photo courtesy of St. Lawrence-Eastern Lake Ontario Partnership for Regional Invasive Species Management

communication with neighboring states, and participation in multistate meetings and other events (Section 1) should be encouraged as part of the horizon scanning procedure.

- Utilize existing information, such as the iMapInvasives and CAPS data, to inform the priority setting objectives.
- At a minimum, hold an annual meeting of the Horizon Scanning Committee to review, add, or modify State-level priorities.

Use the State-level priorities to inform and establish regional/local priorities.

- Encourage collaboration among PRISMs, CCE, land trusts, and SWCDs to develop regional/local priorities that include both public and private land.
- Advance and utilize a manager-level prioritization process and tool(s), being developed in partnership with NYISRI and NYNHP, to assist in refining regional/local priorities.
- Recognize that State-level priorities will be cross-cutting and inclusive to all of New York, but regional/local priorities may be informed by place-based conditions and considerations.
- Include state, regional, and local priority areas on NYS's Environmental Resource Mapper.

Advance preparedness through information gathering and sharing.

- Advance knowledge of marine IS and their impacts by supporting basic

taxonomic, biological, and ecological research focused on New York's marine ecosystem (all estuarine, coastal, and offshore waters from New York out to the Atlantic continental shelf break).

- For prioritized species, engage experts and collect information related to biology, habitat preferences, potential control alternatives, outreach and education strategies, and how best to monitor.
- For prioritized locations, identify which species pose greatest risks to a prioritized area and have a high likelihood of introduction, and evaluate how to incorporate these species into early detection monitoring.
- Review and update, as appropriate, Part 575 Prohibited and Regulated Species lists (6 NYCRR Part 575). These lists could incorporate high risk species identified by a priority and Horizon Scanning Committee.



We need to be able to work in appropriate priority areas, but we generally end up working in areas where impacts are most heavily felt rather than the areas that... would have the greatest positive impact.

— PRISM STAFF

4. Engage and Inform the Public

4A. NEED

The introduction, spread, and management of invasive species is heavily influenced by the actions of citizens who live, work, and recreate on public and private lands and waterways in New York. Education and outreach about IS increases public awareness and knowledge, which are necessary precursors to behavior changes that could reduce risks throughout the State. The National Invasive Species Council has acknowledged that “although invasive species are among the greatest threats to biodiversity, the economy, and human well-being worldwide, the invasive species issue has not yet achieved a level of recognition that is consistent with the

substantial scale of the ecological and socioeconomic impacts resulting from biological invasion” (2016, 18).

Research in NYS has shown that “about 76% of New York’s residents are aware of the term ‘invasive species,’ and about one third of New York residents ‘know something about’ invasive species” (NYSDEC 2016b). However, New York residents lack deeper knowledge about the risks IS pose to public health, the economy, and natural areas, and steps that can be taken to actively prevent the spread of IS. Public education and outreach should stress the power of individual and collective actions, and should be targeted toward audiences whose choices and behavior are most likely to have a beneficial influence on IS prevention and management.

Lack of outreach is the greatest barrier to preventing the spread of invasive species. Public reporting has been especially useful in detecting many of these species, so outreach is important there, too.

— NYSDEC FOREST AND
TERRESTRIAL HEALTH STAFF

”

Progress to Date

- In 2005, the Invasive Species Task Force recommended establishing a comprehensive education and outreach effort in New York. Since then, NYSDEC has launched efforts to identify IS outreach priorities and guide strategic communication with the public: Cornell University’s Human Dimensions Research Unit conducted a three-phase study on IS awareness and perceptions, supported by the EPF (Connelly, Lauber, and Stedman 2015; Lauber, Connelly, and Stedman 2015a; 2015b), and NYSDEC’s IS Coordination Section surveyed stakeholders in 2015-16. Results of these studies offer insights into public knowledge about IS

threats and understanding of the links between behavior and preventing the spread of IS. These studies culminated in the Strategic Recommendations for New York Invasive Species Education & Outreach, 2016-2021 (NYSDEC 2016b).

- Statewide initiatives include Invasive Species Awareness Week (ISAW), Hydrilla Hunters, hemlock woolly adelgid (HWA) survey teams, and Cornell University's annual invasive species in-service. Programs that have been especially successful are the Watercraft Inspection Steward Program and the "Don't Move Firewood" campaign, which enhance public awareness of specific IS vectors, and the iMapInvasives program, which both educates citizen scientists and expands our collective knowledge base.
- Individual PRISMs have spearheaded outreach efforts that vary by region and setting. For example, in 2017 the Adirondack Park Invasive Plant Program

(APIPP) developed an IS toolkit for highway departments as an outgrowth of its strategic effort to enhance messages, distribution channels, and outreach products for target audiences.

4B. APPROACH

The need for greater public awareness and engagement regarding IS can be addressed by improving public access to IS information, so residents can easily find appealing, accurate sources of IS knowledge through media they rely on most heavily. In addition to raising awareness, outreach materials should focus on behavior changes that are likely to control IS effectively without being too cost-prohibitive or time consuming, as these factors negatively affect people's willingness to engage and implement management practices. Education and outreach efforts should be targeted toward specific audiences whose behavior changes are most likely



AIS training at Bolton Landing, photo courtesy of Adirondack Park Invasive Plant Program

to be influential in the short term and/or long term. Finally, new approaches to communicating about IS should tap into the power of partnership networks that have the potential to strengthen outreach and education by providing clear, concrete messages to key public audiences.

4C. RECOMMENDED ACTIONS

Establish a centralized statewide branding/marketing initiative.

- Develop unified messaging that can be used by PRISMs, ambassadors, and the media to promote IS solutions and tools with key audiences. Consider seeking the services of a specialized marketing/communication consultant as part of this effort, and potentially draw on materials from national and regional campaigns. Through improved IS branding, audiences will be repeatedly exposed to consistent, effective, visually appealing messages, regardless of the medium (i.e., billboards, brochures,

social media, televised PSAs). Note that this unified messaging and branding may be used in addition to identifiers that are familiar to local or regional audiences (e.g., PRISM-specific).

- Promote the awareness of major, centralized sources of information (e.g., iMapInvasives and a unified website discussed as part of the “centralized framework” in Section 2) so that engaged stakeholders can contribute to an expanded knowledge base (e.g., via citizen science); easily access the most current information; and understand where to find specific additional resources (e.g., PRISM networks).
 - Use positive messages in developing a unified branding initiative. Consult with market research experts in developing a logo or slogan, and include audience testing as part of this effort.
 - Deliver information to audiences using media that are most likely to reach them, based on research about audience preferences. For example, television and the internet are primary sources of information for New Yorkers (Connelly, Lauber, and Stedman 2015), so IS information distributed via these media may be more likely to reach target audiences. Social media outreach should be integrated into the centralized effort.
- Emphasize behavior change in messaging.**
- People are more likely to be persuaded to change behavior if it is not cost-prohibitive or time consuming, and if it is likely to control IS effectively (Connelly, Lauber, and Stedman 2015, 14, 26).

A challenge to managing invasive species is difficulty engaging stakeholders and bringing about broad preventative behavior changes.

— PRISM STAFF



Therefore, messages should, to the extent possible, provide instruction on easily adoptable changes in behavior, as well as clear explanation of how behavior changes will contribute to solutions.

- Publicize best management practices (BMPs) emphasizing the use of positive messaging to show that effective practices have been identified and improvement is possible.
- Target messages about behavior change to high-priority audiences identified in NYSDEC (2016b) strategic recommendations for statewide education and outreach: highway personnel, municipalities, tourists/tourism industry, pet trade/water gardeners, urban communities, direct users of natural resources. Messages may also be tailored to meet the needs of specific ecosystems (e.g., marine ecosystem).

Develop campaigns specifically targeted to reach private landowners.

- Motivate landowners to take steps that would contribute to landscape-level efforts to manage IS. These efforts could involve leveraging the target audience's underlying interests by crafting messages that address their priorities (e.g., economic motivations). Staff leading these types of campaigns should consult the growing body of research on human dimensions of IS management (e.g., Niemiec, Ardoin, Wharton, and Asner 2016).
- Use the connections and resources of NYSDAM, SWCDs, CCE, NY Forest Owner's Association, USDA's Natural

Resources Conservation Service (NRCS), and NYSDEC's Forest Resource Management Bureau to engage and educate private landowners on the availability of conservation incentive programs, and evaluate potential landowner barriers to participating in such programs. Possible mechanisms might include USDA's Wildlife Habitat Incentive Program (WHIP) and Wetland Reserve Program (WRP), and New York's Forest Tax Law (480a-b).

- Utilize partnerships to reach landowners who already have established relationships with organizations represented on the IS Council and IS Advisory Committee. For example, education/outreach staff housed at or supported by NYSDEC could collaborate with Extension-based organizations that specialize in transferring research-based knowledge to landowners in agricultural and suburban settings (e.g., the NYSIPM Program, Master Gardeners). This approach will take advantage of existing trust levels and well-established outreach networks, while tapping into branding and messaging focused specifically on IS.
- Encourage private landowners in each region of the State to perform ecosystem-based management (EBM). This process could be initiated with PRISMs, SWCDs, or organizations such as NY Forest Owner's Association identifying and engaging with large (1,000 ac+) landowners, land trusts, and/or those with high priority landholdings (e.g., headwater forest stands at risk of HWA) and identify opportunities to implement ecosystem-based management on their land. Existing NYSDEC Landowner Incentive



Eastern Lake Ontario Boat Launch Stewards SLELO PRISM, photo courtesy of St. Lawrence-Eastern Lake Ontario Partnership for Regional Invasive Species Management

Programs (voluntary partnerships between private landowners and the NYSDEC to protect habitat), and Federal grant or easement programs, can be utilized to advance such initiatives (Section 7).

- Add consideration of invasive species to the existing guidelines for Landowner Forest Stewardship Plans.

Strengthen relationships with local municipalities to foster or improve local engagement and buy-in.

- Encourage PRISM leaders and partners to establish new relationships with municipal leaders in their regions.
- Develop messages targeted specifically

toward key municipal officials, such as urban foresters, planning departments, highway departments, and parks departments (e.g., promoting awareness of available grants/funding opportunities, BMPs for mulching and tree planting).

