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Lower Hudson

Partnership for Regional Invasive Species Management
Annual Report 2014

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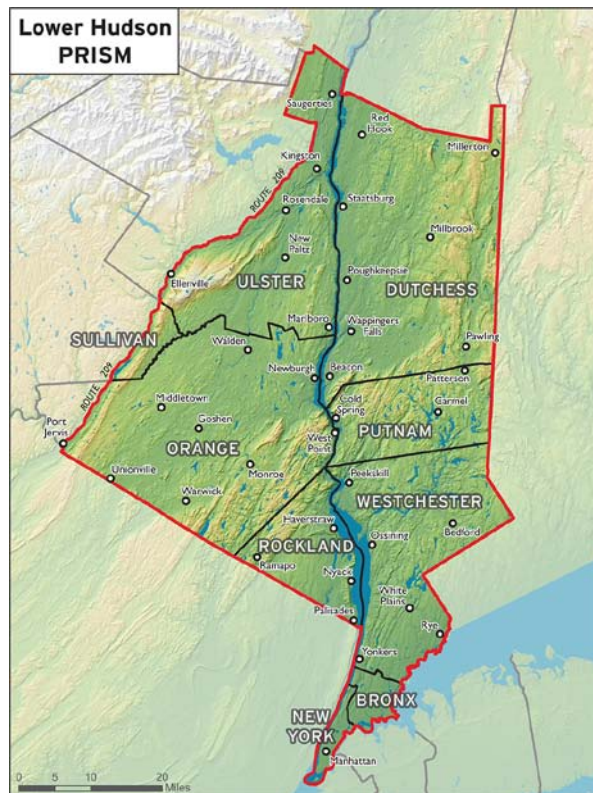


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Executive Summary

The Lower Hudson Partnership for Regional Invasive Species Management (PRISM) is a cooperative partnership between environmental organizations and individuals who aim to protect the Lower Hudson region from the negative effects of invasive species. Together, the PRISM partners work together to preserve the beauty of the nine counties and boroughs that make up the Lower Hudson region.

This was the first full year of the Lower Hudson PRISM's operation after receiving our signed contract in August 2013. At the beginning of the year, we wrote and published an annual report of Lower Hudson PRISM partner activities related to invasive species during 2013. We also conducted a partner survey to determine partner needs and resources to guide our efforts.

As the host organization, the Trail Conference convened several meetings of regional partners that were well attended by an average of 35 participants per meeting to complete our five-year strategic plan and 2014 annual work plan with goals, objectives, actions, and outcomes. We recruited steering committee candidates and held an election to seat the committee members. We then led efforts to define a partner agreement, which included structural components defining the PRISM steering committee and partner responsibilities, and had it ratified by the partners. We also led the documentation of project proposal evaluation criteria that were then reviewed and approved by the partners. We wrote and issued a request for proposals (RFP) and coordinated the proposal selection process by the steering committee.

In 2014, the Lower Hudson PRISM contracted out projects to multiple parties, all with the goal of fulfilling portions of the PRISM's annual work plan. Some of the projects focused on surveying for, or managing and removing priority invasive species. Others worked to satisfy specific PRISM goals by increasing the capacity of our partners, creating the criteria for conservation targets and making a list of species that should be considered conservation targets in the Lower Hudson region.

The PRISM partners worked hard to carry out all type of trainings, educational events, and eradication projects for diverse audiences throughout the region. This year, the Lower Hudson PRISM partners conducted a total of 212 training and education programs, and together with our 2,556 volunteers who dedicated 17,106 hours to volunteering, we were able to manage 1,221 acres of invasive species infestations throughout the Lower Hudson region.

Looking Ahead

This was a very productive year for the Lower Hudson PRISM. We completed six contracted projects and reached an extensive audience through our educational events, trainings, and eradication projects. The Lower Hudson PRISM will continue to grow next year by engaging new partners, beginning new projects, reaching out to more people, and continuing website development. The website will include education and outreach materials, best management practices (BMPs), current research, and links to iMapInvasives and other databases as well as a geo-database of partners and activities and partner project descriptions. We will also be creating a coherent, standardized, repeatable, and adaptive methodology for prioritizing our management projects across the region. The PRISM will work to increase its capability for early detection and rapid response to new introductions. We will be developing an education program that will be delivered to living industry points of sale, and teaching these industries about alternatives. We will also be developing a resource bookshelf and tool kit, and participating in Invasive Species Awareness Week to continue our outreach and education efforts.

2014 Steering Committee

This year, six members of the Steering Committee were elected by the participants at our April meeting to guide the Lower Hudson PRISM.

Members of the 2014 Steering Committee include:

Brenda Bates – Westchester County Parks (3 year term)
David Strayer – Cary Institute of Ecosystem Studies (1 year term)
Erik Kiviat – Hudsonia (2 year term)
Jennifer Stengle – Cornell Cooperative Extension, Putnam County (1 year term)
Meredith Taylor – NYC Department of Environmental Protection (3 year term)
Marnie Miller-Keas – West Point US Army Garrison Natural Resources Branch (2 year term)

Marnie Miller-Keas had to leave before the end of the year and Kali Bird (Hike NY) was elected to replace her at the October meeting. Election was also held at the October meeting to fill the seats occupied by David Strayer and Jennifer Stengle whose terms expire at the end of 2014.

2015 Steering Committee

Members of the 2015 Steering Committee include:

Brenda Bates – Westchester County Parks
Erik Kiviat – Hudsonia
Meredith Taylor – NYC Department of Environmental Protection
Kali Bird – Hike NY
Michael Fargione – Cary Institute of Ecosystem Studies

Coordination Activities

The Lower Hudson PRISM coordinator attended many conference calls, meetings, and conferences throughout the year in order to stay up to date with the invasive species research happening year-round. The monthly PRISM conference call gave updates on the latest events or news happening in each region, as well as new research in the invasive species field. The Lower Hudson PRISM coordinator began attending the statewide hydrilla conference calls this year to stay updated on pertinent hydrilla research and news, which is critical since the discovery of the hydrilla infestation found in the Croton River in 2013. All of these conference calls were vital for staying updated with invasive species control efforts and research happening throughout the state.



Figure 1: Lower Hudson PRISM Partner Meeting

The Lower Hudson PRISM coordinator, along with a few PRISM partners, attended the 2014 Cornell In-Service Conference in Ithaca, NY, where dozens of presentations were given regarding new invasive species biocontrol options, volunteer coordination, and early detection and rapid response protocol.

The Lower Hudson PRISM coordinator organized and conducted 6 partner meetings this year held at various locations around the region, where an average of 35 participants attended. Partners commit to support the strategy of the PRISM, attend at least 50% of the meetings, and provide a report of their invasive species activities for our annual report. These meetings are held to discuss new research, outreach and education opportunities, and how to meet the goals set out at the beginning of each year.

Summary of Accomplishments

The Lower Hudson PRISM had a very successful year due to the hard work of all its partners. Our work to fight invasive species would be impossible without the collaborative efforts of each partner. A summary of this year's accomplishments can be found below:

- Over 40 environmental organizations and individuals have joined together as participants to help fight against invasive species in the Lower Hudson region.
 - An amazing 36 participants have signed our partner agreement to become partners in the Lower Hudson PRISM.
 - An average of 35 participants attended the 2014 bimonthly PRISM meetings.
- The PRISM funded six contracted projects this year. While each project's goal was different, they all helped the PRISM further its goal of invasive species management in the Lower Hudson region.
- The PRISM participants conducted 121 invasive species trainings, which covered invasive species identification, monitoring, management, and prevention.
 - 1,630 individuals participated in these invasive species trainings.
- The PRISM participants directed 91 educational programs this year. Educational materials including brochures, flyers, blogs, slideshows, handouts, and more were created and distributed at many of the events. The programs reached out to a diverse audience and included a wide range of invasive species.
 - 6,583 individuals attended these education programs.
- Together, the PRISM participants entered a total of 12,644 iMapInvasives entries.
- The PRISM participants conducted 317 eradication projects, which successfully managed and removed 34 species (see Appendix B) over a total of 1,221 acres.
- The PRISM participants monitored 390 acres of treated lands post-treatment.
- Collectively, the PRISM partners engaged a total of 2,556 volunteers who dedicated 17,106 volunteer hours to help fight invasive species in the Lower Hudson region.