- Provide short articles and informational links that municipalities can share with residents in community newsletters and social media posts.

Educate future generations by incorporating IS into curricula for grade school and college students.

- Provide IS curriculum units aligned to the new NYS P12 science learning standards. This initiative would continue work begun as part of NYSDEC's IS Coordination Section's collaboration with the NYS Department of Education (NYSDOE) representative on the IS Council. One approach may be to integrate IS into existing curricula that are already being used in schools, such as Project Learning Tree, Project Wild, or Project Aqua.
- Engage with the Boards of Cooperative Educational Services (BOCES) to develop a technical training program for high school students focused on invasive species management.
- Promote the integration of invasive species topics into college/university courses and look for ways to raise awareness across the broader campus community by drawing on ideas presented in NYSDEC's strategic recommendations for IS education and outreach (2016b, 10): create a network of professors interested in promulgating

IS-related concepts; provide students with opportunities to contribute to an invasive species monitoring network (Section 5) through field-based research; invite students to share invasive species research findings at conferences and webinars; and showcase professor/student research via shareable media.

Engage “ambassadors” by formalizing a role for key stakeholders from various sectors.

- Initiate a program to recruit and train leaders from various professions (e.g., nurseries, realtors, science educators, foresters/loggers, municipalities) who would be willing to help to reach additional target audiences. Provide these volunteers with tools to help spread the word to their constituents. Formalize these networks and offer recognition to reward

professionals willing to assist in this effort. Programs such as CCE Master Gardeners and NYSDEC Cooperating Foresters may have insights into building successful ambassador networks.

- Include elected officials as a target audience in IS outreach efforts, emphasizing the value and effectiveness of programs that are underway. Planning departments could also help to enhance meaningful engagement at the municipal level and support elected officials in the role of ambassador.
- Provide an incentive for industry professionals (e.g., horticultural, lumber, pet trade/aquarium, gravel and sand companies) to participate in IS training by establishing a certification program that would allow employees and managers to be recognized for capabilities in this area.

5. Advance Prevention and Early Detection

5A. NEED

Prevention is the first line of defense against would-be invaders and is the preferred management strategy. Because of the potential for new preventative measures to affect commerce and trade, an economic assessment of the risk of harm from specific IS can provide critical information for decision makers. That is, the economic impacts of proposed prevention measures need to be evaluated in context of potential economic impacts of IS.

Though investment in prevention measures at all scales is the first line of defense, even the most robust prevention efforts will not be 100% effective. For this reason, early detection (and rapid response, Section 6) of IS infestations is essential. Emerging technologies may assist with early detection of IS. For example, NYSDEC has deployed a fleet of 22 Unmanned Aerial Vehicles (UAVs) for IS detection. Current and potential citizen science programs also present important opportunities to expand

early detection capabilities while complementing technological approaches with boots on the ground. The iMapInvasives database provides a venue for citizens to report IS observations, and the PRISMs are responsible for developing early detection networks comprised of trained staff and volunteers. Other existing programs, such as the Citizens Statewide Lake Assessment Program (CSLAP) and Water Assessments by Volunteer Evaluators (WAVE), involve many stakeholders across the State to collect ecological data, but these programs are not specifically designed to detect IS. By expanding the scope of existing citizen monitoring programs to include IS or creating similar programs with an IS focus, there are opportunities to strengthen NYS's early detection capacity while building partnerships through public engagement (Section 4).

While these examples represent significant progress toward effective statewide prevention and early detection/monitoring systems, there is a need to take stock of current practices to identify gaps in the State's early detection program including taxonomic expertise; technological, human, or financial resources; and spatial or ecosystem-specific gaps.

Progress to Date

- In 2005, the Invasive Species Task Force highlighted prevention as an essential strategy of an IS management

Prevention is always the goal, but when an invasion has occurred, early detection and rapid response is ideal.

— AUDUBON SOCIETY STAFF





Boat wash station, photo courtesy of Adirondack Park Invasive Plant Program

- program. In response, NYS adopted the Part 575 Prohibited and Regulated Species lists (6 NYCRR Part 575), which prohibits or regulates the possession, transport, importation, sale, purchase and introduction of select invasive species.
- Adoption of aquatic invasive species regulations at NYSDEC boat launching and fishing sites (6 NYCRR Sections 59.4 and 190.24), which prohibit watercraft from launching from a State boat launch or fishing access site or leaving these sites with any visible plant or animal material on, in, or attached to the watercraft and associated equipment. Likewise, all watercraft must be drained prior to launching from and leaving these sites. Additional regulations (6 CRR-NY 576.3) were adopted in June of 2014 requiring watercraft to be cleaned, drained, and treated (dried, rinsed, or painted) before launching into any public waterbody.
 - Through the Aquatic Invasive Species Spread Prevention Program, NYSDEC has awarded over \$2 million to 24 projects that actively address the spread of aquatic IS by advancing public outreach and boater education, and directly preventing the dispersal of aquatic IS by deploying boat launch stewards, and establishing boat decontamination stations at lakes statewide. This program serves as a model of collaboration among State agencies, municipalities, lake associations, colleges and universities, and environmental organizations.
 - Since 2014 NYS OPRHP has operated a watercraft inspection program designed to contribute to the goals of the Aquatic Invasive Species Spread Prevention Program. NYS OPRHP partnered with SUNY ESF to administer this program in 2018.
 - In 2012 NYS issued a new water quality certification requiring the installation of

ballast water treatment technology to treat water to meet State-specific ballast water discharge standards. Under this certification ballast water exchange and/or flushing is required for all vessels entering New York's waters; and all vessels will be required to install ballast water treatment technology.

- Recognizing that the movement of firewood represents a potential major pathway for forest pest spread, NYS adopted firewood regulations in 2008 (6 CRR-NY 192.5) prohibiting the import of untreated firewood from locations outside the State, requiring people who possess untreated firewood to have source documentation, and limiting the transport of untreated firewood to no more than 50 miles from its source.

- As a partner of the USDA APHIS Plant Protection and Quarantine program, the NYSDAM CAPS program has partnered with other State agencies, industry, and professional organizations to detect, respond to, and eliminate infestations of invasive species since 2002.
- As part of the NYSDEC Forest Health Aerial Survey Program, forest health conditions, including those that may indicate the presence of invasive forest pests, are monitored annually. NYS is surveyed every two years.
- In 2016, the NYNHP/iMapInvasives team completed development of an initial spatial prioritization model. The goal of the model is to assist natural resource managers in prioritizing where to allocate resources for early detection surveys and other forms of management by highlighting areas with significant biodiversity values or other high value natural areas that are susceptible to invasive species dispersal.
- In 2012, iMapInvasives introduced its email alert system. Significant or suspicious invasive species observations trigger email alerts to iMapInvasives staff and relevant experts thus facilitating rapid confirmation and response.



Watercraft inspection, photo courtesy of NYS Office of Parks, Recreation, and Historic Preservation

5B. APPROACH

While ensuring that NYSDAM has the staffing resources needed both to coordinate with other agencies/partners and to assist with IS prevention, potential new commerce regulations intended to prevent IS introductions should be evaluated with economic cost-benefit analyses and debated

openly among the IS Council, IS Advisory Committee, and other involved agencies. Geographic resources such as iMapInvasives and PRISMs can be used to establish a statewide monitoring network to facilitate early detection of IS in sensitive natural areas, likely new introduction points, corridors, and other critical areas identified by pathway analyses. In parallel with staffing, this monitoring network with boots on the ground, research, development, and application of emerging technologies should be explored and utilized to expand capabilities wherever possible.

5C. RECOMMENDED ACTIONS

Maintain and expand resources dedicated to prevention and early detection.

- Maintain support for CAPS in recognition that this is NYS's first line of defense against potential invaders. NYSDEC and NYSDAM should evaluate opportunities to support increased CAPS staff capacity to conduct more extensive surveys of incoming shipments and related agricultural and horticultural products distributors (greenhouses, plant dealers, forest products, as well as the pet trade and water garden supply trade).
- Continue to support programs that strengthen NYS's taxonomic capabilities including the NYSDEC ecosystem health intern employment, training, and evaluation program, and evaluate the availability of additional educational programs to advance the taxonomic capabilities of future IS and pest management professionals.

- Ensure NYS has the appropriate taxonomic resources to facilitate timely taxonomic and diagnostic results by providing additional support to existing resources such as the Diagnostic Laboratories at Cornell University.
- Expand support for programs that have had a demonstrable impact on prevention and early detection of IS, such as the Aquatic Invasive Species Spread Prevention Program.

Conduct economic impact evaluations of IS to support cost-benefit analyses and priority setting.

- Identify researchers and trade organizations with the credibility and know-how to produce unbiased IS economic impact evaluations and advance such work. Initial IS economic impact evaluations should be completed for priority species selected by a prioritization and Horizon Scanning Committee (Section 3).

Develop and apply emerging technologies.

- Identify technological, analytical, or other programmatic gaps, facilitate the research and development needs of emerging monitoring technologies (e.g., UAV photogrammetric approaches and eDNA) and identify barriers to widespread application. This may be accomplished by advancing knowledge, expertise (collection and processing) and resources among State agencies and partners through research, program growth and partnerships.
- Support the establishment of certified eDNA labs specifically designed and



eDNA sampling, photo courtesy of St. Lawrence-Eastern Lake Ontario Partnership for Regional Invasive Species Management

equipped to provide reliable results by minimizing potential DNA contamination. Develop BMPs for the dissemination and application of eDNA results (e.g., confirmation protocols). Advance eDNA technology by gathering the baseline data required to perform risk and change analyses.

- Continue to advocate for the development and application of more effective ballast water treatment technologies, while promoting the establishment of tighter ballast water standards.
- Identify researchers, managers, and other individuals developing or utilizing emerging monitoring tools, technologies, or techniques for inclusion in the Invasive Species Expert Database managed by NYISRI.
- Expand support for research focused on prevention through pathway and vector management. Research may encompass social, biological (e.g., biological dispersal barriers), and engineering (e.g., physical barriers) components.

Establish an IS-specific monitoring network.