Progress According to Strategic Plan

The Lower Hudson PRISM strives to address invasive species issues through its partnerships and aims to protect the rich biodiversity of the region by identifying conservation areas. Collectively, we focus on likely areas of introduction and methods of early detection and rapid response. Together we reach out to new audiences to increase public awareness and participation. We engage volunteers in data collecting, restoration and management projects. The Lower Hudson PRISM gathers and shares information about invasive species to support each other and to reach key people such as teachers, Master Gardeners and landscape professions. Our emphasis is on education, prevention, early detection and rapid response.

Lower Hudson PRISM Goals

Capacity Building

The Lower Hudson PRISM has a robust public identity, strong internal structure and a sustainable resource base to continue its mission.

The Lower Hudson PRISM has made great strides in building its partnerships, and has successfully met its goal of increasing membership from no official partners at the beginning of the year to 36 signed partners by the end of 2014. We created our official Partner Agreement that outlines a statement of mutual benefit and interest, partner duties, the Lower Hudson PRISM governance policy, etc. If you would like to see a more information about how to become a Lower Hudson PRISM partner, view our Partner Agreement by visiting the Lower Hudson PRISM website at <http://lhprism.org/content/partners>.

The PRISM also launched its website, which provides a toolkit for new partners and volunteers by containing current information about the PRISM, invasive species, and volunteer events. Requests for Proposals (RFPs), notices, and program announcements go out on the listserv. If you are interested in signing up for the listserv, instructions can be found at the bottom of the Lower Hudson PRISM website (<http://lhprism.org>).

Conservation Targets

The Lower Hudson PRISM protects the rich, native biodiversity of the Lower Hudson Valley by focusing on priority targets for conservation.

Hudsonia was contracted to create a list of potential conservation target animal species based on their research on Species of Greatest Conservation Need and those species interactions with

invasive species. They recognized data gaps and hypothesized what the interaction between the SGCN and invasive species would be in the absence of scientific literature.

Geospatial and Ecological Services was contracted to reach out to other partners to collect and develop Conservation Target landscape-level layers that will allow the PRISM to determine areas that we want to protect. The layers (discussed below and shown in Appendix C) will help locate potential conservation target areas throughout the Lower Hudson region. It was also decided that the conservation target area layers will be used to help select projects to fund, but the Steering Committee will be left to determine the weight given to each layer during proposal evaluations.

The landscape-level conservation layers that the Lower Hudson PRISM partners decided to adopt for use in 2015 are:

- Audubon's Important Bird Areas (IBA)
- Natural Heritage Program's Element Occurrences (Natural Heritage Program Communities layer is included in lieu of element occurrences which cannot be distributed)
- Hudson River Estuary Program's Significant Biodiversity areas
- The Nature Conservancy's Portfolio and Focal areas
- NYS Parks and Protected lands
- Forest blocks greater than 500 acres derived from Landfire
- Landscape-scale Connectivity

Final reports detailing the results from these efforts to identify conservation targets in the Lower Hudson are posted on our web site.

Strategic Invasive Species Management

The Lower Hudson PRISM supports and optimizes regional conservation through strategic invasive species management.

Over the past year we have trained and implemented our early detection/rapid response crews, which were able to begin eradication of populations of hardy kiwi, scotch broom, and giant hogweed. The crews were able begin containing many populations and removed others.

At the end of this year, the Trail Conference led efforts to document methods of strategic management of invasive species by ranking and prioritizing the various invasive species. This prioritization method was accepted by the membership for use in 2015 to guide our efforts.

The partnership also approved a method of selecting areas to be considered Invasive Species Prevention Zones. The partners decided that the criteria for invasive species prevention zones (ISPZs) would include: minimally invaded areas that are dominated by natives, sites being

selected for conservation should be defensible, sites chosen have to be adopted for long-term stewardship by a group(s), and there will be no acreage size limit. These criteria will stay in effect for one year, at which point another vote will take place to determine if the criteria should become permanent or needs corrections.

The PRISM has also developed a Priority Species list, which includes NYS Invasiveness rank, the Lower Hudson invasiveness rank, and observation count for each species found in the Lower Hudson region. These categories were used to determine whether a species should be watched, is a threat, or is emerging in the Lower Hudson PRISM and still at relatively low levels, established in the Lower Hudson PRISM but not yet in neighboring areas, or widespread throughout our area (see Appendix E). These designations will be in effect for 2015 and will be re-evaluated for 2016.

The PRISM sponsored two interns this summer who worked on mapping regional nurseries, hiking trail parking lots, and transmission lines through natural areas for use in invasive species surveillance projects. Having these areas mapped out will help determine where our early detection efforts should be located, since these areas are highly disturbed making them prime locations for invasive species infestations.

Education and Outreach

The Lower Hudson PRISM reaches out to new audiences and delivers education that communicates the positive impacts of invasive species management on ecosystems. The Lower Hudson PRISM offers clear steps for action on personal and community levels.

This year the Lower Hudson PRISM partners led 212 trainings, workshops, and educational events and reached a very diverse population throughout the entire region. The PRISM created its website (<http://lhprism.org>), which has numerous resources for teachers, environmental organizations, and interested individuals alike. Many of the PRISM partners and participants created their own educational resources, including blogs, slideshows, brochures, and flyers and distributed them at these trainings and events.

The Lower Hudson PRISM made a concerted effort to participate in New York State's first invasive species awareness week July 6-13. The Lower Hudson PRISM conducted more than 25 events during this week – approximately one quarter of all the events held in the state.

Mitigating Pathways of Invasion

The Lower Hudson PRISM has a coordinated program to prevent species introduction by focusing on pathways.

In 2014 the Lower Hudson PRISM set out to gain a better understanding of the most important pathways for invasive species spread and introduction into the region. A Bard College student worked to gather resources and create a comprehensive list of the vectors and potential species that they might introduce. The working group took this list and created a table that included Lower Hudson specific examples of pathways (see Appendix F). For example, military vehicles were a potential pathway for terrestrial plants and pathogens; Camp Smith, West Point, and Stewart Air Base were all specific pathways identified for military vehicles to enter the LH PRISM.

In order to build on the work that was done gathering information on all of the potential pathways, partners discussed doing a larger scale prioritization to rank each one against others. It was determined that this would be arbitrary and there was no good way to do this effectively. As an alternative it was decided that in 2015 a single group of pathways, living industry, would be the primary focus. This group was selected because of the new invasive species regulations and to coordinate with the Education and Outreach group. A campaign will be launched in 2015 to target the points of sale for ornamental plants and aquaria species.

Information Exchange

The establishment of an information exchange allows Lower Hudson PRISM partners and other professionals to strategically manage and integrate information relevant to the management of invasive species and offer that information to any person, group, or agency (partner and non-partner alike).

This year, the Lower Hudson PRISM launched its website (<http://lhprism.org>), a place to gather, organize, and share information relevant to the management of invasive species. Regional invasive species events, workshops, and trainings are routinely posted on our web site as well as information about invasive species. Resources that can be found on the website include best management practices (BMPs), information about multiple invasive species, volunteer opportunities, invasive species job opportunities, and links to other helpful websites.

The Lower Hudson PRISM also created and regularly posts to a Facebook page (<http://www.facebook.com/LHPRISM>) in July 2014. The Facebook page lists invasive species job opportunities, new observations and infestations both in our area and nationally, news and research articles, and new legislation regarding invasive species. The Facebook page currently has 66 likes.

Contracted Projects

This year, the Lower Hudson PRISM decided to contract out some of the more in-depth projects. While each project differed from the next, they were all important in furthering the success of the PRISM. A total of six projects were funded in 2014. The Lower Hudson PRISM wrote and issued a request for proposals (RFP) and coordinated the proposal selection process by the Steering Committee. Some of the contracted projects included managing, treating, and surveying for invasive species infestations throughout the Lower Hudson region, while other projects worked on determining criteria for conservation targets and creating a list of potential conservation targets specifically for the Lower Hudson region.

Final reports for all of these projects are posted on our web site (<http://lhprism.org>).

Allied Biological, Inc.

Survey of the Extent of the Hydrilla Population in the Croton River

After the discovery of *Hydrilla verticillata* in the Croton River System in 2013, a delineation of the hydrilla as well as workshops to educate volunteers was needed. Allied Biological conducted a detailed aquatic macrophyte inventory of the Croton River System. During the survey, 354 GPS-referenced locations were sampled for the presence of aquatic macrophytes as well as two other locations surveyed on foot or via kayak, and the southeast corner of the Reservoir was sampled from the shoreline. All surveys were conducted between late August and early September.

The Point Intercept Method (PIM) sampling technique was used. The number of sample locations (which is typically one sample location per acre) varied throughout the Croton River System because it is comprised of several different habitats, each requiring different sampling techniques due to habitat and access options.



Figure 2: View of Croton River from New Croton Reservoir Dam

A weed anchor attached to a 10 meter-long piece of rope was tossed from a random side of the boat, and was slowly retrieved along the bottom and carefully hoisted into the boat. One of five densities was assigned to each location: no plants (empty anchor), trace (one or two stems per anchor), sparse (three to ten stems per anchor), medium (more than 10 stems per anchor), or dense (entire anchor full of stems).

Four invasive macrophytes, including Eurasian watermilfoil, brittle naiad, hydrilla, and curly-leaf pondweed were found throughout the Croton River System, as well as 17 native species. Hydrilla was collected at 150 (or 42%) of the total sites surveyed in 2014, which can be classified as widespread in the Croton River System. NYC DEP staff also confirmed that hydrilla was rooted in several scattered patches of the reservoir up to the boat launch. It is recommended that the New Croton Reservoir be extensively surveyed for hydrilla in 2015.

Allied Biological, Inc.

Survey of Greenwood Lake, One of the Largest and Most Heavily Used By Boaters in the Region, for Aquatic Invasive Plants

Allied Biological conducted a detailed aquatic macrophyte inventory of the northern end of Greenwood Lake in Orange County, NY. During the survey, 285 GPS-referenced locations were sampled for the presence of aquatic macrophytes. The primary goal of the survey was to document exotic aquatic macrophyte species, especially near several large marinas and other lake access points. The secondary goal was to document all aquatic macrophyte species.



Figure 3: View of Greenwood Lake

The Point Intercept Method (PIM) was used to survey the northern section, which is the section that lies in the Lower Hudson PRISM region. The west and east fingers of the northern region were surveyed based on their habitat, abundance of aquatic macrophytes, the high use of the area, pending herbicide applications, and presence of large marinas, which have an increased risk of invasive species introductions. Random sample locations were plotted on a grid overlay map of the target locations with a focus on littoral zones.

A weed anchor attached to a 10 meter-long piece of rope was tossed from a random side of the boat, and was slowly retrieved along the bottom and carefully hoisted into the boat. One of five densities was assigned to each location: no plants (empty anchor), trace (one or two stems per

anchor), sparse (three to ten stems per anchor), medium (more than 10 stems per anchor), or dense (entire anchor full of stems).

Four invasive macrophytes, including water chestnut, Eurasian watermilfoil, curly-leaf pondweed, and fanwort were found throughout the northern end of Greenwood Lake, as well as 26 native species.

Geospatial & Ecological Services

Development of Conservation Targets for the Lower Hudson PRISM

Geospatial & Ecological Services, along with many partnering organizations, acquired thematic, digital geospatial and logic-model data in order to establish an adequate understanding and spatial representation of the natural and built systems. By creating these layers, we will be to provide a rough estimate of “what’s here, how is it doing, where is the ‘good stuff’ and are there clear or apparent priorities that, through active invasive management, we can help preserve our important and valuable biodiversity features.” These layers (see Appendix C) include:

- Audubon Important Bird Areas (IBA)
- Natural Heritage Program Element Occurrences (Natural Heritage Program Communities layer is included in lieu of element occurrences which cannot be distributed)
- Hudson River Estuary Program Significant Biodiversity areas
- TNC Portfolio and Focal areas
- NYS Parks and Protected lands
- Forest blocks from Landfire (>500 acres)
- Landscape-scale Connectivity

The project mission was to use these layers to determine which habitats of multiple viable populations of Lower Hudson PRISM target species within hotspots should be protected or enhanced. *Conservation targets* are prioritized ecological and biodiversity features, species, resources, and habitats that we would most want to help protect and conserve through our invasive species management efforts. These targets will represent regions where invasive species management would deliver the highest good and where effective results are both practicable and likely.

In addition, under this effort, further progress was made to define Highly Probable Areas (HPA’s) of invasive species introduction. These data layers will be used to help target future survey efforts for invasive species. Geospatial and Ecological Services oversaw two GIS inters to

develop layers for parking lots at hiking trailheads, Utility right-of-ways, and Nurseries/Garden Centers (See figure in Appendix C).

A draft map of candidate Invasive Species Prevention Zones (ISPZs) was also produced. (Appendix C).

Housatonic Valley Association

Japanese Knotweed Management and Education

The Housatonic Valley Association (HVA) used a stream corridor restoration project in the town of Dover as a springboard to integrate Japanese knotweed education and management into our watershed management work in the Ten Mile River watershed. HVA used an early infestation of knotweed at a stream restoration site as a case study to educate local land managers and high school students, while building capacity within the organization to manage knotweed at this and other stream restoration sites.

HVA held three educational/work sessions in the field for teachers and students of Dover High School, where students learned how to cut and remove knotweed as well as plant restoration plants in the stream buffer. During this time they encountered several interested citizens and talked to them about invasive plant management. This project allowed HVA to add invasive species management into their existing summer River Stewards program. During the entire project period, they had planted over 300 plants designed to enhance biodiversity, stabilize the stream bank, improve habitat, and ultimately replace the knotweed and other invasive species.

HVA developed a GIS layer of the “ideal” variable-width riparian buffer for stream reaches in the Ten Mile watershed based on soils, terrain, and other information. They also analyzed a known and confirmed knotweed patch on aerial photography and used the specific image signature of the knotweed to identify other potential knotweed patches in the “ideal” riparian buffer for the Wassaic Creek Watershed.

Hudsonia

Conservation Targets: Analysis of Invasive Species Threats to Animal Species of Greatest Conservation Need

Hudsonia’s goal with this project was to identify native animal species of conservation concern that the Lower Hudson PRISM should protect from the adverse effects of invasive animals or plants with the rationale that the limited resources for managing invasive species should be

directed to protecting those rare native species that could be adversely affected, even extirpated, by invasive species.