- Design a statewide IS early detection monitoring network based on a strategic monitoring plan that incorporates permanent monitoring points (e.g., high risk areas, assets, corridors), standard techniques, and emerging technologies (e.g., eDNA). The monitoring plan and network should address existing technological, spatial, or knowledge gaps and be designed to target priority species selected by a prioritization and Horizon Scanning Committee (Section 3). Permanent monitoring points and data may be housed within the iMapInvasives database (Section 2). The spatial prioritization tools developed by NYNHP and iMapInvasives (Section 3) may be used to inform the design of this network around areas of ecological significance with substantial risk of IS invasion. Major connecting watercourses

such as the Hudson River and Erie and Champlain Canals should be also be a significant consideration.

- Designate an organization with the necessary capacity to oversee development and maintenance of a statewide IS early detection monitoring network. This organization should also be responsible for synthesizing collected data and reporting outcomes.
- NYSDEC should review staffing, training, and licensure needs to establish capacity to provide IS monitoring and respond to new IS introductions.
- Evaluate existing statewide monitoring programs (e.g., CSLAP) and determine the extent to which they can be modeled or adapted for IS monitoring purposes and included as part of a larger network.
- Support development and application of pathway analyses to inform the design of an IS early detection monitoring network and associated monitoring plan. Identify data sources (e.g., trail registry sheets, boat launch steward data, public campground records, lodging services, shipping records) and researchers with capacity to assist in the development of a pathways study.
- Provide IS identification and reporting training to all State employees who conduct regular field work including

NYSDEC biologists, foresters, Environmental Conservation Officers (ECOs), and Forest Rangers; NYSDAM scientists, and inspectors; NYSDOT personnel; and others. All State employees should be encouraged to utilize iMapInvasives to record IS infestations observed during field activities. Forest Rangers and ECOs should be encouraged to record enforcement and public education actions relating to IS in addition to IS observations.

Support the advancement of the early warning notification system.

- An early warning notification system should provide real-time updates to the agricultural, silvicultural, horticultural, and aquacultural communities as well as PRISMs and other management entities concerning new discoveries of invasive pests (all taxa).
- iMapInvasives is well positioned to collaborate with NYSDEC and NYSDAM in unifying early warning systems to enhance the existing email alert system that provides updates to key agency staff about target species as identified by NYSDAM (selected from the national list provided by APHIS's New Pest Advisory Group) and NYSDEC. Emerging species identified by a prioritization and Horizon Scanning Committee described in Section 3 should also be included.

6. Improve the Response to Invasive Species

6A. NEED

While the IS Council and partners respond to IS throughout the state, there is a need to improve processes and the overall structure of IS responses. Specifically, clarity is needed for when an Incident Command System (ICS) is appropriate and when a response action is warranted. The development and implementation of IS response decision tools that are applicable to all taxa are needed to make well-informed and transparent decisions in the planning phase of an IS response.

Additionally, the dispersed nature of current IS responses (spatially, temporally, and administratively) means that information and knowledge sharing may not be fully realized. Response projects and specific management actions need to be shared among practitioners across the State to facilitate information sharing, and to increase collective understanding of appropriate actions and their outcomes. Streamlined permitting for IS management actions would increase efficient implementation of appropriate responses, and strategically procuring resources is vital to quickly combat new, verified invasions. Innovative techniques, such as biocontrol of IS, offer promising outcomes and there is a need to continue support for biocontrol research, its development, and application.

Ultimately, a comprehensive IS management program relies on staff commitment to rapidly respond to early detections of IS.



The Incident Command System protocol should be incorporated into the rapid response process, especially when decision making is urgent”

— LANDSCAPE ARCHITECT

Progress to Date

- Responses to IS currently encompass actions of State agencies, municipalities, permittee responsible work (e.g., wetland mitigation), environmental cleanups governed by NYSDEC Division of Environmental Remediation (DER-10), PRISMs, and work funded by Federal programs (e.g., Great Lakes Restoration Initiative). Eight PRISMs have been established throughout New York to, in part, increase rapid response capacity and implement IS control projects.
- Development and release of NYSDEC’s Rapid Response for Invasive Species: Framework for Response (NYSDEC 2016a). This document provides procedures to respond to IS, including verification and notification, rapid assessment, planning, rapid response, monitoring and evaluation, and restoration following an IS early detection.

- Implementation of NYSDEC's Invasive Species Rapid Response and Control Grant Program, which provides funding for management actions (physical/mechanical, chemical, and biocontrol) to address IS. In 2017, 35 projects were funded, totaling \$1.7 million.
- Support for and advancement of biocontrol program. NYISRI has been engaged in supporting biological control research across the State including swallow-wort, water chestnut, Mile-a-Minute, knapweed, and HWA. NYSDOT has also provided significant funding for the research and development of a biocontrol agent targeting invasive common reed (*Phragmites australis*).
- Support for and advancement of the NYSIPM Program and the New York State Agricultural Experiment Station (NYSAES), in partnership with Cornell University, to research innovated methods to respond to agricultural pests, including invasive species.
- NYS has recent experience responding to new invasions – hydrilla, oak wilt, Asian long horned beetle (ALB), emerald ash borer (EAB), and HWA.

6B. APPROACH

To standardize the response to IS within the State, NYSDEC's Rapid Response Framework (NYSDEC 2016a) should be fully implemented. To help clarify decision-making within the Rapid Response Framework, criteria to implement ICS should be identified, vetted, and adapted. The prioritization information developed under Initiative 3 may be considered in the development

of ICS criteria, but ICS implementation must also be flexible to encompass species or locations that have not been identified as State priorities. Further, tools to assist in IS response decision-making should be evaluated, and new response decision-support tools developed to encompass all taxa. These response decision-support tools can be used to provide transparency, and assist in making informed decisions about resource needs and levels of urgency for management response alternatives.

Because of the dispersed nature of IS responses, current or proposed projects being implemented by the IS Council and partners should be added to a master schedule and mapped to identify procurement, coordination, and knowledge sharing opportunities among resource managers. Additionally, a streamlined permitting process to



Biocontrol, *Galerucella* beetle release, photo courtesy of NYS Office of Parks, Recreation, and Historic Preservation



Stem injection, photo courtesy of Adirondack Park Invasive Plant Program

implement IS management action(s) should be evaluated, perhaps by issuance of general permits informed by vetted BMPs for IS management actions. Similarly, opportunities to increase efficiencies in procurement of resources will serve to increase the speed to which management actions can be implemented for a verified early detection.

6C. RECOMMENDED ACTIONS

Implement NYSDEC's Rapid Response Framework.

- Review and adapt the Rapid Response Framework, as appropriate, to make applicable to all State agencies. The IS Council is positioned to conduct the review and make adaptations.
- Encourage IS Council partners to utilize the Rapid Response Framework to ensure consistency in responding to IS across the State.

Develop criteria to determine when an ICS is needed to govern an IS response.

- NYSDEC and NYSDAM are best positioned to develop ICS implementation criteria and guidelines.
- At a minimum, establish a Lead Coordinator following an IS verification, and before the rapid assessment phase, to maximize efficiency of the response.
- Provide periodic ICS training to staff members and conduct annual stress test exercises to simulate roles and responsibilities and to identify challenges.



Using the Incident Command System has allowed us to have effective communication with other agencies.

— NYSDEC FOREST AND TERRESTRIAL HEALTH STAFF

Leverage and develop IS response decision-support tools.

- Evaluate the effectiveness of existing tools, such as the Invasive Plant Management Decision Analysis Tool (IPMDAT), and generate new tools that will inform the level of effort, cost-benefit analysis, and urgency applied to a response.
- New IS response decision-support tools should be applicable to all taxa and include region-specific considerations such as species biology (e.g., leaf out, flowering, seed set) and climatic conditions, as well as time of introduction (e.g., season), and spatial extent of an initial established population. Decision-support tools should be designed to incorporate the results of post-intervention monitoring (Section 8) and recommend additional or alternative management approaches as conditions change.

Enable visibility across the full scope of IS response actions being implemented.

- Establish a web-based application that includes a centralized schedule of who is doing what, where, when, and how for IS Council and IS Advisory Committee members and partners. Include information on treatment/control methodologies, and the results of treatment(s) based on post-monitoring data collection.
- Incorporate the actions of the centralized IS response schedule into iMapInvasives to produce maps of response actions to facilitate strategic procurement, coordination, and knowledge sharing.



Buckthorn removal in Thatcher Park, photo courtesy of NYS Office of Parks, Recreation, and Historic Preservation

Streamline the regulatory permitting process for IS management response actions.

- Develop and promote BMPs for IS management alternatives. BMPs could include vetted treatment options across habitats (terrestrial and aquatic) and taxa and be made available on the centralized website described in Section 2.
- Evaluate the use of a general permit for IS management/response related to approved management actions, informed by the States' IS management BMPs. Coordinate with Federal agencies to develop general permits for IS-related management actions.
- Evaluate the development of a Generic Environmental Impact Statement (GEIS), to include IS management alternatives as a Type II action to pre-position managers for IS response actions.



Herbicide application, photo courtesy of Adirondack Park Invasive Plant Program

Ensure IS Council staff commitment to rapid response.

- Continue to build, and maintain, in-house expertise to effectively respond to IS
- Utilize internal staff to populate IS rapid response strike teams within an ICS

Advance strategic procurement of resources to respond to IS.

- Utilize the operational capacity of existing State and partner organizations to implement IS actions. For example, Bill S4396A-2013, signed by Governor Cuomo in 2014, authorizes directors of SWCDs to implement preventative

and control measures for the spread of invasive species. Use of the SWCDs for these services could avoid the additional administrative and cost layers associated with contracting. Similar scenarios are likely possible in related IS actions (e.g., mechanical controls, rapid response strike teams).

- Utilize existing or new Master Service Agreements (MSAs) or term contracts to procure IS response support, as needed within an ICS or otherwise.

Continue to support research and development.

- Evaluate if additional funding is justified to increase capacity of the biocontrol research program, and if deemed appropriate, pursue funding opportunities.
- Maintain engagement with biocontrol academic partners to advance innovative applications of biocontrol, and seek new partnerships to preposition the State to respond to new invasions.
- Ensure necessary funding for programs that foster innovation in the control of agricultural IS, such as the NYSIPM Program and the NYSAES.
- Encourage collaboration among research programs focused on IS response applications; and support research on meaningful metrics to assess the effectiveness of various IS control methods (both established and innovative) in natural areas and agricultural settings. This may be achieved, in part, by supporting more extensive post-intervention monitoring (Section 8).