Because there are so many rare native animal species that we might want to protect, Hudsonia chose to focus on the NYSDEC Species of Greatest Conservation Need (SGCN) list. Removing species thought to be introduced to eastern New York, are relatively common, or appear to be functionally extirpated further condensed the list. Next, each animal of conservation concern was assessed for invasive species impacts. This involved searching scientific literature databases, assessing the quality of science, and asking questions such as “how near geographically was the reported research to the region of concern?” and “is the invasive species or the interaction already the subject of a management program?”

A brief description of SGCN that were deemed of priority for the Lower Hudson PRISM management was written for each species. The descriptions include a quick summary, habitats, diet, predators, invasive species threats and management considerations.

Trillium Invasive Species Management

Treatment of Hardy Kiwi Populations

Trillium Invasive Species Management (Trillium) worked to remove and treat a patch of hardy kiwi (*Actinidia arguta*) in Pound Ridge, NY. The first phase of control involved physically removing the plant and piling it on site. The root system was exposed and treated using the cut-stump method. Stumps were treated with glyphosate, using undiluted Roundup Weed and undiluted Grass Killer in a sponge applicator.



Figure 4: Hardy Kiwi infestation before treatment

Upon returning to the site about two months later, it was noted that the patch contained many re-sprouts ranging from a few inches to about two feet in height. All but one re-sprout appeared to exhibit symptoms of herbicide impact (yellowing of leaves). All growth was exposed and sprayed with the same herbicide solution. Approximately seven ounces of herbicide were used over the two treatment days. A representative from Pound Ridge Land Conservancy was brought to the treatment site to familiarize him with the area, as he will be monitoring the site for re-growth in 2015-2018.

Some things should be considered for future projects. It is possible that the herbicide application points were too close to the soil to easily keep the cuts clean, and absorption by soil particles reduced the amount of herbicide available for uptake. Also, hardy kiwi growing along fence rows or open areas may grow more bush-like. This makes removal very labor intensive. In areas where feasible, it may be advantageous to mechanically mulch the area prior to treatment, followed by an herbicide application or a cut-stump application.



Figure 5: Hardy Kiwi infestation after treatment

Partner Successes

At the Lower Hudson PRISM, we understand that the fight against invasive species is a collective goal, and it needs the support of its partners to be successful. Our partnership is composed of 36 organizations and individuals concerned about invasive species in and approaching the region. We take action year round and work together on education, prevention, detection, and management to stop the spread of aquatic and terrestrial invasive species throughout the region. It is with the help of all of our partners that we were able to achieve 317 invasive species removals, and educate and train 2,556 volunteers who, in total, dedicated 17,106 volunteer hours to help fight against invasive species and preserve the biodiversity of our region.

Intern Projects

This year the Lower Hudson PRISM partners oversaw 28 interns who helped with many projects, including leading and participating in trainings, invasive species removals, surveys, early detection projects, and much more.

The New York-New Jersey Trail Conference sponsored 5 interns this summer. Two of the interns completed mapping (GIS) projects which helped us create maps of regional nurseries, hiking trail parking lots, and transmission lines through natural areas for use in invasive species surveillance projects. Another intern helped manage invasive species data and learned valuable GIS skills while helping produce maps for our Invasives Strike Force trail-surveying volunteers. A



Figure 6: Pound Ridge Land Conservancy interns installing a deer-proof fence

high school intern worked on researching and collecting management and control techniques for 7 different invasive plants including interviewing an extensive list of local land managers. Another intern is developing an aquatic invasive species program for the PRISM, and also conducted 3 training workshops for volunteers, recruited 21 volunteers and surveyed 41 areas for aquatic invasive species. The Palisades Interstate Park Commission sponsored an intern who led a 3-hour training session covering identification of common invasive species for two

Rockland County AmeriCorps members. Pound Ridge Land Conservancy hosted 6 interns who both led and attended numerous work sessions and invasive removals, where they cleared out acres of barberry, phragmites, and mile-a-minute. Scenic Hudson's intern led multiple invasive removal days and mapped invasive polygons for future management. New York City DEP sponsored 9 interns who conducted early detection surveys for giant hogweed, amur cork tree, and plumed poppy. They also did control work to suppress the growth of water chestnut, mile-a-minute, swallowwort and tree of heaven, and helped with their mitigating pathways analysis (see Appendix F). Teatown Lake Reservation had two interns map and manage black swallowwort and water chestnut on Teatown property. The Mianus River Gorge intern helped with a literature review on current and potential invasive species in their preserve, which included a report that detailed the biology, impacts, and management options for several invasive species and prioritized species for management based on impacts and management feasibility. The Old Croton Aqueduct intern surveyed multiple miles of trails and wrote a report about the invasive species found along the trails. The Bedford Audubon Society intern did multiple invasive species removals for oriental bittersweet, porcelainberry, multi-flora rose, and winged euonymus in and around their Native Garden. Hudsonia's two interns did literature searches and provided other assistance to Hudsonia's Conservation Target project, which was one of the six contracted PRISM projects. Allied Biological also hosted an intern who helped complete their contracted PRISM projects of surveying the Greenwood Lake for aquatic macrophytes and the Croton River System for hydrilla.

Some of the interns were high school students, while others attended colleges including SUNY ESF, SUNY Purchase, SUNY Ulster, Bard College, Centenary College, Oberlin College, Bates College, Middlebury College, and many others. The interns that the PRISM and its partners sponsored this year were able to get a lot of very important work done. We appreciate all of the time and effort that they contributed to the fight against invasive species in the Lower Hudson region.

Training Sessions/Educational Programs

Protecting and preserving our environment is a collaborative goal, and for invasive species management to be successful we need the help of our partners as well as our volunteers. Many invasive species infestations are initially found by the public, which is why we put such an emphasis on citizen-science.

This year, the partners of the Lower Hudson PRISM were able to conduct many training sessions, where volunteers were taught about invasive species identification, monitoring, management and prevention. The PRISM partners were able to connect with 1,630 participants during the 121 trainings held throughout the year. Some of the trainings were for a specific

group, including Master Gardeners and landowners seeking to manage their land for conservation value, while others were for anybody interested in learning about invasive species. Some topics were very specific and discussed one type of aquatic or terrestrial species, while others covered a broad range of species that can be found in our region. One of the PRISM partners hosted a plant identification workshop that taught volunteers how to identify and remove invasive species during the winter season. Another partner, along with the PRISM coordinator, sponsored a hydrilla identification workshop with presentations about hydrilla,



Figure 7: Family being trained in invasive species removal

followed by a field trip to Black Rock Park in Croton-on-Hudson to learn how to identify the plant.

The Lower Hudson PRISM partners also coordinated many educational programs. These events were intended for all audiences, with programs focusing on teaching children about invasive species, and others reaching out to a more general audience. Educational materials including brochures, flyers, and handouts were distributed at many of these

events. One organization created an invasive species brochure that also incorporated restoration projects. Some events that focused on one species, like the water chestnut pull, where the event coordinator handed out flyers depicting what water chestnut looks like. Another program held at the Pound Ridge Elementary School exhibited “something good and something bad” about log piles. For example, a log pile is a good habitat for native wildlife. At the same time, it is important not to move firewood because it may be inhabited by the Emerald Ash Borer and Asian Long-Horned Beetle, two invasive insects that are devastating our woodlands. The leaders of the event gave out decals of the insects along with a “What’s In a Log Pile” word search for the children. Over the course of the year, a total of 91 educational programs were held, with 6,583 people participating.

iMapInvasives Entries

Data collection is a critical component of any invasive species surveying. The partners of the Lower Hudson PRISM created a volunteer base with a total of 2,456 volunteers who were out surveying trails, parks, lakes and streams. This large volunteer force collected a lot of data, which was then uploaded to the citizen-science database iMapInvasives. This year, the Lower Hudson PRISM contributed 12,644 online entries and bulk upload entries to iMapInvasives.