7. Recover Ecosystem Resilience

7A. NEED

Resilience is the ability for ecosystems to resist disturbance and/or recover from it. This attribute is vital to the consistent delivery of ecosystem services. Many factors in addition to IS have reduced the resilience of New York's ecosystems. For example, forest regeneration in portions of NYS has been suppressed by white-tailed deer browsing and other anthropogenic factors (e.g., Shirer and Zimmerman 2010). Climate change is another factor affecting the delivery of ecosystem services. Improving ecosystem resilience throughout New York is a critical component of IS management, especially considering that some pests have the potential to cause major ecosystem disturbance by negatively impacting keystone species such as ash and hemlock. Restoration must be considered as an element of IS control and eradication. Public awareness of the need for restoration can build support when disruptive measures are needed to achieve IS management goals.

Effective management for most invasive species requires 3-5 years of removal activities and follow-up habitat restoration. This is widely accepted as a reality; however, most management projects are only 1-2 years.

— PRISM STAFF



Progress to Date

- PRISMs have undertaken ecological restoration efforts. For example, the Western New York PRISM has partnered with the Buffalo Museum of Science and Tifft Nature Preserve to restore vernal pools, and the Capital/Mohawk PRISM is developing a riparian zone planting guide for landowners.
- Ecological restoration efforts in Braddock Bay in Monroe County, NY include the re-creation of a barrier beach that protects the bay and associated wetlands from the erosive effects of wind, waves, and ice; and the enhancement of emergent and submergent wetland habitat through channeling, potholing, and invasive species management. These actions will promote ecological diversity and improve ecosystem resilience to invasive species.
- Since 2012 NYS OPRHP has allocated over \$5 million toward invasive species control and habitat restoration projects that promote species diversity and improve ecosystem resilience.
- Through its Environmental Protection Fund Local Waterfront Revitalization Program, NYSDOS has awarded over \$10 million to municipalities across New York since 1994, particularly in New York City and Long Island, for planning and implementation of projects to prevent, mitigate, and manage invasive species, followed by extensive restoration.

7B. APPROACH

Ecosystem-based management principles underlie several recent NYSDEC management plans, including, for example: the 2017 to 2027 *New York Ocean Action Plan*, 2012 to 2016 *White-Tailed Deer Management Plan*, 2015 *New York State Wildlife Action Plan*, 2013 *Hudson River Estuary Habitat Restoration Plan*, and the 2010 *Forest Resource Assessment & Strategy*. There may be opportunities to pool resources and implement projects identified in these planning documents to provide broad benefit. In intensively managed systems (e.g., agricultural, urban) there is a need to advance soil and water conservation BMPs to protect the quality of downstream aquatic resources and

help to prevent degraded conditions that may favor IS. Additionally, there is a need to further our understanding of the interactions among invasive species and other biotic and abiotic factors (e.g., white-tailed deer, earthworms, climate change, habitat loss, etc.) which may act as drivers of ecosystem change. There is also an opportunity to reveal the linkages between invasive species, ecosystem resilience and economic vitality by pursuing and implementing IS projects in a broader context of economic and community development.

7C. RECOMMENDED ACTIONS

Broaden collaborations focused on ecosystem restoration and ecosystem-based management.

- Numerous existing programs, such as the Great Lakes Areas of Concern, Finger Lakes Water Hub, and the Hudson River Estuary Program are pursuing ecosystem restoration and/or improved ecosystem management. The IS Council and PRISMs are well positioned to engage with such organizations and explore opportunities for collaboration. Marketing of the PRISMs should be advanced in this context.
- The IS Coordination Section is well positioned to work closely with the NYSDEC Division of Fish and Wildlife to identify focal areas for Deer Management Assistance Programs and identify other areas of shared goals. This collaboration could be supported by incorporating data from the AVID (Assessing Vegetation Impacts from Deer) protocol (Sullivan et al. undated) into iMapInvasives to overlay



Wetland with habitat structure, photo courtesy of OBG



Swamp milkweed, photo courtesy of OBG

- white-tailed deer impacts with priority IS management areas. Additionally, the IS Coordination Section should seek opportunities to collaborate with the NYSDEC Division of Fish and Wildlife during future white-tailed deer management plan updates to identify and include mutually beneficial management strategies.
- Explore opportunities to advance ecosystem-based management within the purview of IS Council members' respective agencies and professional networks. For example, the IS Council can promote and advance existing soil and water conservation programs to help maintain ecosystem integrity and resistance to invasive species. The IS Council could engage with the New York State Soil & Water Conservation Committee to evaluate shared goals and evaluate opportunities to promote soil and water conservation in the context of invasive species management.
 - Evaluate mechanisms to advance IS opportunities identified in the 2016 *New York State Open Space Conservation Plan* (NYSDEC and OPRHP 2016) and the 2017 *New York Ocean Action Plan* (NYSDEC and NYSDOS 2017). Such opportunities provide multiple benefits in the control of IS while protecting open space, improving wildlife habitat and water quality, and conserving the environment.
 - Establish a collaborative relationship with New York State's Water Quality Rapid Response Team to identify critical linkages between IS and water quality (e.g., HWA and invasive dreissenid mussels) and potential management strategies.
 - Explore opportunities for collaboration among the IS Coordination Section, the Lower Hudson and Long Island PRISMs, and the NYSDEC Division of Marine Resources to highlight key ecological and programmatic linkages, and identify shared goals.

Evaluate creative management opportunities and mechanisms to advance IS management on priority private lands.

- Promote integrated ecosystem restoration and IS projects in the context of legal settlements. For example, the *Onondaga Lake Natural Resource Damage Assessment Restoration Plan* includes a 15-year strategy to control invasive species in the surrounding wetlands, littoral zone and riparian areas (USFWS 2017). The Natural Resource Damage Assessment program may be an important opportunity to advance win-win IS projects throughout NYS.
- In situations where intensive IS management and ecosystem restoration are critically needed on private lands, Open Space Funding from the Environmental Protection Fund may be considered as a tool to advance access, and couple management with restoration actions.
- Encourage eligible partners to pursue IS projects under NYS's Regional Economic Development Council (REDC) awards. In 2017, 95 projects (\$87 million in total) were funded through this program to improve and protect water quality, reduce polluted runoff, and restore aquatic habitats. Projects included land acquisition to safeguard water quality and aquatic habitat restoration. Pursuing IS projects within the economic development context serves the dual purpose of highlighting the critical role that IS play in economic development and expanding the network of funding opportunities.

Evaluate drivers of ecosystem alteration.

- Support research to evaluate how interactions among invasive species and other biotic and abiotic stressors (e.g., white-tailed deer, invasive dreissenid mussels, earthworms, climate change, habitat loss, etc.) that act as drivers of ecosystem alteration and influence the establishment and proliferation of invasive species. Such research may contribute to IS control effectiveness and habitat restoration success.

Build ecological restoration planning into IS management projects.

- Encourage IS Council members, PRISMs, contract awardees (e.g., within the Invasive Species Rapid Response and Control Grant Program) and private landowners (e.g., those participating in conservation incentive programs) to incorporate an ecological restoration strategy, and associated long-term (i.e., > 5 years) monitoring plan, as an essential element of IS management projects. In some cases, a viable restoration strategy may be natural recovery. In other cases, more intensive strategies may be needed where extenuating circumstances inhibit natural recovery (e.g., dispersal limitations, herbivore pressures). Incorporation of restoration considerations will advance opportunities to mitigate reinvasion of project areas and build ecosystem resilience, as well as add a more holistic perspective on appropriate project collaborators and stakeholders. Incorporation of restoration initiatives into relevant IS management projects should be supported with corresponding funding and tracked in iMapInvasives.

8. Evaluate Success

8A. NEED

The overarching goal of this ISCMP is to help minimize the introduction, establishment, proliferation, and negative impacts caused by invasive species. One clear challenge is that the success of this ISCMP will, in many ways, be reflected in avoided negative impacts, which are not easily measured or communicated. Despite this limitation, there are measures that will improve NYS's ability to document and quantify the success of IS management efforts. This final section of the ISCMP describes various ways to track progress, both with the specific recommended actions and the outcomes they seek to achieve. Defining benchmarks for both actions and outcomes is a key element of evaluating success.

8B. APPROACH

Measure and Report Progress with Plan Recommendations and Outcomes

An annual report card of progress with specific recommendations of the ISCMP would be a useful tool for the IS Council as they develop annual work plans and communicate progress to stakeholders. A template with examples of potential metrics is included as [Attachment 1](#). The following examples illustrate the challenges of measuring progress and outcomes in the context of recommendations in two sections of this document:

Section 1: Build Partnerships and Capacity. Several of the recommended

actions are directed at enhanced institutional capacity and coordination; implementation can be tracked by documenting staffing levels and meeting attendance. These metrics, along with other appropriate indicators identified by the IS Council and partners, should be benchmarked and tracked. The desired outcome of Section 1 recommendations – enhanced collaboration – can be more challenging to measure; one indicator may be a count of multi-agency research proposals.

Section 4: Engage and Inform the Public. Recommendations are directed at improving awareness of IS across NYS. Progress with implementing specific actions, such as development of web-based materials and curriculum content, can be readily measured and reported. However, the desired outcome would be assessed by examining behavior and knowledge. The 2015 Cornell University Human Dimension Unit survey can serve as a benchmark of current conditions and a template for periodic reassessment.

Measure and Report Progress with IS Impacts

Currently, there is no requirement for systematic evaluation and reporting of the effectiveness of various interventions designed to manage IS and reduce their harmful impacts on public health, economic stability, food security, and natural areas. One challenge is the time frame over which a realistic assessment of progress can be made, another is to define robust indicators and assessment protocols that provide meaningful results.

A centralized clearinghouse for information regarding the success of management practices would assist partners with decision making and resource allocation. The value of the information in the centralized clearinghouse would be enhanced by requiring IS Council members, cooperators, and contract partners to explicitly define the objectives of their IS programs and activities, and to measure and report relevant measures of success in achieving these objectives. An engaged research community can provide practical and robust indicators of ecosystem functions resulting from IS management efforts. When done in conjunction with tools such as iMapInvasives, this approach will facilitate information sharing and strengthen the adaptive management approach.



Monitoring, photo courtesy of Adirondack Park Invasive Plant Program

Progress to Date

- Annual funding levels for IS-related programs are tracked through the Environmental Protection Fund.
- Participation in education and outreach events, such as Invasive Species Awareness Week, is tracked and reported.
- Each PRISM prepares annual reports of their activities.
- Boat steward programs track and report intercepted aquatic IS at launches.
- The CAPS (which is funded by the USDA and managed by the NYS Plant Health Director at NYSDAM) reports results of surveys and inspections and emergency responses to IS. These reports are shared with other State agencies, industries, and professional organizations in a continual effort to detect, respond to, and eliminate outbreaks of invasive pests and diseases.

8C. RECOMMENDED ACTIONS

Develop quantitative metrics designed to evaluate progress and outcomes of key recommendations.

- Collaborations among the research community and PRISMs may elicit practical metrics to evaluate the success of interventions.
- The IS Council and partners should review these metrics annually in light of staffing, budget resources, and prioritization.



Encouraging quantitative metrics and incorporating both ecological and economic analysis would help to measure the impact of IS management on the entire ecosystem, including humans.

— PRISM STAFF

- A Report Card should be prepared at regular intervals to document and communicate progress with the Plan's recommendations.
- Continue to develop economic data and information needed to support a cost-benefit analysis of IS management.

Develop a template for cooperators and contract partners to define objectives and measures of success.

- This initiative, which may be managed through the IS Coordination Section, is analogous to the requirement for water quality monitoring programs to develop and adhere to a Quality Assurance Project Plan (QAPP). Measures of success should be informed by research focused on developing metrics to assess treatment effectiveness (Section 6).
- Provide training and mentoring to cooperators and contract partners to ensure that data and information gathered will be standardized (i.e., standardized metrics, and data collection methods) and support an evaluation of effectiveness.

Conduct post-intervention monitoring to evaluate and document effectiveness in accordance with the pre-defined objectives and criteria.

- The spatial and temporal scale of monitoring should reflect the nature of the IS and its dispersal patterns.
- Support the long-term assessment of IS treatment outcomes through post-intervention monitoring. Results of post-intervention monitoring should be integrated into decision-support tools, and may be used to further research focused on developing meaningful metrics to assess treatment outcomes and the effectiveness of various control methods (Section 6).
- Due to the short-term contract period for most IS projects, a phased approach to funding may be needed or permanent and temporary (i.e., interns) NYSDEC staff should be used to perform such monitoring.

Document IS management and outcomes in iMapInvasives.

- This recommendation extends to all PRISMs, cooperators, and contract partners involved in IS management.
- When feasible, incorporate submission of invasive species data to iMap in the deliverables for state-funded invasive species work.
- Ensure that the updated iMap3 software includes this capability so that all interested parties can be informed regarding the effectiveness of various interventions.

Convene an annual meeting to review the outcomes of post-intervention monitoring.

- The meeting can also address whether the suite of monitoring parameters adequately capture progress toward control.
- The outcomes can inform an adaptive management approach to IS interventions and continually improve the design of follow-up monitoring programs.
- This meeting could be coordinated by NYISRI, with involvement of partner organizations that have been significantly involved in measuring the outcomes of IS projects and initiatives.

Summary of Recommendations

1

Continue to Build Partnerships and Capacity

- Maintain the existing IS Council/IS Advisory Committee model with PRISMs, NYISRI, and iMapInvasives as critical elements to a decentralized program.
- Incorporate agriculture programs more fully within the IS leadership framework.
- Engage climate change experts in invasive species collaborations.
- Increase State agency engagement, and leverage strengths of existing agency programs.
- Strategically expand stakeholder groups represented within the IS leadership structure.
- Connect with national IS organizations and neighboring states to leverage knowledge and resources.
- Work together when pursuing extramural funding.

2

Commit to a Centralized Framework for Sharing Invasive Species Information

- Reduce overlapping online information by advancing one actively managed IS website.
- Leverage the collective capacity of partner organizations to maintain an active and interesting online presence, and promote interaction when possible.
- Advance the capabilities of iMapInvasives.

3

Set Priorities for Invasive Species Management and Advance Preparedness

- Establish a collaborative Horizon Scanning Committee focused on prioritization at the State level.
- Use the State-level priorities to inform and establish regional/local priorities.
- Advance preparedness through information gathering and sharing.

4

Engage and Inform the Public

- Establish a centralized statewide branding/marketing initiative.
- Emphasize behavior change in messaging.
- Develop campaigns specifically targeted to reach private landowners.
- Strengthen relationships with local municipalities to foster or improve local engagement and buy-in.
- Educate future generations by incorporating IS into curricula for grade school and college students.
- Engage “ambassadors” by formalizing a role for key stakeholders from various sectors.

5

Advance Prevention and Early Detection

- Maintain and expand resources dedicated to prevention and early detection.
- Conduct economic impact evaluations of IS to support cost-benefit analyses and priority setting.
- Develop and apply emerging technologies.
- Establish an IS-specific monitoring network.
- Support the advancement of the early warning notification system.

6

Improve the Response to Invasive Species

- Implement NYSDEC's Rapid Response Framework.
- Develop criteria to determine when an ICS is needed to govern an IS response.
- Leverage and develop IS response decision-support tools.
- Enable visibility across the full scope of IS response actions being implemented.
- Streamline the regulatory permitting process for IS management response actions.
- Ensure IS Council staff commitment to rapid response.
- Advance strategic procurement of resources to respond to IS.
- Continue to support research and development.

7

Recover Ecosystem Resilience

- Broaden collaborations focused on ecosystem restoration and ecosystem-based management.
- Evaluate creative management opportunities and mechanisms to advance IS management on priority private lands.
- Evaluate drivers of ecosystem alteration.
- Build ecological restoration planning into IS management projects.

8

Evaluate Success

- Develop quantitative metrics designed to evaluate progress and outcomes of key recommendations.
- Develop a template for cooperators and contract partners to define objectives and measures of success.
- Conduct post-intervention monitoring to document and evaluate treatment effectiveness in accordance with the pre-defined objectives and criteria.
- Document IS management and outcomes in iMapInvasives.
- Convene an annual meeting to review the outcomes of post-intervention monitoring

Attachment 1

Annual Report Card Template

Examples of Potential Metrics for IS Progress and Outcomes

Priority levels one through three (relatively high to low, respectively) are given for each recommendation. This initial ranking reflects a combination of schedule and budget priority, but may be modified by the IS Council as conditions change over time.

PRIORITY	SUMMARY OF RECOMMENDATIONS	OUTCOME	POTENTIAL METRIC(S)
1. Continue to Build Partnerships and Capacity			
1	Maintain the existing IS Council/IS Advisory Committee model with PRISMs, NYISRI, and iMapInvasives as critical elements to a decentralized program.	Continued collaboration within IS network and partners	Number of meetings with quorum
2	Incorporate agriculture programs more fully within the IS leadership framework.	Improved integration of information, data and knowledge	- NYSDAM IS Coordinator position filled - Full representation of IS Advisory Committee members at meetings
2	Engage climate change experts in invasive species collaborations.	Increased collaboration with climate change experts and greater consideration given to climate-IS interactions	- Number of experts engaged - Presentation(s) at IS Council, Advisory Committee meetings
2	Increase State agency engagement, and leverage strengths of existing agency programs.	Effective coordination and utilization of existing state resources	- Once annual IS Council meeting on Long Island - IS management considerations including into existing programs (e.g., LWRP, Unit Management Plans)
2	Strategically expand stakeholder groups represented within the IS leadership structure.	Expanded engagement with important stakeholders	Number of stakeholder meetings
3	Connect with national IS organizations and neighboring states to leverage knowledge and resources.	Improved communication channels and strengthened networks across political boundaries	Number of meetings with regional partners
2	Work together when pursuing extramural funding.	Increased collaboration among agencies and partners with a focus toward shared goals; less competition for limited resources	- Numbers of collaborative proposals submitted - Value of related awards

PRIORITY	SUMMARY OF RECOMMENDATIONS	OUTCOME	POTENTIAL METRIC(S)
2. Commit to a Centralized Framework for Sharing Invasive Species Information			
2	Reduce overlapping online information by advancing one actively managed IS website.	New centralized website launched, and regularly curated	- Number of visits/unique visitors to centralized site - Diverse visitor demographics (e.g., location) - Varied sources of website traffic (e.g., direct, links, social)
3	Leverage the collective capacity of partner organizations to maintain an active and interesting online presence, and promote interaction when possible.	A more impactful social media presence	- Number of views/shares/follows and related social media metrics - Demonstrated relationships between centralized site and partner outreach (i.e., partners drive traffic to central site)
1	Advance the capabilities of iMapInvasives.	Increased data integration and standardization; enhanced functionality; and expanded usership	- Number of users, observations recorded - Number of data providers/sources
1	Continue the centralized reporting of the Watercraft Inspection Steward Program.	Accessible statewide view of the NY Watercraft Inspection Steward Program data	- Number of participating organizations - Number of WISPA records - Number of “intercepts”
3. Set Priorities for Invasive Species Management and Advance Preparedness			
1	Establish a collaborative Horizon Scanning Committee focused on prioritization at the State level.	State-wide risks identified, communicated, and prevented when possible	Number of invasive species evaluated and prioritized
2	Use the State-level priorities to inform and establish regional/local priorities.	Regionally specific risks identified, communicated, and prevented when possible	Number of invasive species evaluated and prioritized within each PRISM
2	Advance preparedness through information gathering and sharing.	Information on prioritized IS, BMPs, and locations documented and shared on centralized website	- Numbers of document downloads - Website visits/unique visitors