Eradication Projects

One of the objectives of the Lower Hudson PRISM is early detection and rapid response of new and pre-existing invasive species infestations. One of the final steps that need to be taken in

order to successfully respond to an infestation is to control and remove it. These removal projects are important for ecological health as well as human health in some cases. One of the species that the Lower Hudson PRISM partners is helping to eradicate is giant hogweed, an invasive plant with sap that can cause severe skin irritation and burns.

This year, the Lower Hudson PRISM was able to begin the control and removal of 34 species (a list of species can be found in Appendix B). We had a total of 317 eradication and control projects that treated 1,221 acres of natural lands. Both aquatic and terrestrial invasive species were controlled, treated, and removed throughout the year.



Figure 8: An infestation of giant hogweed before treatment

Post-treatment Monitoring

One of the most critical, yet most commonly overlooked parts of any invasive species management project is post-treatment monitoring. Without monitoring, it is likely that the infestation will return and the time put into the treatments and removals will have been wasted. A majority of the Lower Hudson PRISM partners returned to their treatment sites and did follow-up treatments and monitoring this year. One group of volunteers has been returning to the same site annually for ten years. Some groups return to the treatment site at least once each year, while others return weekly to do post-treatment monitoring and to remove any regrowth. This year, 390.14 acres of infested land and waterbodies were monitored post-treatment.

Appendix A: Lower Hudson signed PRISM partners and participants.

Signed Partners

- Allied Biological
- Andrew P. Thompson
- Bedford Audubon Society
- Black Rock Forest Consortium
- Bronx River Alliance
- Bronx River Parkway Reservation Conservancy
- Cary Institute of Ecosystem Studies
- Cornell Coop Ext – Dutchess Co.
- Cornell Coop Ext – Orange Co.
- Cornell Coop Ext – Putnam Co.
- Cornell Coop Ext – Rockland Co.
- Ecological Research Institute
- Friends of the Great Swamp
- The Friends of the Old Croton Aqueduct
- Hike New York
- Housatonic Valley Association
- Hudson Highlands Land Trust
- Hudsonia
- Geospatial & Ecological Services
- Mianus River Gorge Inc.
- Mohonk Preserve
- The Native Plant Center
- Natural Areas Conservancy
- The New York Botanical Garden
- NY City DEP
- NY City Dept of Parks & Recreation
- New York – New Jersey Trail Conference
- The Pound Ridge Land Conservancy
- Scenic Hudson
- Teatown Lake Reservation
- The Invasives Project – Pound Ridge
- Trillium Invasive Species Management
- Village of Tuxedo Park
- Walt Daniels
- Westchester County Parks
- Westchester Land Trust

Participants

- Christopher Mangels
- EC Tuxedo Park
- Friends of Hunt Woods Park
- iMapInvasives
- NYS Parks Recreation & Historic Preservation
- Palisades Interstate Park Commission
- Three Lakes Council

Appendix B: Invasive Species that the Lower Hudson PRISM partners targeted in eradication projects.

Scientific Name	Common Name	Area Treated
<i>Actinidia arguta</i>	Hardy Kiwi	0.5
<i>Aegopodium podagraria</i>	Bishop's weed	0.1
<i>Ailanthus altissima</i>	Tree of Heaven	5.42
<i>Alliaria petiolata</i>	Garlic mustard	0.57
<i>Ampelopsis brevipedunculata</i>	Porcelain berry	14
<i>Aralia elata</i>	Japanese Angelica Tree	61.63
<i>Artemisia vulgaris</i>	Mugwort	34.2
<i>Berberis thunbergii</i>	Japanese Barberry	12.711
<i>Celastrus orbiculatus</i>	Oriental bittersweet	7.1
<i>Cuscuta</i>	Dodder	0.15
<i>Cynanchum louiseae</i>	Black swallow-wort	13.286
<i>Cytisus scoparius</i>	Scotch Broom	0.5
<i>Elaeagnus umbellata</i>	Autumn olive	1
<i>Euonymus alatus</i>	Burning Bush	4
<i>Fallopia japonica</i>	Japanese Knotweed	11.84
<i>Ficaria verna</i>	Fig Buttercup	3
<i>Hedera helix</i>	English Ivy	0.1
<i>Heracleum mantegazzianum</i>	Giant Hogweed	1
<i>Liquidambar styraciflua</i>	Sweet Gum	4.5
<i>Lonicera japonica</i>	Japanese honeysuckle	5.075
<i>Lythrum salicaria</i>	Purple Loosestrife	1
<i>Macleaya cordata</i>	Plume Poppy	1
<i>Microstegium vimineum</i>	Japanese Stiltgrass	9.4
<i>Myriophyllum spicatum</i>	Eurasian Watermilfoil	68.45
<i>Pachysandra terminalis</i>	Japanese pachysandra	0.25
<i>Persicaria perfoliata (Polygonum perfoliatum)</i>	Mile-a-minute	53
<i>Phragmites australis</i>	Phragmites	40.645
<i>Potamogeton crispus</i>	Curly-leaf Pondweed	164.7
<i>Pyrrhalta viburni</i>	Viburnum Leaf Beetle	17
<i>Rhamnus cathartica</i>	Common Buckthorn	0.07
<i>Rosa multiflora</i>	Multi-flora rose	5.07
<i>Rubus phoenicolasium</i>	Wineberry	1.41
<i>Trapa natans</i>	Water Chestnut	22

*The treated acreage for each species is lower than the actual number. Some projects that were completed did not report a calculated acreage amount. Projects that did not report accurate treated acreage were not included in this table.

Appendix C: Geospatial & Ecological Services Layers and Overlays

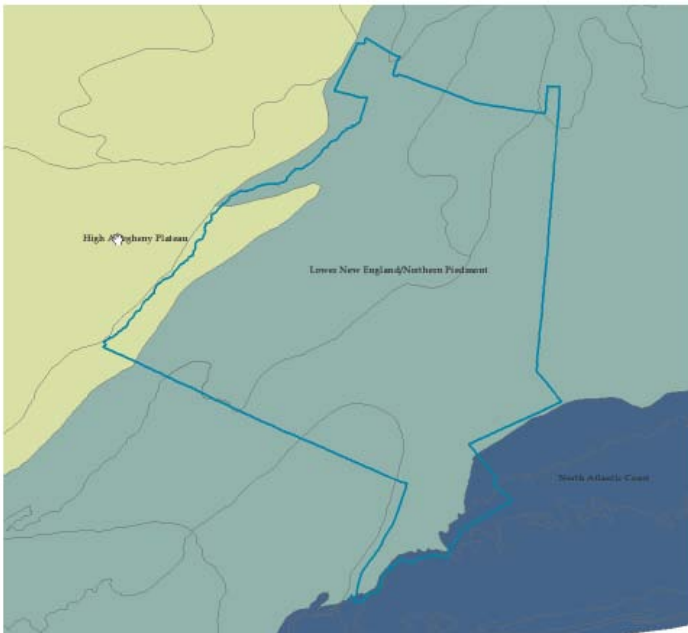


Figure: TNC Ecoregional Boundaries & Subdivisions with Lower Hudson Prism Boundary