PRIORITY	SUMMARY OF RECOMMENDATIONS	OUTCOME	POTENTIAL METRIC(S)
4. Engage and Inform the Public			
1	Establish a centralized statewide branding/marketing initiative.	A consistent, recognizable, and unified messaging and content delivery system	- Number people reached on various media (Facebook, Twitter, email, etc.) - Number of visits/unique visitors/new users on various websites (iMapInvasives, clearinghouse) - Number of potential views (e.g., roadway statistics and potential billboard views) - Number of attendees at various invasive species related events (ISAW events, etc.) - Number and distribution of tradeshow and other events attended by IS network member
2	Emphasize behavior change in messaging.	Audiences understand specifics steps they can take to reduce IS risks/impacts; they act on this information	Survey tracking questions and metrics designed specifically to elicit feedback on planned or implemented behavior changes
2	Develop campaigns specifically targeted to reach private landowners.	Increased IS awareness and motivation among landowners to contribute to landscape-level management efforts	- Number of new enrollees in conservation incentive programs/number of plans that incorporate IS - Amount of land under conservation incentive program containing IS control requirements
1	Strengthen relationships with local municipalities to foster or improve local engagement and buy-in.	Improved local engagement	Number of meetings with municipalities/number of municipalities engaged (total, and by region)
1	Educate future generations by incorporating IS into curricula for grade school and college students.	Improved awareness and engagement among grade school and college students	Number of students reached
3	Engage “ambassadors” by formalizing a role for key stakeholders from various sectors.	Expansion of messaging reach	Number of ambassadors engaged

PRIORITY	SUMMARY OF RECOMMENDATIONS	OUTCOME	POTENTIAL METRIC(S)
5. Advance Prevention and Early Detection			
1	Maintain and expand resources dedicated to prevention and early detection.	CAPS support maintained; Taxonomic capabilities strengthened	- Number of CAPS staff hired; number of CAPS surveys conducted or % of shipments evaluated; number of infestations discovered and responded to - Amount of time required to produce taxonomic/diagnostic results - Number of taxonomic experts employed by agencies and partners
3	Conduct economic impact evaluations of IS to support cost-benefit analyses and priority setting.	Economic assessments completed	Number of priority species or ecosystems assessed
2	Develop and apply emerging technologies.	IS Program remains current with respect to IS monitoring, and response technologies	- Number of individuals included in NYSIRI IS Expert Database. - Number of agency and partner staff with current technological licensure or certification (e.g., UAV pilot license, GIS certification) - Number of certified labs established
1	Establish an IS-specific monitoring network.	An effective early detection and tracking system	- Number of permanent monitoring points established - Geographic distribution/coverage of monitoring program - Number of trainings held - Number of IS observations/enforcement/education activities reported to iMap - Number of new infestations detected - Staff hours/volunteer hours
3	Support the advancement of the early warning notification system.	Warning system updated	- Time needed for all essential parties to be notified upon detection of a new/priority species, or a species new to a previously uninhabited region - Number of early warning notifications sent

PRIORITY	SUMMARY OF RECOMMENDATIONS	OUTCOME	POTENTIAL METRIC(S)
6. Improve the Response to Invasive Species			
1	Implement NYSDEC's Rapid Response Framework.	Coordinated, effective rapid response to new invasions	Number of attendees at annual "stress tests"
3	Develop criteria to determine when an ICS is needed to govern an IS response.	Maximized response efficiency and effectiveness	- Number of ICS trainings held - Number of ICS-trained agency staff
3	Leverage and develop IS response decision-support tools.	Decision support tools evaluated, updated, or created	- Website visits/unique visitors - New tools applicable to other taxa developed
2	Enable visibility across the full scope of IS response actions being implemented.	Increased cooperation, coordination, and information sharing	- Number (or percentage) of IS control/response projects input to centralized schedule - Geographic distribution of projects input to centralized schedule
1	Streamline the regulatory permitting process for IS management response actions.	Maximized response efficiency and effectiveness by minimizing regulatory permitting hurdles	- Number of developed BMPs annually - Distribution of BMPs (taxa, ecosystem, government sector, commercial sector)
2	Ensure IS Council staff commitment to rapid response.	Continued commitment	- Participation of State agency staff within ICS structure (per event) - Agency staff participation in annual "stress tests" - Number of ICS-trained agency staff - IS-related staff turnover
2	Advance strategic procurement of resources to respond to IS.	Cost savings, increased effectiveness, and consistency	- Cost savings generated by using State resources (e.g., equipment, staff) - Number of MSAs or term contracts established
1	Continue to support research and development.	Innovation emphasized and encouraged	- Amount of external funding awarded for R&D - Size and meeting frequency of NYSRI Advisory Council

PRIORITY	SUMMARY OF RECOMMENDATIONS	OUTCOME	POTENTIAL METRIC(S)
7. Recover Ecosystem Resilience			
2	Broaden collaborations focused on ecosystem restoration and ecosystem-based management.	Improved collaboration with existing programs and advancement of shared goals	Number of projects completed in collaboration with other programs
1	Evaluate creative management opportunities and mechanisms to advance IS management on priority private lands.	Advancement of resilience goals on private land	- EPF funds spent to advance restoration goals of IS control projects - Number and size of landowner cooperatives established - Amount of funding awarded by REDC or other programs
2	Evaluate drivers of ecosystem alteration.	Improved understanding of the combined effects of invasive species and other biotic and abiotic stressors, leading to more effective control and restoration	Number of researchers engaged with these topics
1	Build ecological restoration planning into IS management projects.	Ecological restoration strategies become standard practice	Number of IS control grant recipients to include restoration strategies
8. Evaluate Success			
1	Develop quantitative metrics designed to evaluate progress and outcomes of key recommendations.	A mechanism for tracking progress and advancing a culture of accountability	Metrics developed
2	Develop a template for cooperators and contract partners to define objectives and measures of success.	Report card or other tracking mechanism developed and regularly updated. May use this document as a guide	Annual review of metrics
1	Conduct post-intervention monitoring to evaluate and document effectiveness in accordance with the pre-defined objectives and criteria.	Consistent tracking and communication of successes, failures, and challenges to improve future management actions	Number of management outcomes reported to iMapInvasives
1	Document IS management and outcomes in iMapInvasives.	Consistent tracking and communication of successes, failures, and challenges to improve future management actions	Number of management outcomes reported to iMapInvasives
3	Convene an annual meeting to review the outcomes of post-intervention monitoring.	Consistent tracking and communication of successes, failures, and challenges to improve future management actions	Annual meeting held

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| Appendices

APPENDIX A. INVASIVE SPECIES MANAGEMENT PLANS IN NEW YORK STATE

1. National Invasive Species Management Plan

[National Invasive Species Council Management Plan \(2016-2018\)](#)

2. New York State Invasive Species Management Plans and Reports

Statewide

[Final Report of the New York State Invasive Species Task Force \(2005\)](#)

[New York State Invasive Species Management Strategy \(2011\)](#)

[New York State Aquatic Invasive Species Management Plan \(2015\)](#)

[Rapid Response for Invasive Species: Framework for Response \(2016\)](#)

[Strategic Recommendations for New York Invasive Species Education and Outreach \(2016-2021\)](#)

[New York Ocean Action Plan \(2017-2027\)](#)

Regional

[Lake Champlain Basin Aquatic Nuisance Species Management Plan \(2005\)](#)

[Adirondack Park Aquatic Nuisance Species Management Plan \(2006\)](#)

[LIISMA Invasive Species Strategic Plan \(2012-2015\)](#)

[Adirondack PRISM Invasive Species Strategic Plan \(2013-2017\)](#)

[Western New York PRISM Strategic Plan \(2014-2018\)](#)

[Finger Lakes PRISM Invasive Species Strategic Plan \(2016-2021\)](#)

[Lower Hudson PRISM 2017 Action Plan \(2017\)](#)

[Capital/Mohawk PRISM Work Plan \(2018\)](#)

[Catskill Regional Invasive Species Partnership Strategic Plan \(2018-2022\)](#)

APPENDIX B. STAKEHOLDER ENGAGEMENT PROCESS FOR THE NEW YORK STATE INVASIVE SPECIES COMPREHENSIVE PLAN

KEY GROUPS ENGAGED

- **IS Council:** Nine state agencies that address the impacts of invasive species.
- **IS Advisory Committee:** Nongovernmental organizations, academic institutions, research entities, and trade organizations that provide information and guidance to the Council.
- **Partnerships for Regional Invasive Species Management:** Eight regional PRISMs.
- **iMapInvasives:** Managed by the New York Natural Heritage Program.
- **NY Invasive Species Research Institute (NYSRI):** Coordinates IS research, and collaborates with the IS Council and IS Advisory Committee to identify research priorities.

2017 QUESTIONNAIRE AND WORKSHOP

In July 2017, an open-ended, informal survey was distributed to IS Council and IS Advisory Committee members, as well as all PRISMs, in preparation for a workshop held on August 22, 2017, immediately following a joint meeting of the IS Council and IS Advisory Committee. Questionnaire recipients were encouraged to share it with colleagues and solicit their input prior to the workshop, and to submit written questionnaires to the project team, regardless of whether they were able to attend the workshop. The written questions were grouped into five general categories that related to addressed in the ISCMP: (1) coordination among agency and partner organizations, (2) IS management strategies, (3) planning for effectiveness, (4) public engagement, and (5) funding. (See attached sample questionnaire.)

The August 22 workshop was open to the public. Forty-three participants attended the 2 ½ hour event facilitated by the project team, which included breakout groups and exercises to encourage brainstorming, collective feedback, and discussion. Note-takers captured stakeholder input and used it to identify themes and suggestions that were used in development of the Plan. (See attached summary of themes.)

ADDITIONAL STAKEHOLDER OUTREACH AND CONSULTATION

In addition to the questionnaire and workshop, project consultants engaged in numerous stakeholder-led IS meetings and events in 2017, including monthly PRISM phone calls, the ISAW Conference, the Northeast Regional Invasive Species and Climate Change conference, and the Cornell Cooperative Extension annual Invasive Species In-Service. The project team also reached out to consult directly with professionals in groups that had been identified as potentially under-represented in the process, including experts in marine ecosystems, nuisance wildlife, and integrated pest management.

In addition to engaging with key groups involved in the current IS structure, the project team built on past stakeholder engagement by consulting the following previously published IS documents, which had incorporated surveys or solicited public comments:

- Final Report of the New York State Invasive Species Task Force (2005)
- New York State Invasive Species Management Strategy (Ecology and Environment 2011)
- Cornell Human Dimensions Research Unit study of perspectives on invasive species (residents, farmers, aquarium owners, water gardeners) (Lauber, Connelly, and Stedman 2015)
- Strategic Recommendations for New York Invasive Species Education & Outreach (NYSDEC 2016)

QUESTIONNAIRE FOR AGENCIES AND PARTNERS

NYS Invasive Species Comprehensive Management Plan

You have been invited to participate in a planning workshop as part of development of the NYS Invasive Species Comprehensive Management Plan (ISCMP). The workshop will be held on August 22, 2017, from 12:30 to 3:00 p.m., immediately following a joint meeting of the IS Council and IS Advisory Committee. This workshop will include members of the Council and Advisory Committee, as well as staff from NYSDEC's Coordination Unit and PRISM leaders. Participants will be asked to share information on behalf of the stakeholder groups they represent.

Purpose

The goal of the workshop and questionnaire is to generate productive discussion and solicit input from agencies and key partners involved in IS management in New York. The team developing the ISCMP will use your input to ensure the plan is grounded in the insights and experiences of organizations directly involved in IS management. This informal questionnaire offers participants an opportunity to consider questions prior to the workshop and discuss them with colleagues. The open-ended questions are grouped into five general categories that relate to topics that will be addressed in the ISCMP: (1) coordination among agency and partner organizations, (2) IS management strategies, (3) planning for effectiveness, (4) public engagement, and (5) funding. Specific responses to the questionnaire will not be published as part of the ISCMP, although the plan will summarize the input we receive.

Instructions

If you plan to attend the workshop: We encourage you to review these questions with colleagues to gather input that you can share in discussions during interactive breakout sessions at the event. Please feel free to submit written responses to this questionnaire in addition to attending the workshop.

If you are unable to attend the workshop: We are eager to hear from all groups represented on the IS Council and IS Advisory Committee, so we encourage you to confer with colleagues or stakeholders about their views and to share feedback using this fillable questionnaire.

Submission and deadline: You may return your questionnaire any time before September 1, 2017. Save the completed questionnaire document with a new name and return it via email to Elizabeth Myers, EcoLogic LLC: emyers@ecologicllc.com

Note: The questionnaire covers a broad range of topics and includes a level of detail that is intended to stimulate discussion and brainstorming. Please feel free to respond only to those questions that feel most relevant and productive for you and your stakeholders (i.e., it's okay to leave blanks).

Please tell us about your affiliation and the stakeholders you represent:

I am a member of (place an X next to all that apply):

- ☐ IS Council
- ☐ IS Advisory Committee
- ☐ IS Coordination Section (NYSDEC)
- ☐ PRISM
- ☐ Other, please note: _____

- What stakeholder group(s) or agency does your organization represent (e.g., private forest land owners, researchers, agricultural producers)?
- Does your agency/organization focus on specific geographic region within NY State? If so, which region?

Planning to plan (some preliminary questions):

- Are you familiar with recently completed IS plans for specific geographic areas (e.g., Lake Champlain) or classes of pests (e.g., aquatic invasives)? What aspects of these plans do you find helpful?
- How will your organization use the new NYS Invasive Species Comprehensive Management Plan (ISCMP)?
- What would make the ISCMP a success for the stakeholders you represent?

1. Coordination among Agency and Partner Organizations

Current status

- Why is your organization engaged in managing invasive species (IS)? What's the driver? (e.g., how are IS affecting the major mission?)
- Which organizations do you primarily connect with to address IS issues?

Challenges

- What are the challenges or barriers to effective coordination with other organizations?

Lessons and Opportunities

- What's working well?
- What other organizations are positioned to help you achieve your objectives?
- What IS-related strengths could your organization share with partners?
- Does your organization share lessons learned with others? If so, how?

2. Management Strategies (prevention, early detection, rapid response, control, restoration, and resilience)

Current status

- Which IS pose the biggest threat to the resources you manage? Why?
- What are the primary strategies your organization uses to address IS issues?

Challenges

- What challenges are associated with managing IS using each of these strategies (i.e., prevention, ED/RR, control, restoration and resilience)?
- What are the barriers to using an ecosystem-based management approach to IS?

Lessons and Opportunities

- What tools would help you manage IS more effectively (e.g., technical expertise, diagnostics, policy initiatives, enforcement training)?
- Do you have suggestions for improving the effectiveness of the rapid response process when risks are high?
- How might your organization incorporate restoration of resilient ecosystems into its approach to IS management?

3. Planning for Effectiveness

Current status

- How does your organization prioritize management of IS?
- What are your organization's data needs with regard to IS?
- What IS research does your organization conduct or rely upon?
- How does your organization measure IS management successes?
- Does your organization conduct adaptive management? If so, what information is gathered and evaluated to guide adaptations?

Challenges

- Does your organization lack data or information that could strengthen priority-setting and management decisions?
- Other related challenges or barriers?
- How are IS data or research needs communicated within your organization and shared with researchers?

Lessons and Opportunities

- What's working well?
- What needs to be built upon?
- What would help to improve evaluation of impacts for IS-management activities?
- How could we measure the impact of IS management on the entire ecosystem, including humans?

4. Public Engagement

Current status

- What needs do your stakeholders (end-users) have for IS information?
- How do you currently communicate with your target audiences?
- What's working well?

Challenges

- What are the barriers to reaching a broader audience?
- What are the challenges to prompting changes in behavior of target audiences?
- What's missing?

Lessons and Opportunities

- What has been your organization's biggest IS education and outreach success? What made it work?
- What outreach and education efforts need to be expanded or built upon?

5. Funding

Current status

- What are your current financial sources for IS management? (e.g., programmatic funds; % soft v. budgeted funds; federal or state funds)
- What staffing resources does your organization currently use to manage IS (a) in-house staff, (b) in coordination with other agencies/organizations, or (c) via contracting to get work done.
- What economic incentives exist to encourage your stakeholders (internal or external) to better manage IS?

Challenges

- What funding-related challenges do you perceive with regard to IS management?
- Use your crystal ball to predict changes in funding streams related to IS management. What do you see?

Lessons and Opportunities

- What's working well?
- What needs to be built upon?
- Are there financial resources that could be leveraged to better manage IS?
- If unlimited funding were available to manage IS, how would your program change?

Thank you for your participation!

Would you like to connect with us to discuss thoughts or questions about the plan? If so, please let us know how to reach you:

Name: _____
Phone: _____
Email: _____
Address: _____

STAKEHOLDER WORKSHOP AGENDA

When: Tuesday, August 22, 2017, 12:30-3:00 p.m. (following joint meeting of ISAC and ISC at 10 a.m.)

Where: NYSDEC Central Office, 625 Broadway, Room PA129, Albany, NY 12233

Overview:

Participants will choose to be part of a breakout group on one of four topic areas:

1. Coordination among partners
2. Management strategies
3. Planning for effectiveness and preparedness
4. Public engagement

Each group will address two sets of questions related to their respective topic area:

- Breakout session 1: (a) Challenges; (b) Lessons learned and opportunities
- Breakout session 2: Concrete plan recommendations.

Composition of groups will be the same for both sessions (groups will stay together).

Time	Activity	Facilitator
12:30-12:50	Introduction and Logistics (20 mins) ■ Workshop objectives ■ Introduce team ■ Plan for the plan ■ Data and information gaps ■ Scale of the recommendations ■ Representation ■ Questionnaire ■ Logistics	Liz Moran
12:50-1:05	Ice-breaker Session (15 mins) Individual participants respond to two questions on post-its: 1. What are you (personally) most worried about regarding IS? 2. What is the biggest IS-related threat to the resources your organization or stakeholders manage? Group selection process: Participants will move to a facilitator holding a sign for the topic area in which they are most interested.	Liz Moran, Elizabeth Myers
	Transition to breakout session (5 mins)	

Time	Activity	Facilitator
1:10-1:50	Breakout Session 1: Challenges, Lessons Learned, and Opportunities (40 mins) Topic area (group) 1: Coordination among partners a. What are the challenges or barriers to effective coordination with other organizations? b. What IS-related strengths could your organization share with partners? Topic area (group) 2: Management strategies (prevention, early detection, rapid response, control, restoration and resilience) a. What strategies are you using to address the biggest challenges to resources you manage? How is it working? b. What tools would help you manage IS more proactively or effectively (e.g., technical expertise, diagnostics, policy initiatives, enforcement, training)? Topic area (group) 3: Planning for effectiveness and preparedness (prioritization, information management, research needs, evaluation) a. What challenges does your organization (or stakeholders) face with regard to setting priorities, managing information, and evaluating success? b. What data or information could help your organization strengthen priority-setting and management decisions? Topic area (group) 4: Public engagement (education, outreach, civic engagement) a. What are the challenges to prompting changes in behavior of target audiences? b. What has been your organization's biggest IS education and outreach success? What made it work? At end of this session, groups will be prompted to list the top five ideas that emerged.	Tony Eallonardo Andrew Brainard, Dan Rockefeller Liz Moran Elizabeth Myers
	Break (10 mins)	
2:00-2:30	Breakout Session 2: Concrete recommendations (30 mins) All groups consider the same questions with regard to their respective topic area: a. What would make the ISCMP a success for the stakeholders you represent? b. What specific recommendations would you like to see included in the plan?	Same as session 1 above
	Transition back to full group (5 mins)	

Time	Activity	Facilitator
2:35-3:00	Reporting back by the four groups (5 mins each): ■ Themes or ideas that emerged. ■ Specific recommendations to include in the plan. Wrap-up (5 mins): ■ Participants invited to revisit post-it responses to questions posed during ice-breaker session. (Have your perceptions changed? Anything to add?) ■ Questionnaire reminder: written responses due by Sept. 1. ■ Thanks to everyone for participating!	Liz Moran

SUMMARY OF THEMES FROM STAKEHOLDER WORKSHOP

Word Clouds Derived from Individual Exercise

Pre-workshop:

What is the biggest IS-related threat to the resources your organization or stakeholders manage?



What are you (personally) most worried about regarding IS?



Post-workshop:

What is the biggest IS-related threat to the resources your organization or stakeholders manage?