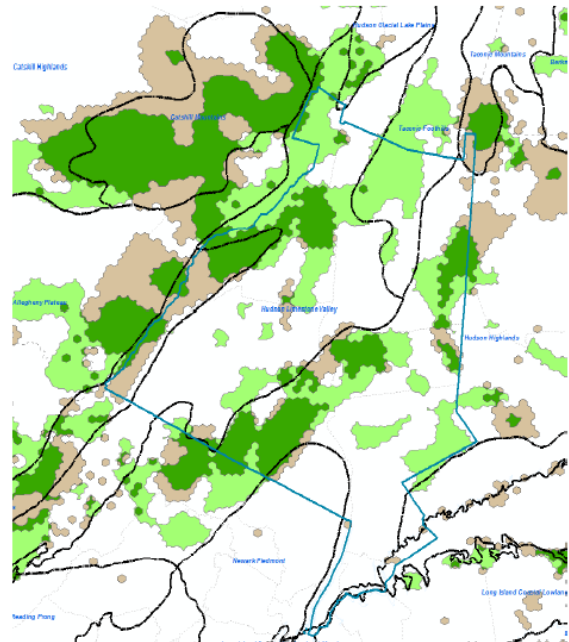


Figure: TNC Ecoregional Conservation Portfolio Layers

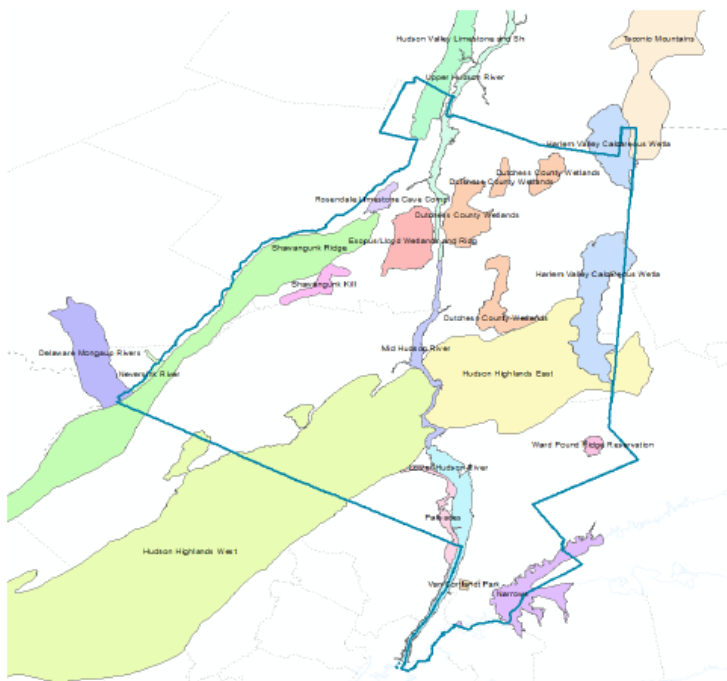


Figure: HREP Significant Biodiversity Areas

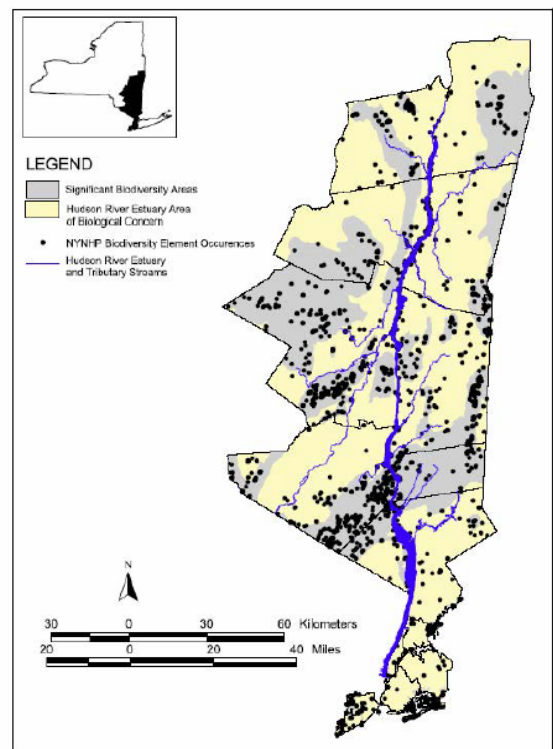


Figure: Biodiversity element occurrences tracked by the NY Natural Heritage Program within the Hudson River Estuary corridor

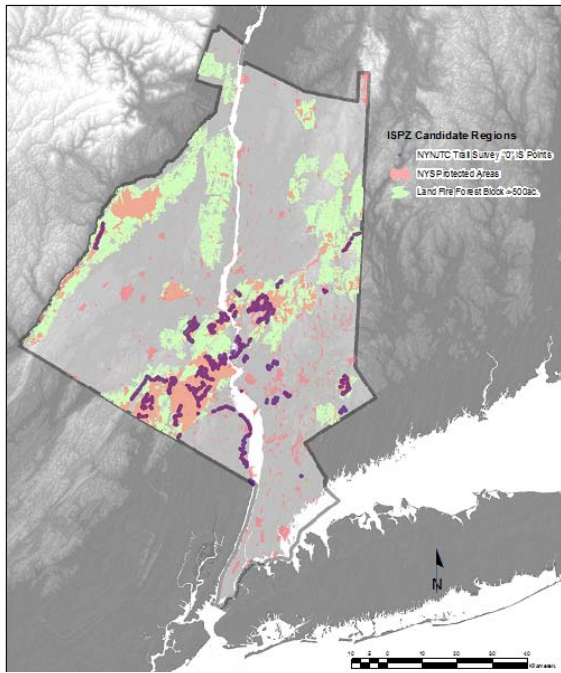


Figure: Draft ISPZ Candidate Regions

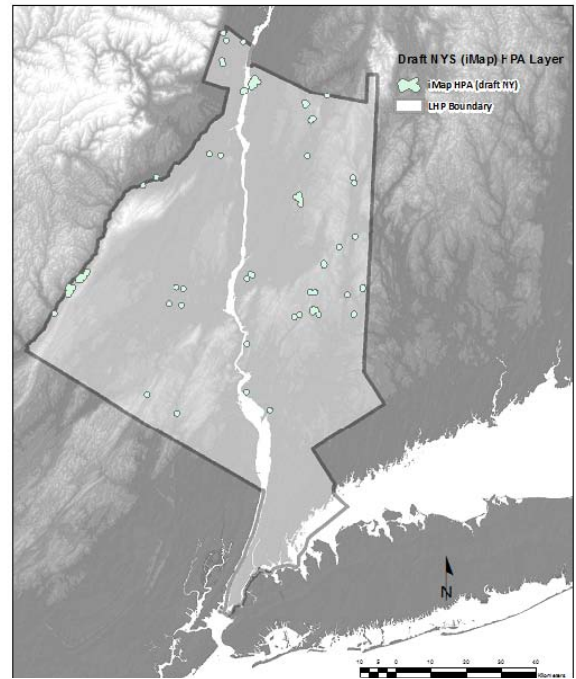


Figure: Draft HPA layer from iMapInvasives

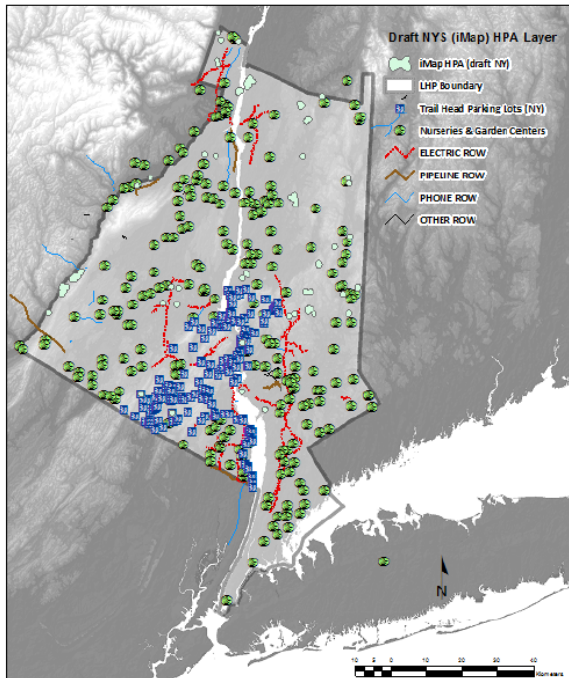


Figure: Features added to HPA model (parking lots, ROW, and Nurseries/Garden Centers)