NOTES FROM BREAKOUT GROUPS

Breakout Group 1: Coordination among Partners

Question 1: What are challenges/barriers to effective coordination

- Need to know the partners and their roles, capabilities, etc.
- Need centralized decision makers. Project officer- with subject matter expertise
- Challenge- small stakeholders can feel alienated
- Challenge- uneven levels of motivation of partners
- Need tools to evaluate potential impacts
- ICS works well- consider adopting as template

Question 2: What IS-related strengths could your organization share with partners?

- Technical expertise (need more)
- We know our partners
- Used to being the Hub
- Common interests and different strengths
- Experience with public communication, and knowing what does and doesn't work
- Getting the IS message communicated, despite information overload
- Cultural impacts- understand the human dimension
- Media relations, advertising, press

Discussion: Recommendations for Plan

- Plan needs to describe organizational roles
- Need a consistent process for screening - and a go-to team to do this- current and expected IS
- Statewide rapid response team, must be adaptive and able to get through permit challenges
- Need funding
- Prioritization should include human health elements
- Prior plans underemphasized the importance of streamlining permit process
- Need pre-screened BMPs at a level that can facilitate permit acquisition – species specific

Breakout Group 2: Management Strategies

Question 1: What strategies are you using to address the biggest challenges to resources you manage?

- Various, along the management continuum (prevention – monitoring – response – control).

- Some organizations allocated more resources to specific strategies (e.g., control)
 - ADK PRISM (APIPP): goes full circle from prevention – monitoring – response – control – adaptive change
 - Agricultural stakeholders more focused on control
 - DOT is focused more on training and educating their staff to be aware of IS issues and BMPs to deal with IS (e.g., cleaning of equipment, how to identify)

Question 2: What tools would help you manage IS more proactively, or what barriers are in place that prevent you from doing more proactive management?

TOOLS	BARRIERS
New chemicals for use (may be safer than what is currently registered) or chemicals not currently permitted in NYS.	Staffing for EDRR
Enforcement – focus more on ‘bad actors’ ■ <i>This was in reference to PA lumber companies coming into NYS to cut in protected/quarantine areas (per John Bartow)</i>	Cost of non-profit to do control (e.g., permits, licenses, training) ■ <i>PRISM leader (Andrea Locke) stressing the financial burden to treat IS chemically</i>
Increased emphasis on evaluation of outcomes	Regulatory restrictions (herbicides)
Advance research – loss of regional funds, only federal competitive grants available to some ■ <i>this feedback was less focused on NYS problems</i>	Liability of insurance costs
Need accountability for management outcomes – if have poor plan and/or execution, who is liable?	Monitoring – equitable distribution between public versus private land
Need more reporting on negative outcomes – make part of permit process	Accuracy of monitoring
	Lack of native plant material for restoration (e.g., locally adapted genotypes – especially herbaceous species)
	Grant funding cycle out of sync with management and research time frame

Discussion: What would make the ISCMP a success for your stakeholders? What specific recommendations would you like to see in the plan?

- Need to be specific, workable, tangible, with accountability [from PRISM leader]
- Recommend funding an administrative position to work directly with the Invasive Species Advisory Committee

- Plan should promote the end result = resilient ecosystems and productive agricultural systems
- Enhance information sharing + contracting efficiencies
- Promote economic metrics as success criteria
- Incorporate human health into the 'why' of IS management –
- Plan should be adaptable and a living document
- Proactive versus reactive – need horizon scanning to be ready
- Promote data standardization of data collection where possible; issues with private landowner reporting
- Agriculture – highlight existing capacity and infrastructure
- Clarification of terms – pest vs. invasive species – need to adhere to definitions in the ISCMP
- Provide incentives/empowerment to private landowners

Breakout Group 3: Planning for Effectiveness and Preparedness

Question 1: How does your agency or group set priorities?

- DAM has to fulfill federal responsibilities; these are also tied to funding. Resources at NYS level also play in. Used to be dedicated IS person in DAM. Economic value of commodity/crop/product affects prioritization
- DEC – needs to keep multiple stakeholders and interests happy. Politics! Hard to get support for something that is not yet here (unseen). Frustrated that media not picking up on successes
- Greenhouse/nursery – work at the initial source of production-. Attentive to what's coming in (horizon scanning). Need robust risk assessment- and buy-in from industry. Also true for pet industry
- Cost implications – recurrent theme. Need metrics for economic risk that are agreed to
- Where is the species on the invasives curve? (how likely is control to be successful?)
- PRISM – more attention going to terrestrial than aquatics? Nurseries a problem, selling ornamentals that take over natural areas. Have a list of species of most concern.
 - Discussion – enlist the CCE master gardeners to help educate- there are gardening bloggers who can help
 - Much frustration with requirements and \$\$ associated with licensed pesticide applicators. Seems that PRISM applies pesticides?
- Parks – identify resources, threats, and capacity. Have to triage. Example- HWA in Watkins Glen

Question 2: What data and information do you need?

- Much discussion of risk assessment.
 - Develop a common set of criteria to set priorities, maybe scale based
 - The PRISMs do not have a common set of criteria to define Tier 1, Tier 2, etc. HARMONIZE
 - Need for a rapid ranking mechanism (pathways, how does it spread, seed longevity)
 - Decision regarding areas to treat need to consider conservation value
 - Institute post-doc joining soon to begin this task

- Selection of project (i.e., treatment) needs to consider context- are upstream or neighboring areas treated
- NHP – there should be a nexus between the RTE areas and the iMap data- seems important to be able to keep the IS out of the highest value areas. This is not yet the case, but it could be a tool for setting priorities
- Real need to document success- and be quantitative- require post-treatment monitoring
- May need to develop template for this
- Capture data somewhere (iMap? IPMDAT?)
- Track successes as well as failures
- Messaging – ‘flip the narrative’ promote success, virtues of native species

Discussion: What do you want to see in the Plan?

- Call for steady/continuous/guaranteed funding
- Better tools for risk assessment methodology (including economics)
- Centralized repository of BMPs for IS management (e.g., control, eradication, prevention). BMPs need to be fairly specific (e.g., just listing ‘chemical treatment’ is not helpful)
- Education and outreach plans updated and nimble to reflect new and evolving technologies (e.g. social media)
- Recommendations of pathways to simplify and reduce the expense to land managers/ owners trying to apply pesticides. Needs to be uniform across DEC regions!
- Evaluation tools for projects (begin with specific objectives- what constitutes success?) Provide tools, templates. Require this to be reported. Develop metrics that can assess success vs. failure
- Learn from failures- document and report out what did not go well.
- Need for an IS decision tree. Methodologies that can help determine management strategy.

Breakout Group 4: Public Engagement

Questions 1 and 2 (blended into discussion)

1. What are the challenges to prompting behavior change of target audiences?
2. What has been your organization’s biggest IS education and outreach success? What made it work?

Challenge: Getting the “average person” to understand the potential impact of IS on them. Raising this kind of awareness among mass audiences is a challenge. Getting them to take action on a personal level. Watercraft inspection programs have been a great example of raising awareness.

Identifying Gaps: How do we reach audiences who are not already “in the loop”? We need to identify those audiences, and find venues to reach audiences who have not heard the message.

Homeowners

- Need to put a positive spin on messages and provide a solution that will be meaningful to them.
- Need outreach in multiple languages (e.g., Spanish)
- IS issues can be complicated, and homeowners may not grasp the importance or benefit of using native plants. One approach could be to facilitating change via demonstration projects – changing perceptions in a way that could cause a paradigm shift in industry. Native plant appreciation classes at nurseries would be a good approach.

Industry

- Shifting paradigms in industry – drive consumer demand
- Need partnerships with animal and plant industries (“no inspectors in Petco and PetSmart”)
- Realtors might help at a local level, promote native plants through “best gardens” type publicity.

Schools – reaching young people is a key opportunity

- Reaching schools (k-12) and professional networks
- Envirothon teams
- Merit badges
- Standards-based curricula
- Challenge: How do we bring IS into a school curriculum that has existing priorities? Requires engaged teachers and supportive administration.

Policy makers

- Education and outreach information is needed for to help policy makers understand the implications of a proactive versus reactive approach to IS control

Municipalities

- Need to educate and work with municipalities, which bear the costs of IS problems. They need resources allocated to deal with invasions (e.g., EAB)

Other suggestions that led to emerging themes:

- Public/private partnerships – (ALA example?)
- Best management practices: Encourage sharing of BMPs across NY with various stakeholders, and provide information on how to scale them up as necessary
- Define and use metrics for evaluating and measuring success (one participant “12 Rules of Engagement” by Gallup organization – suggest utilizing these because they are oriented toward behavior change; note that these rules appear to be focused on employees)
- Leverage motivations and underlying interests of stakeholders (including industry, which “has skin in the game”).

- Engage ambassadors: The idea of creating “ambassadors” emerged as a theme. Tapping into key audiences (nurseries, teachers, realtors, etc.) and then having them help to spread the word and help others learn about IS. Ask people what they can do to help spread the word.
- Focus on prevention and disseminating messages early
- Holistic approach required, be sure to get input from all sides
- Use strategic and unified, consistent messaging – multiple contact with same stakeholder groups, repetitive messaging is key
- Regional collaboration is key, as invasives don’t know political boundaries

Themes:

- Consistent, standardized information to stakeholders to ensure understanding of issues
- Inclusive, holistic approach
- Prioritization
- Proactive not reactive
- Evaluation
- Tap into what people and industries care about
- Provide solutions

What would make the ISCMP a success for you?

- Metrics for measurable outcomes
- Able to be utilized by various groups, broad in basis yet with specific actions
- Provides templates for consistent informational materials
- Provides or identifies tools needed for communication, collateral pieces
- SMART objectives: Specific, Measurable, Assignable (who will do it), Realistic, Time-based
- Prioritize outreach efforts: outline existing audiences, determining who is missing
- Connection to business/industry and a strategy for engagement
- Avoid negative messages, work with stakeholders and not against them
- Strategies for outreach that cause positive behavior change or adoption of behaviors that prevent IS.

Specific Recommendations (or qualities of the plan)

- Clear goals and deliverables
- Timeline for implementation
- Benchmarking
- Lessons learned
- Look at what others are doing or have done
- Adaptability
- Strategies for influencing public policy and funding (local and state)
- Identify channels for communication with municipalities
- Restoration of public and private lands