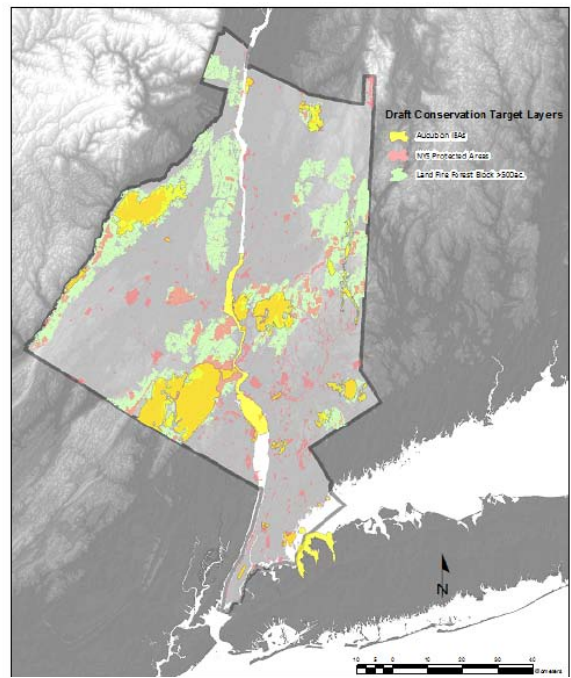


Figure: Audubon's Important Bird Areas with Protected Lands and Forest Blocks

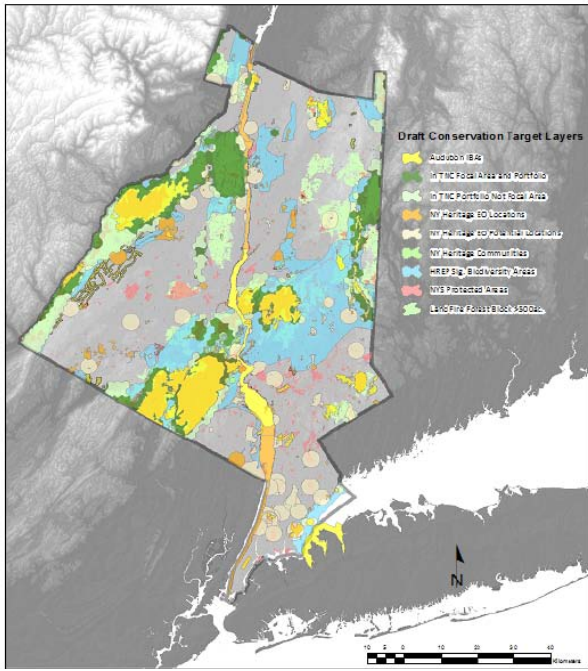


Figure: Conservation Target Overlay Layers from: NY Audubon, NYS-NHP, HREP, TNC & the Lower Hudson PRISM

Proposed Prioritization Hierarchy

For those that are on the Lower Hudson PRISM **Widespread** species list, prioritize according to threat posed to conservation target or invasive species prevention zones. For species that are not on the Lower Hudson PRISM Widespread list,

First look at those with **VH or H invasive rank** by NYS,

Threat gets highest attention

Next **Emerging**

Next **Established**

Treat those populations closer to a neighboring region that has low levels of that species

Then look at Species that have a **High** invasiveness rank in a neighboring region or which is on the **Early Detection** list of a neighboring region

First deal with those where the Geographic region in question is near that neighboring region

Then for those in a Geographic region that is not near that neighbor

Treat those which are at Low levels of populations in LH PRISM (**Threat, Emerging**)

Then look at Species that are not in either of the above categories (Not VH or H Invasive rank in NYS or High or ED status in neighboring region)

Treat species with **Moderate** invasive rank with low population numbers (**Threat, Emerging**)

All others record and monitor

Appendix E: The Lower Hudson Status of NY Prohibited and Regulated Species

<u>Scientific Name</u>	<u>Common Name</u>	<u>NY Invasive Rank</u>	<u>LH Category</u>	<u>Presence in LH</u>
<i>Didymosphenia geminata</i>	Didymo	NA	Threat	1
<i>Bellamya chinensis</i> (<i>Cipangopaludina chinensis</i>)	Chinese Mystery Snail	VH	Underreported	2
<i>Corbicula fluminea</i>	Asian Clam	H	Underreported	9
<i>Dreissena polymorpha</i>	Zebra Mussel	VH	Established	40
<i>Eriocheir sinensis</i>	Chinese Mitten Crab	M	Established	39
<i>Hemigrapsus sanguineus</i>	Asian Shore Crab	VH	Threat	16
<i>Orconectes rusticus</i>	Rusty Crayfish	H	Established	33
<i>Carassius auratus</i>	Gold Fish	VH	Established	358
<i>Channa argus</i>	Northern Snakehead	H	Emerging	9
<i>Cyprinus carpio</i>	Common Carp, Koi	VH	Established	3416
<i>Gambusia affinis</i>	Western Mosquitofish	VH	Threat	0
<i>Gymnocephalus cernuus</i>	Ruffe	M	Threat	
<i>Hypophthalmichthys nobilis</i>	Bighead Carp	M	Threat	0
<i>Misgurnus anguillicaudatus</i>	Oriental Weatherfish	VH	Threat	6
<i>Scardinius erythrophthalmus</i>	Rudd	M	Threat	1
<i>Acer platanoides</i>	Norway Maple	VH	Widespread	818
<i>Acer pseudoplatanus</i>	Sycamore Maple	H	Emerging, Underreported	78
<i>Achyranthes japonica</i>	Japanese Chaff Flower	H	Threat	0
<i>Alliaria petiolata</i>	Garlic Mustard	VH	Widespread	1909
<i>Ampelopsis brevipedunculata</i>	Porcelain Berry	H	Established	180
<i>Anthriscus sylvestris</i>	Wild Chervil	H	Emerging	41
<i>Aralia elata</i>	Japanese Angelica Tree	VH	Established	398
<i>Artemisia vulgaris</i>	Mugwort	H	Widespread, Underreported	192
<i>Arthraxon hispidus</i>	Small Carpgrass (Hairy Jointgrass)	VH	Emerging	6
<i>Berberis thunbergii</i>	Japanese Barberry	VH	Widespread	4114
<i>Brachypodium sylvaticum</i>	Slender False Brome	VH	Emerging	53
<i>Cabomba caroliniana</i>	Fanwort	H	Emerging, Underreported	23
<i>Cardamine impatiens</i>	Narrowleaf Bittercress	H	Emerging, ?Underreported	45
<i>Celastrus orbiculatus</i>	Oriental Bittersweet	VH	Widespread	1837
<i>Centaurea stoebe</i> (<i>C. biebersteinii</i> , <i>C. diffusa</i> , <i>C. maculosa</i> misapplied, <i>C. xpsammogena</i>)	Spotted Knapweed	H	Established, Underreported	83
<i>Cirsium arvense</i> (<i>C. setosum</i> , <i>C. incanum</i> , <i>Serratula arvensis</i>)	Canada Thistle	H	Emerging, Underreported	67
<i>Clematis terniflora</i>	Japanese Virgin's Bower	H	Emerging	40

<i>Cynanchum louiseae</i> (<i>C. nigrum</i> , <i>Vincetoxicum nigrum</i>)	Black Swallow-wort	VH	Established	461
<i>Cynanchum rossicum</i> (<i>C. medium</i> , <i>Vincetoxicum medium</i> , <i>V. rossicum</i>)	Pale Swallow-wort	VH	Emerging	2
<i>Dioscorea polystachya</i> (<i>D. batatas</i>)	Chinese Yam	H	Threat	3
<i>Dipsacus laciniatus</i>	Cut-leaf Teasel	H	Threat	1
<i>Egeria densa</i>	Brazilian Waterweed	H	Emerging	8
<i>Elaeagnus umbellata</i>	Autumn Olive	VH	Widespread	200
<i>Euonymus alatus</i>	Burning Bush	VH	Widespread	1114
<i>Euonymus fortunei</i>	Winter Creeper	H	Emerging	13
<i>Euphorbia cyparissias</i>	Cypress Spurge	H	Established, Underreported	90
<i>Euphorbia esula</i>	Leafy Spurge	H	Established, Underreported	105
<i>Ficaria verna</i> (<i>Ranunculus ficaria</i>)	Lesser Celandine	VH	Emerging	16
<i>Frangula alnus</i> (<i>Rhamnus frangula</i>)	Smooth Buckthorn	H	Established	52
<i>Glyceria maxima</i>	Reed Manna Grass	H	Threat	0
<i>Heracleum mantegazzianum</i>	Giant Hogweed	H	Emerging	12
<i>Humulus japonicus</i>	Japanese Hops	H	Emerging	39
<i>Hydrilla verticillata</i>	Hydrilla, Water Thyme	VH	Emerging	5
<i>Hydrocharis morus-ranae</i>	Frogbit	VH	Threat	1
<i>Imperata cylindrica</i> (<i>I. arundinacea</i> , <i>Lagurus cylindricus</i>)	Cogon Grass	H	Threat	0
<i>Iris pseudacorus</i>	Yellow Iris	H	Emerging	72
<i>Lepidium latifolium</i>	Broad-leaved Pepper-grass	H	Threat	1
<i>Lespedeza cuneata</i>	Chinese Lespedeza	H	Threat	1
<i>Ligustrum obtusifolium</i>	Border Privet	H	Emerging, Underreported	159
<i>Lonicera japonica</i>	Japanese Honeysuckle	VH	Widespread	663
<i>Lonicera maackii</i>	Amur Honeysuckle	VH	Widespread	63
<i>Lonicera morrowii</i>	Morrow's Honeysuckle	VH	Widespread	322
<i>Lonicera tatarica</i>	Tartarian Honeysuckle	VH	Widespread	56
<i>Lonicera x bella</i>	Fly Honeysuckle	VH	Widespread	6
<i>Ludwigia hexapetala</i> (<i>L. grandiflora</i>)	Uruguayan Primrose Willow	VH	Threat	0
<i>Ludwigia peploides</i>	Floating Primrose Willow	VH	Threat	0
<i>Lysimachia vulgaris</i>	Garden Loosestrife	H	Threat	4
<i>Lythrum salicaria</i>	Purple Loosestrife	VH	Widespread	963
<i>Microstegium vimineum</i>	Japanese Stilt Grass	VH	Widespread	3324
<i>Miscanthus sinensis</i>	Chinese Silver Grass	H	Emerging, Underreported	1
<i>Murdannia keisak</i>	Marsh Dewflower	H	Threat	0
<i>Myriophyllum aquaticum</i>	Parrot-feather	H	Threat	1

<i>Myriophyllum heterophyllum</i>	Broadleaf Water-milfoil (Variable Leaf Milfoil)	VH	Emerging	13
<i>Myriophyllum heterophyllum x M. laxum</i>	Broadleaf Water-milfoil Hybrid	VH	Threat	0
<i>Myriophyllum spicatum</i>	Eurasian Water-milfoil	VH	Widespread, Underreported	138
<i>Nymphoides peltata</i>	Yellow Floating Heart	H	Threat	1
<i>Oplismenus hirtellus</i>	Wavyleaf Basketgrass	H	Threat	0
<i>Persicaria perfoliata</i> (<i>Polygonum perfoliatum</i>)	Mile-a-minute Weed	VH	Established	230
<i>Phellodendron amurense</i>	Amur Cork Tree	H	Emerging	3
<i>Phragmites australis</i>	Common Reed Grass	VH	Widespread, Underreported	512
<i>Phyllostachys aurea</i>	Golden Bamboo	NA	NA	0
<i>Phyllostachys aureosulcata</i>	Yellow Groove Bamboo	NA	NA	0
<i>Potamogeton crispus</i>	Curly Pondweed	H	Established	108
<i>Pueraria montana</i>	Kudzu	VH	Emerging	40
<i>Reynoutria japonica</i> (<i>Fallopia japonica</i> , <i>Polygonum cuspidatum</i>)	Japanese Knotweed	VH	Widespread	330
<i>Reynoutria sachalinensis</i> (<i>Fallopia sachalinensis</i> , <i>Polygonum sachalinensis</i>)	Giant Knotweed	VH	Threat	7
<i>Reynoutria x bohemica</i> (<i>Fallopia x bohemica</i> , <i>Polygonum x bohemica</i>)	Bohemian Knotweed	VH	Threat	2
<i>Rhamnus cathartica</i>	Common Buckthorn	VH	Widespread, Underreported	139
<i>Robinia pseudoacacia</i>	Black Locust	VH	Widespread, Underreported	148
<i>Rosa multiflora</i>	Multiflora Rose	VH	Widespread	2262
<i>Rubus phoenicolasius</i>	Wineberry	VH	Widespread	1676
<i>Salix atrocinerea</i>	Gray Florist's Willow	VH	Threat	3
<i>Silphium perfoliatum</i>	Cup-plant	H	Threat	0
<i>Trapa natans</i>	Water Chestnut	VH	Established	104
<i>Vitex rotundifolia</i>	Beach Vitex	H	Threat	0
<i>Adelges tsugae</i>	Hemlock Woolly Adelgid	H	Established	105
<i>Agrilus planipennis</i>	Emerald Ash Borer	VH	Established	134
<i>Anoplophora glabripennis</i>	Asian Longhorned Beetle	H	Threat	0
<i>Lymantria dispar</i>	Asian and European Gypsy Moth	H	Emerging	16
<i>Trachemys scripta elegans</i>	Red-eared Slider	M	Threat	1

*This table only includes species that are already present in the Lower Hudson region. The Priority Species list will continue to be updated as new species approach and are introduced to the region. The observation numbers were collected from iMapInvasives and are accurate as of November 2014.

Appendix F: List of Pathways of Invasive Species in the Lower Hudson Region

This is a high-level overview of the Lower Hudson PRISM Pathways. It is not a complete breakdown of the pathways system.

Lower Hudson PRISM Potential Pathways

- Transportation
 - Air
 - Commercial airlines, cargo, military, sea planes
 - Water
 - Ballast water, recreational boat hulls/holds, dredge spoils
 - Land
 - Cars, busses, trucks, construction equipment, military vehicles, ATVs, horses, roadside maintenance, boat trailers
 - Shipping Materials
 - Shipping containers, packing materials
 - Travel and Tourism
 - Pet/sport/decorative animals, baggage/gear, travelers, hiking
- Living Industry
 - Plant Trade
 - Landscaping, nursery, hay and straw, Christmas trees, fruits and vegetables, flowers, raw logs/chips, mulch, soil and sod, plants for research, plant hitchhikers
 - Non-Food Animals
 - Aquaculture/seafood, pet and aquarium trade, non-pet animals, bait
 - Food Animals
 - Live seafood, other live food
- Miscellaneous
 - Aquatic Pathways
 - Waterways, canals, interbasin transfers, aqueducts
 - Natural Spread
 - Waterfowl, deer, currents
 - Ecosystem Disturbance
 - Highways, utilities, RR ROWs, logging, land clearing, habitat restoration, fires

Key

- Pathway Category
- Pathway Sub-Category
- Pathway

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